Planning & Development Act, 2000 - 2020,
European Communities (Environmental Impact Assessment) Regulations 1989 (as amended), Planning & Development Regulations, 2001 (as amended)

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

APPENDICES

Peamount Substation and transmission lines
Milltown

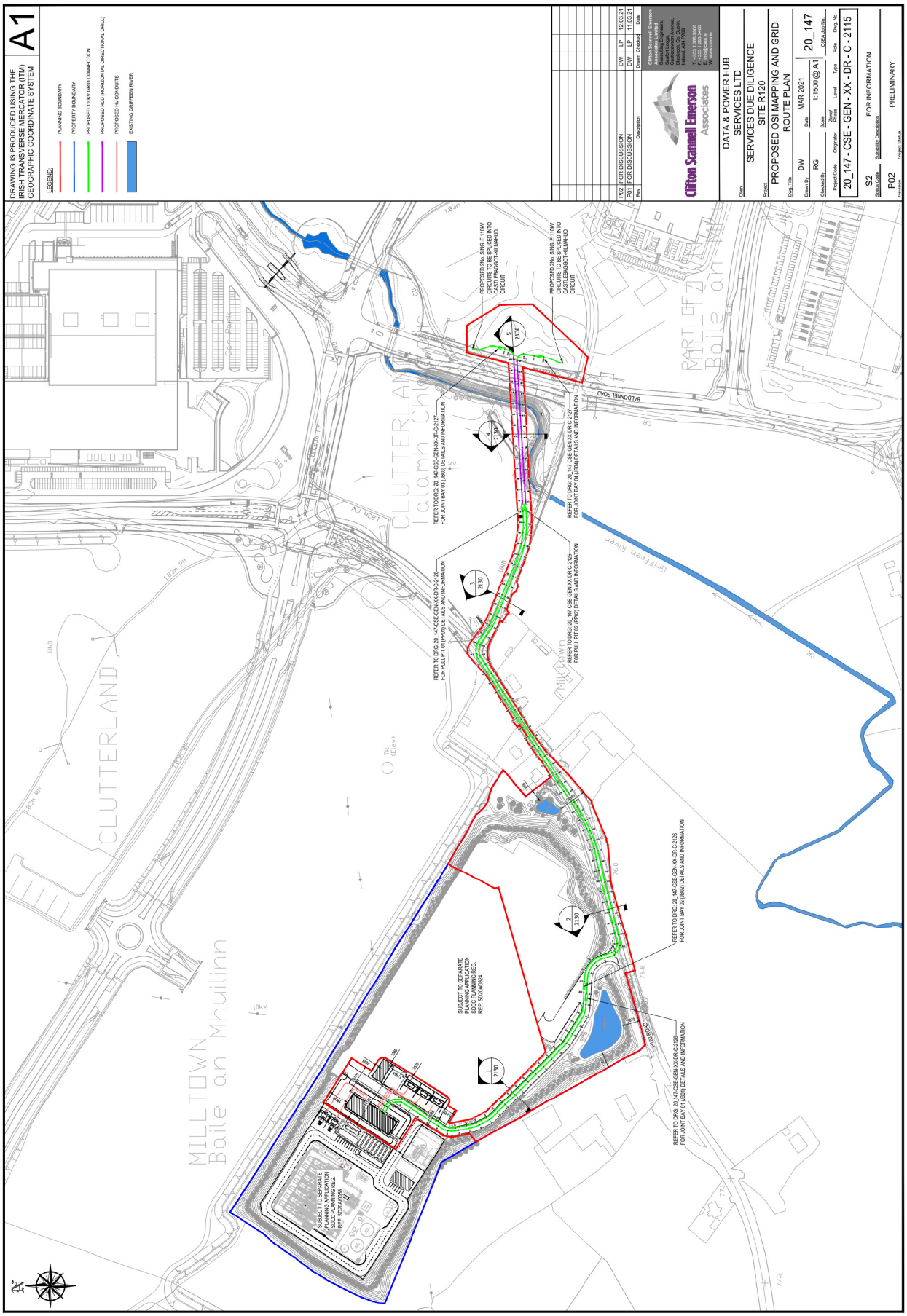
March 2021

MARSTON
PLANNING CONSULTANCY

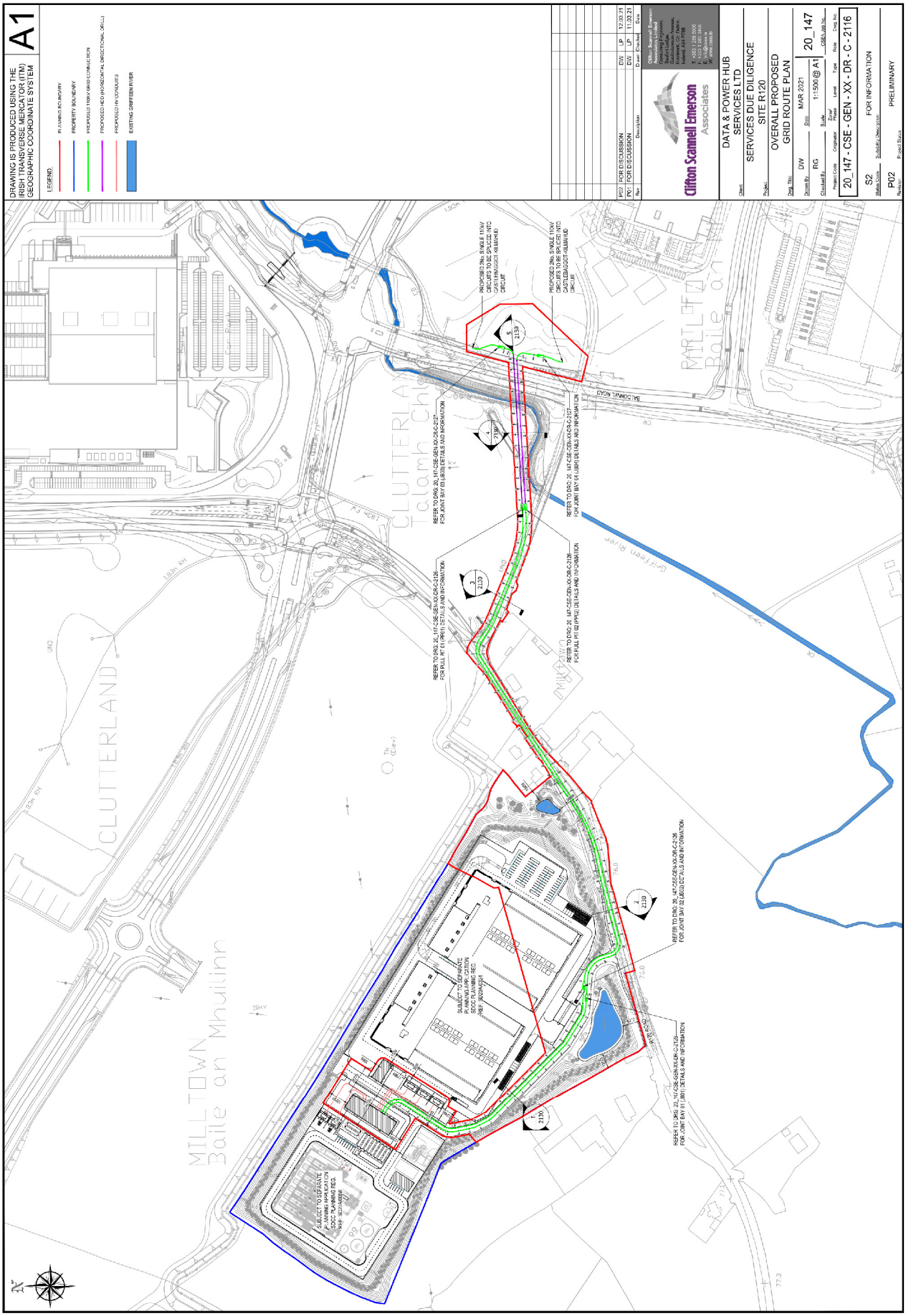
CONTENTS

CHAPTER 2 DESCRIPTION OF THE PROPOSED DEVELOPMENT

Appendix 2.1 Proposed site layout plan (not to scale) indicating Permitted Development



Appendix 2.2 Proposed site layout plan (not to scale) indicating Permitted Development and concurrent application



Appendix 2.3 Schedule of mitigation measures

Project Phase	Mitigation Measures
	Biodiversity
Construction *- European sites*	The Proposed Development is not likely to have a significant effect on any European sites, mitigation measures intended to avoid or reduce any harmful effects of the Proposed Development on designated sites were not required or taken into account.
Construction *- Nationally designated sites*	The Proposed Development is not likely to have a significant effect on any Nationally Designated sites, mitigation measures intended to avoid or reduce any harmful effects of the Proposed Development on designated sites were not required or taken into account.
Construction *- Habitats*	The following mitigation measures are proposed in relation to the protection of trees, treelines and hedgerows: • All trees and hedgerows marked for retention will be fenced off at the outset of works and for the duration of construction to avoid damage to the trunk, branches or root systems of the trees and structures. • Temporary fencing will be erected at a sufficient distance from the tree/ treeline/ hedgerow so as to enclose the Root Protection Area (RPA) of the tree (NRA, 2005-2011). The RPA will be calculated by a qualified arborist. In general, the RPA covers an area equivalent to a circle with a radius 12 times the stem diameter (measured at 1.5m above ground level for single stemmed trees); • Where fencing is not feasible due to insufficient space, protection for the tree will be afforded by wrapping hessian sacking (or suitable equivalent) around the trunk of the tree and strapping stout buffer timbers around it. It will still be necessary to ensure that the area within the RPA is not used for vehicle parking or the storage of materials (including oils and chemicals). This measure is considered secondary to fencing of retained habitats, and should only be undertaken as a last resort; • Weekly checks of the fences will take place by the project ecologist and/or contractor. • Spoil materials such as rubble, topsoil, building goods and equipment, will not be placed within the RPA of trees or hedgerows. The following mitigation measures are proposed in relation to the protection of surface waters such as the Griffeen River and drainage ditch identified within the Proposed Development site: • A contract specific Emergency Response Plan will be prepared by the Contractor and will include an emergency work procedure to deal with any accidental/emergency spills of hazardous substances (oils, hydraulic fluids, concrete/cement etc.). • All potentially harmful substances will be stored in compliance with the handling instruction, including separation of incompatible chemicals, provision of adequate firefighting, spill containment and other safety facilities. • The Contractor will ensure that adequate means (Spill Kits) to absorb or contain any spillages of these chemicals are available on site at all times. Any waste or hazardous waste residuals or potentially contaminated sludge from spill clean-up will be stored in appropriate receptacles or containers, or in bunded storage areas prior to their removal by an EPA licensed contractor. • All fuels or chemicals substances (e.g. oils, diesel, herbicides, pesticides, concrete etc) kept on the construction site will be stored in bunded containers in specified hard standing bunded areas with the provision of a storage/retention capacity of 110% of tank storage. • No refuelling or maintenance of vehicles and equipment will be carried out within 20 metres of any watercourse. • Any discharges arising from the construction phase will incorporate silt removal and hydrocarbon removal using a hydrocarbon interceptor (which will comply with current European Standard EN858). • The proposed attenuation storage will be established, and the required outlet control to attenuate the discharge flow, will be constructed as early as possible in the construction stage. • Runoff from all impermeable areas formed during the construction stage will be directed through the existing storm water storage and attenuated to the greenfield runoff rate. • Inland Fisheries Ireland's *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (2016) will be adhered to throughout the construction stage of the Proposed Development. • Foul drainage from all site facilities will be connected to the public sewer, • When cast-in-place concrete is required, all works will be done in the dry and effectively isolated from any flowing water (or water that may enter rivers or streams) for a period sufficient to ensure no leachate from the concrete.

	• No direct discharges will be made to waters where there is potential for cement or other contaminant residues in discharges. • Designated impermeable cement washout areas will be provided. • Any excavated vegetation, soil and subsoil will be temporarily stockpiled away at least 20m from any surface water features in order to reduce the likelihood of any suspended solids reaching them. • Any soil contaminated from an accidental spillage will be contained and treated appropriately and disposed of in accordance with the Waste Management Act 1996-2012. • Discharge points to the drainage network will entail a mechanism for containment of runoff. This will be used to contain any contaminated runoff in the event of a major accident on site. In the event of a fire, the shutoff valve will close and the forewater will be contained in the attenuation storage system.
Construction *- Bats*	All bat species and their roost sites are strictly protected under both European and Irish legislation including: • Wildlife Act 1976 and Wildlife (Amendment) Act, 2000 (S.I. No. 38 of 2000) • Council Directive on the Conservation of Natural Habitats and of Wild Flora and Fauna 1992 (Council Directive 92/43/EEC) • European Communities (Birds and Natural Habitats) Regulations, 2011 It is an offence under Section 23 of the Wildlife Acts 1976-2017 and under Section 51 of the European Communities (Birds and Natural Habitats) Regulations, 2011 to kill a bat or to damage or destroy the breeding or resting place of any bat species. Under the European Communities (Birds and Natural Habitats) Regulations it is not necessary that the action should be deliberate for on offence to occur. This places an onus of due diligence on anyone proposing to carry out works that might result in such damage or destruction. Under Section 54 of S.I. 477 of 2011, a derogation may be granted by the Minister where there is no satisfactory alternative and 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. Given that the proposed development will result in the loss of two small, confirmed bat roosts, a derogation licence under Section 54 of S.I. 477 of 2011 will be required from National Parks and Wildlife Service (NPWS). Mitigation measures have been proposed with reference to practices outlined in *Bat Mitigation Guidelines for Ireland*[1] and within *Bats & Bat Boxes: Guidance Notes for Agri-environment Schemes*[2]. The aims of the mitigation strategy are to avoid disturbance of roosting bats or mortality of bats during the proposed demolition, and to provide alternative roost sites to offset the loss of known roost sites. • **Supervision of Demolition Works:** A suitably qualified, experienced, and licenced bat worker will be employed to supervise demolition works within the proposed development site, and where necessary, remove bats from buildings. In this instance, the exclusion of bats from the buildings in advance of the commencement of works is not considered to be practically achievable in light of the potential for several small access/egress points in the building. • Where possible, buildings confirmed as bat roosts will be demolished during the spring or autumn periods, as the risk of accidental death or injury is lower at this time. Bats may use roosts in smaller numbers in winter but may nevertheless be present. • The following measures are proposed, should the building demolition works take place during the active bat season (April to September): - Presence/absence of bats will be determined by suitably qualified, experienced, and licensed ecologist(s) in advance of building demolition. Presence/absence will be determined by a combination of dusk emergence, dawn re-entry and roost inspection checks (*e.g.* using an endoscope device). - Immediately following completion of the above, cladding on the eves of the roof of buildings will be removed by hand by the demolition contractor, under the supervision of the licenced bat ecologist in daylight hours. The bat worker will inspect the tiles and other roof materials in advance of removal with a suitable device such as an endoscope. If bats were observed entering the roost on the night previous to the demolition works, the roofing materials will also need to be removed by hand under the supervision of the licenced bat ecologist. - The contractor undertaking roof demolition works will facilitate safe access for the bat

[1] Kelleher, C., and 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.
[2] Bat Conservation Ireland (2015). *Bats & Bat Boxes: Guidance Notes for Agri-environmental Schemes*. August 2014. Updated January 2015. Available online at https://www.batconservationireland.org/wp-content/uploads/2015/05/BCIrelandGuidelines_BatBoxes.pdf

	worker to the roof area of buildings to allow inspection of the roof for roosting bats. Safe access may be facilitated via a scaffold, or via a Mobile Elevated Working Platform (MEWP) or similar. - In the event that bats are encountered during inspection of the roof, they will be removed by hand, and transferred to a bat box (for specification, refer to section below on **Provision of Alternative Roost Facilities**), which will be installed on site in advance of works. • The following measures are proposed, should the building demolition works take place over the winter period (October to March): - Presence/absence of bats will be determined by suitably qualified, experienced, and licensed ecologist(s) in advance of building demolition. Presence/absence will be determined primarily by roost inspection checks (*e.g.* using an endoscope device) but may be supplemented by a combination of dusk emergence and/or dawn re-entry surveys, if weather conditions are suitable. - Immediately following completion of the above, cladding on the eves of the roof of buildings will be removed by hand by the demolition contractor, under the supervision of the licenced bat ecologist in daylight hours. The bat worker will inspect the tiles and other roof materials in advance of removal with a suitable device such as an endoscope. The roofing material of the buildings will be removed by hand under the supervision of the licenced bat ecologist. - The contractor undertaking roof demolition works will facilitate safe access for the bat worker to the roof area of the building to allow inspection of the roof for roosting bats. Safe access may be facilitated via a scaffold, or via a Mobile Elevated Working Platform (MEWP) or similar. - In the event that bats are encountered during inspection of the roof, they will be removed by hand, and transferred to a hibernation bat box (for specification, refer to section below on **Provision of Alternative Roost Facilities**), which will be installed on site in advance of works. • **Provision of Alternative Roost Facilities On-site During and Post Construction**: A mixture containing two Habibat Double Chambered Rocket Box, two Schwegler type 2F boxes and four Schwegler type 1FF flat bat boxes (or similar models) will be installed on a suitable location to be determined by the bat worker/ecologist within the Proposed Development boundary. The retained treeline surrounding the Bulmers residential property is considered to be most suitable for locating bat boxes (see Figure 6.14). The tree mounted bat boxes will be installed either by the ecologist or by the contractor under the supervision of the ecologist. It is preferable that each faces a slightly different aspect from southeast to southwest facing, to provide a range of slightly differing temperature regimes (Bat Conservation Ireland, 2015). The Rocket Box is a pole mounted box which will be installed in a suitable location on site along the eastern hedgerow. All bat boxes will be installed at least 3m above ground level to minimise the risk of interference by humans. The bat boxes will be located away from areas that are subject to artificial light spill.
Construction phase *– small mammals*	There are no significant effects predicted on small mammal species as a result of the proposed works, and therefore no mitigation measures are required.
Construction phase *– amphibians*	Mitigation measures have been designed to protect water quality during construction and are outlined as per earlier in this chapter in terms of mitigation measures for National and European sites.
Construction phase *– birds*	The following mitigation measures are proposed to comply with legislation protecting birds and their nests: • In order to avoid disturbance of breeding birds, their nests, eggs and/or their unfledged young, all works involving any vegetation clearance will be undertaken outside of the nesting season (1st March to 31st August inclusive). **<u>Or where this seasonal restriction cannot be observed then:</u>** • A breeding bird survey will be undertaken, prior to works commencing, during the appropriate survey season (between early March and late June) by an ecologist with experience undertaking breeding bird surveys in order to confirm whether birds are nesting within suitable habitat affected by or immediately adjacent to the Proposed Development lands. Prior to any vegetation clearance during the nesting season (1st March to 31st August inclusive) a check of vegetation for nesting birds must be undertaken. If no breeding birds are found nesting in trees or hedgerows on the site, this vegetation must be removed within 48 hours or repeat surveys will be necessary. Should nesting birds be present during surveys, the removal of trees or hedgerows may be required to be delayed until after the nesting season (1st March to 31st August inclusive).

	The following mitigation measures are proposed to enhance habitat suitability for breeding birds within the Proposed Development: • The planting of bird friendly plants, specifically trees and shrubs with berries suitable for foraging local bird species (see Appendix 6.6) • The installation of bird boxes within the new native woodland belt surrounding the development and within native trees planting in the wetland areas in the south of the site.
Operational *– bats*	• **Lighting proposals for the operational phase:** Lighting proposals for the operational phase will adhere to the following guidance: - *Bats & Lighting: Guidance Notes for Planners, engineers, architects and developers* (Bat Conservation Trust, 2010); - *Guidance Notes for the Reduction of Obtrusive Light GN01 (Institute of Lighting Professionals, 2020); and* - *Bats and Lighting in the UK – Bats and the Built Environment Series (Bat Conservation Trust UK, January 2018).* • Operational stage lighting details shall be reviewed by a qualified bat ecologist. Any external lighting system for the Proposed Development will be designed to minimise glare and light spillage to surrounding agricultural lands and linear treelines and hedgerows. All external lighting will be of a type that ensures deflection of lighting downwards. If necessary, the bat ecologist shall recommend adjustments to directional lighting (*e.g.* through cowls, shields or louvres) to restrict light to those areas where it is needed, importantly along linear habitat features to ensure long-term suitability for foraging and commuting bats.
	Land, Soil and Geology
Construction *- CEMP*	An outline Construction Environmental Management Plan (CEMP) has been prepared by J.B Barry Consultimng Engineers for the proposed development and is included with the planning documentation. In advance of work starting on site, the works Contractor will prepare a detailed Construction Environmental Management Plan (CEMP). The detailed CEMP will set out the overarching vision of how the construction of the proposed development will be managed in a safe and organised manner by the Contractor. The CEMP will be a live document and it will go through a number of iterations before works commence and during the works. It will set out requirements and standards which must be met during the construction stage and will include the relevant mitigation measures outlined in the EIA Report and any subsequent planning conditions relevant to the proposed development.
Construction *– Control of soil excavation*	Subsoil will be excavated to facilitate the construction of foundations and auxiliary works associated with the construction of the two storey substation and transmission lines. The proposed development will incorporate the reduce, reuse and recycle approach in terms of soil excavations on site. The construction will be carefully planned to ensure only material required to be excavated will be excavated resulting in as much material left in situ as possible. It is unlikely any contaminated material will be encountered during construction of the proposed development. Nonetheless, any excavation works will be carefully monitored by a suitably qualified person to ensure any potentially contaminated soil is identified and segregated from clean/inert soil. In the unlikely event that any potentially contaminated soils are encountered, they should be tested and classified as hazardous or non-hazardous in accordance with the EPA *Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous* publication, HazWasteOnline tool or similar approved method. The material will then need to be classified as inert, non-hazardous, stable non-reactive hazardous or hazardous in accordance with *EC Decision 2003/33/EC*. It should then be removed from site by a suitably permitted waste contractor to an authorised waste facility. Stockpiles have the potential to cause negative impacts on air and water quality. The effects of soil stripping and stockpiling will be mitigated against through the implementation of appropriate earthworks handling protocol during construction. It is anticipated that any stockpiles will be formed within the boundary of the site and there will be no direct link or pathway from this area to any surface water body.
Construction *– Export of material from site*	It is estimated that approximately 1,556 m3 of topsoil, subsoils, tarmacadam / hardcore fill will be excavated to facilitate construction of the proposed transmission lines. It is currently envisaged that majority of this excavated material will require removal offsite for reuse, recovery and/or disposal. Refer to Chapter 14 Waste Management for further detail. In

	addition to the transmission lines, it is estimated that c. 24,700m^3 of topsoil and subsoils will be excavated for the substation, attenuation, and landscaping component of the proposed development. Suitable soils and stones will be reused on-site as backfill in the grassed areas, where possible. It is currently envisaged that all of the excavated material will be reused for a landscaping on site, and will require an additional import of c. c. 22,000m^3 of soil/stone fill to complete the landscaping aspects. If any waste soil requires removal from site, it should be classified by an experienced and qualified environmental professional to ensure that the waste soil is correctly classified for transportation and recovery/disposal offsite. Refer to Chapter 14 Waste Management for further relevant information.
Construction – *Sources of fill and aggregates*	All fill and aggregate for the proposed development will be sourced from reputable suppliers. All suppliers will be vetted for: • Aggregate compliance certificates/declarations of conformity for the classes of material specified for the proposed development; • Environmental Management status; and • Regulatory and Legal Compliance status of the Company.
Construction – *Fuel and chemical handling*	The following mitigation measures will be taken at the construction stage in order to prevent any spillages to ground of fuels and prevent any resulting soil and/or groundwater quality impacts: • Designation of a bunded refuelling areas on the site; • Provision of spill kit facilities across the site; and • Where mobile fuel bowsers are used the following measures will be taken: – Any flexible pipe, tap or valve will be fitted with a lock and will be secured when not in use; – The pump or valve will be fitted with a lock and will be secured when not in use; – All bowsers to carry a spill kit – Operatives must have spill response training; and – Drip trays used on any required mobile fuel units. In the case of drummed fuel or other potentially polluting substances which may be used during construction the following measures will be adopted: • Secure storage of all containers that contain potential polluting substances in a dedicated internally bunded chemical storage cabinet unit or inside a concrete bunded area; • Clear labelling of containers so that appropriate remedial measures can be taken in the event of a spillage; • All drums to be quality approved and manufactured to a recognised standard; • If drums are to be moved around the site, they will be secured and on spill pallets; and • Drums to be loaded and unloaded by competent and trained personnel using appropriate equipment. The aforementioned list of measures is non-exhaustive and will be included in the CEMP.
Construction – *Control of water during construction*	No significant dewatering is required for the site development. However, run-off from excavations/earthworks cannot be prevented entirely and is largely a function of prevailing weather conditions. Earthwork operations will be carried out such that surfaces, as they are being raised, shall be designed with adequate drainage, falls and profile to control run-off and prevent ponding and flowing. These measures will ensure that there will be minimal inflow of shallow/perched groundwater into any excavation. Care will be taken to ensure that exposed soil surfaces are stable to minimise erosion. All exposed soil surfaces will be within the main excavation site which limits the potential for any offsite impacts. All run-off will be prevented from directly entering into any watercourses/ drainage ditches. Should any discharge of construction water be required during the construction phase, discharge will be to foul sewer. Pre-treatment and silt reduction measures on site will include a

	combination of silt fencing, settlement measures (silt traps, 20 m buffer zone between machinery and watercourses, refuelling of machinery off site) and hydrocarbon interceptors. During the operational phase of the proposed development site, there is limited potential for site activities to impact on the geological and hydrogeological environment of the area. There will be no emissions to ground or the underlying aquifer from operational activities. There will be no impact on local or regional groundwater resources (abstraction) as a result of the proposed development.
Operational – *Environmental procedures*	The following mitigation measures will be undertaken at the operational stage to manage any leaks from vehicles resulting in soil and/or groundwater quality impacts: • Provision of spill kit facilities and training of operatives in use of same; • Where mobile fuel bowsers are used the following measures will be taken: - Any flexible pipe, tap or valve will be fitted with a lock and will be secured when not in use; - The pump or valve will be fitted with a lock and will be secured when not in use; - All bowsers to carry a spill kit; - Operatives must have spill response training; and - Portable generators or similar fuel containing equipment will be placed on suitable drip trays.
Operational – *Increase in hard stand area*	A proportion of the development area will be covered in hardstand which includes the two other developments - data storage facility (SD20A/0324) and power generation application (SD20A/0058). This protects the underlying aquifer but also reduces local recharge in this area of the aquifer. As the area of the aquifer is large this reduction in local recharge will have no significant change in the natural hydrogeological regime.
	Hydrology
Construction - *CEMP*	An outline Construction Environmental Management Plan (CEMP) has been prepared by J.B. Barry Consulting Engineers for the proposed development and is included with the planning documentation. A detailed CEMP will be prepared and maintained by the appointed contractors during the construction phase of the proposed project. The CEMP will cover all potentially polluting activities and include an emergency response procedure. All personnel working on the site will be trained in the implementation of the CEMP. At a minimum, the CEMP will be formulated in consideration of the standard best international practice including, but not limited, to: • CIRIA, (2001), *Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors, (C532)* Construction Industry Research and Information Association; • CIRIA (2002) *Control of water pollution from construction sites: guidance for consultants and contractors (SPI56)* Construction Industry Research and Information Association; • CIRIA (2005), *Environmental Good Practice on Site* (C650); Construction Industry Research and Information Association; • BPGCS005, *Oil Storage Guidelines*; • CIRIA 697 (2007), *The SuDS Manual*; and • *UK Pollution Prevention Guidelines,* (PPG) UK Environment Agency, 2004. All contractors will be required to implement the CEMP.
Construction - *Surface water run-off*	As there is potential for run-off to enter current stormwater systems and indirectly discharge to a watercourse, mitigations will be put in place to manage run-off during the construction phase. Run-off water containing silt will be contained on site via settlement tanks and treated to ensure adequate silt removal. Silt reduction measures on site will include a combination of silt fencing and settlement measures (silt traps, silt sacks and settlement tanks/ponds). The temporary storage of soil will be carefully managed. Stockpiles will be tightly compacted to reduce runoff and graded to aid in runoff collection. This will prevent any potential negative impact on the stormwater drainage and the material will be stored away from any surface

	water drains. Movement of material will be minimised to reduce the degradation of soil structure and generation of dust. Excavations will remain open for as little time as possible before the placement of fill. This will help to minimise the potential for water ingress into excavations. Soil from works will be stored away from existing drainage features to remove any potential impact. Before any works commence for the HDD process, a mud engineer along with the driller will design a drilling programme to include a mud blend for the profile. The starting drilling pad is located c. 50metres east from the Griffeen River. The exit drilling pad is located approx. 30 metres west from the Griffeen River. The drilling route is proposed to be approx. 9.7 metres beneath the river. This will avoid any potential impacts to the Griffeen River. In order to minimize the risk of mud breakouts, care shall be taken to keep the mud pressures between the minimum and maximum calculated pressures. The driller and mud engineer, from experience, will know when to increase the viscosity of the drilling fluid in formations that are prone to break out and reduce the ROP so not to overload the annulus with cuttings. Monitoring the discharge of cuttings over the shale shakers is important, excessive material will indicate a wash out in formation. It is important that any losses to formation are recorded and addressed as this is an early tell-tale sign of a potential breakout. Weather conditions will be considered when planning construction activities to minimise the risk of run-off from the site and the suitable distance of topsoil piles from surface water drains will be maintained.
Construction *– Fuel and chemical handling*	The following mitigation measures will be taken at the construction stage in order to prevent any spillages of fuels and prevent any resulting impacts to surface water systems. • Designation of a bunded refuelling areas on the site; • Provision of spill kit facilities across the site; • Where mobile fuel bowsers are used the following measures will be taken: - Any flexible pipe, tap or valve will be fitted with a lock and will be secured when not in use; - The pump or valve will be fitted with a lock and will be secured when not in use; - All bowsers will carry a spill kit and operatives must have spill response training; and - Portable generators or similar fuel containing equipment will be placed on suitable drip trays. In the case of drummed fuel or other potentially polluting substances which may be used during construction the following measures will be adopted: • Secure storage of all containers that contain potential polluting substances in a dedicated internally bunded chemical storage cabinet unit or inside a concrete bunded areas; • Clear labelling of containers so that appropriate remedial measures can be taken in the event of a spillage; • All drums to be quality approved and manufactured to a recognised standard; • If drums are to be moved around the site, they should be done so secured and on spill pallets; and • Drums to be loaded and unloaded by competent and trained personnel using appropriate equipment. All ready-mixed concrete will be brought to site by truck. A suitable risk assessment for wet concreting will be completed prior to works being carried out which will include measures to prevent discharge of alkaline wastewaters or contaminated stormwater to the underlying subsoil. Wash-down and washout of concrete transporting vehicles will take place at an appropriate facility offsite.
Construction *– Accidental release*	Emergency response procedures will be outlined in the detailed CEMP. All personnel working on the site will be suitably trained in the implementation of the procedures.
Construction *– Soil removal and compaction*	Temporary storage of soil will be carefully managed in such a way as to prevent any potential negative impact on the receiving environment. The material will be stored away from any

	surface water drains (see Surface Water Run-off section above). Movement of material will be minimised to reduce degradation of soil structure and generation of dust. All excavated materials will be visually assessed for signs of possible contamination such as staining or strong odours. Should any unusual staining or odour be noticed, samples of this soil will be analysed for the presence of potential contaminants to ensure that historical pollution of the soil has not occurred. Should it be determined that any of the soil excavated is contaminated, this will be segregated and appropriately disposed of by a suitably permitted/licensed waste disposal contractor. Site investigations carried out at the site in October/ November 2020 found no residual contamination on site. Nonetheless, all excavated materials will be visually assessed for signs of possible contamination such as staining or strong odours. Should any unusual staining or odour be noticed, samples of this soil will be analysed for the presence of potential contaminants to ensure that historical pollution of the soil has not occurred. Should it be determined that any of the soil excavated is contaminated, this will be segregated and appropriately disposed of by a suitably permitted/licensed waste disposal contractor.
Operational *– Environmental procedures*	During operation the site will operate in compliance with the requirements of an Irish Water (IW) licence for discharge to sewer. The following containment measures are included within the design to reduce potential for environmental impact. There will be comprehensive emergency response procedures and standard operating procedures to respond to chemical spillage of all types. All employees will be provided with such equipment, information, training and supervision as is necessary to implement the emergency response procedures and standard operating procedures.
Operational *– Storm water & foul sewer drainage*	The proposed development will provide a significant improvement to the local drainage catchment as it is proposed to provide full attenuation for increase in hardstand area in compliance with the requirements of the Greater Dublin Strategic Drainage Study. A number of measures will be put in place to minimise the likelihood of any spills entering the water environment to include the design of the car park, fitting of refuelling areas with hydrocarbon interceptors and on-site speed restrictions. Refer to the JB Barry, Consulting Engineers Drawing no. 19229-JBB-00-XX-DR-C-01500 and their Water Services Report (19229-JBB-00-XX-RP-C-00008). It is proposed to ultimately discharge surface water from the proposed development, post attenuation and outflow restrictions, to the pre-existing surface water drainage system located along Baldonnel Road where it will connect into the private SDCC waste water treatment system within Grange Castle Business Park.
Operational *– Water supply*	Irish Water has confirmed available capacity for the required water supply for this development A Confirmation of Feasibility was issued by Irish Water on the 14th April 2020 and a copy of this is included with the JB Barry, Water Services Report (19229-JBB-00-XX-RP-C-00008). Flow monitoring for the purpose of billing and leakage monitoring shall be installed at the interface of the public and private mains. The detail of the meter and enclosure required shall be agreed with the water authority in advance of construction. Water meters in line with South Dublin County Council and Irish Water requirements and specifications, will be installed at the connections onto the aforementioned existing water mains as required.
	Noise and vibration
Construction *– Noise and vibration*	With regard to construction activities, reference has been made to BS5228 Parts 1 and 2, which offer detailed guidance on the control of noise and vibration from demolition and construction activities. Various mitigation measures will be considered and applied during the construction of the proposed development. As an example, the following measures will be implemented on site: • limiting the hours during which site activities likely to create high levels of noise or vibration are permitted; • establishing channels of communication between the contractor/developer, Local Authority and residents; • appointing a site representative responsible for matters relating to noise and vibration;

	• monitoring levels of noise and/or vibration during critical periods and at critical sensitive locations; and • all site access roads will be kept even so as to mitigate the potential for vibration from lorries. Furthermore, a variety of practicable noise control measures will be employed, such as: • selection of plant with low inherent potential for generation of noise and/ or vibration; • erection of barriers as necessary around items such as generators or high duty compressors; • situate any noisy plant as far away from sensitive properties as permitted by site constraints and the use of vibration isolated support structures where necessary. It is recommended that vibration from construction activities to off-site residences be limited to the values set out in Table 9.7. It should be noted that these limits are not absolute but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage, these limits may need to be reduced by up to 50%. Appendix 9.5 presents an indicative construction noise and vibration management plan that will be implemented in terms of the day to day operation of the site. This will focus on opening up and maintaining lines of communication with the local community to address issues in relation to noise and/or vibration and to advise the community of periods where specific activities take place (e.g. rock breaking) that have an increased potential in giving rise to issues off site.
Operational - *Building services noise / emergency site operation*	Once operational, there are no noise or vibration measures required. With due consideration as part of the detailed design process, this approach will result in the site operating well within the constraints of the best practice guidance noise limits that have been adopted as part of this detailed assessment.
Operational **-** *Additional vehicular traffic on public roads*	The noise impact assessment outlined previously has demonstrated that mitigation measures are not required.
	Air quality and climate
Construction *– Dust control*	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 and the USA based on the following publications: - 'Guidance on the Assessment of Dust from Demolition and Construction' (IAQM, 2014); - 'Planning Advice Note PAN50 Annex B: Controlling The Environmental Effects Of Surface Mineral Workings Annex B: The Control of Dust at Surface Mineral Workings' (The Scottish Office, 1996); - 'Controlling the Environmental Effects of Recycled and Secondary Aggregates Production Good Practice Guidance' (UK Office of Deputy Prime Minister, 2002); - 'Controlling Particles, Vapours & Noise Pollution From Construction Sites' (BRE, 2003); - 'Fugitive Dust Technical Information Document for the Best Available Control Measures' and the USA (USEPA, 1997); and - 'Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition' (periodically updated) (USEPA, 1986). In advance of work starting on site, the works contractor will prepare a detailed Construction Environmental Management Plan (CEMP). The CEMP will set out the overarching vision of how the construction of the Proposed Development will be managed in a safe and organised manner by the Contractor. The CEMP will be a live document. It will set out requirements and standards which must be met during the construction stage and will include the relevant mitigation measures outlined in the EIA Report and any subsequent planning conditions relevant to the Proposed Development.
Construction *– 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 10.1 for the wind rose for Casement Aerodrome). As the prevailing wind is predominantly westerly to south-westerly, locating construction compounds and storage piles downwind (to the east or north-east) 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 (UK Office of Deputy Prime Minister (2002), BRE (2003)). 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; and 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.
Construction - *demolition*	Prior to demolition, blocks should be soft stripped 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.
Construction *– site roads / haulage routes*	Movement of construction trucks along site roads (particularly unpaved roads) can be a significant source of fugitive dust 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 Office of Deputy Prime Minister, 2002), as follows: • A speed restriction of 20 km/hr will be applied as an effective control measure for dust for on-site vehicles using unpaved site roads; • Access gates to the site will be located at least 10m from sensitive receptors where possible;

	• Bowsers or suitable watering equipment will be available during periods of dry weather throughout the construction period. Research has found that watering can reduce dust emissions by 50% (USEPA, 1997). Watering will be conducted during sustained dry periods to ensure that unpaved areas are kept moist. The required application frequency will vary according to soil type, weather conditions and vehicular use; • Any hard surface roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads shall be restricted to essential site traffic only.
Construction *– Land clearing / earth moving*	Land clearing / earth-moving works during periods of high winds and dry weather conditions can be a significant source of dust. The following mitigation measure shall be employed: • During dry and windy periods, and when there is a likelihood of dust nuisance, watering will be conducted to ensure moisture content of materials being moved is high enough to increase the stability of the soil and thus suppress dust; • During periods of very high winds (gales), activities likely to generate significant dust emissions will be postponed until the gale has subsided.
Construction *– storage piles*	The location and moisture content of storage piles are important factors which determine their potential for dust emissions. The following mitigation measure shall be employed: • Overburden material will be protected from exposure to wind by storing the material in sheltered regions of the site. Where possible storage piles will be located downwind of sensitive receptors; • Regular watering will take place to ensure the moisture content is high enough to increase the stability of the soil and thus suppress dust. The regular watering of stockpiles has been found to have an 80% control efficiency (UK Office of Deputy Prime Minister, 2002); and • Where feasible, hoarding will be erected around site boundaries to reduce visual impact. This will also have an added benefit of preventing larger particles from impacting on nearby sensitive receptors.
Construction *– Site traffic on public roads*	Spillage and blow-off of debris, aggregates and fine material onto public roads will be reduced to a minimum by employing the following measures: • Vehicles delivering or collecting material with potential for dust emissions shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust; • At the main site traffic exits, a wheel wash facility will be installed. All trucks leaving the site must pass through the wheel wash. In addition, public roads outside the site shall be regularly inspected for cleanliness, as a minimum on a daily basis, and cleaned as necessary.
Construction *– Dust mitigation*	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.
Operational	No mitigation is proposed for the operation phase of the Proposed Development as it is predicted to have an imperceptible impact on air quality and climate. Cumulatively, in relation to climate mitigation, the proposed development has been designed to minimise the impact on climate. The proposed development will allow for the proposed Information Communication Technology (ICT) development (SDCC Reg. Ref. SD20A/0324) to source electricity from the national grid. Data centres are typically 84% more efficient than on-premises servers. In addition, in terms of total forecasted capacity, it is predicted that 1,700MW of data centres capacity will be operational by 2025. However, the carbon intensity of electricity is predicted to decrease from 331 gCO_2/kWh in 2019 to 100 gCO_2/kWh in 2030 as a result of the increase in renewables to

	70% of the electricity market by 2030. Overall, it is predicted that data centres will peak at 2.2% of total GHG emissions in 2024 and will fall or level off after this date (Host In Ireland, 2020).
	Landscape and visual assessment
Operational *– visual impact*	The mitigation of potential negative landscape and visual impacts has influenced the design and layout of the scheme from the start of the design process. As a result of this, the following landscape design mitigation measures have been made as part of the Proposed and already granted under the Permitted Development: ▪ Earth modelling and large tree planting reinforced with woodland whip planting in belts has been proposed to provide a high level of visual screening of the most sensitive views of the development; and ▪ The retention of a number of existing trees and hedgerow belts with reference to the arborists' report to maintain some existing levels of screening to the site.
	Traffic and transportation
Construction *– traffic and transportation*	A detailed Construction Traffic Management Plan (CTMP) will be prepared by the appointed lead contractor. The CTMP will consider the safety and operational impact on construction traffic from all phases of the development and will pay particular attention to: • Routes to be used by vehicles; • Working hours of the site; • Details of construction traffic forecasts; • Times when vehicle movements and deliveries will be made to site; • Facilities for loading and unloading; • Facilities for parking cars and other vehicles; and • Details of lane closures. The lead contractor will be required to appoint a dedicated construction manager and construction traffic manager. The construction traffic manager will be required to coordinate and schedule all deliveries to the site, ensure that roadways are kept clear of mud and debris, advise haulage contractors on routes, and adhere to good traffic management principles. The following measures will also be implemented: • The contractor will be required to provide wheel cleaning facilities, and regular cleaning of the main access road; • Temporary car parking facilities for the construction workforce will be provided within the site and the surface of the car park will be prepared and finished to a standard sufficient to avoid mud spillage onto adjoining roads; • Monitoring and control of construction traffic will be ongoing during construction works; and • Construction traffic will be minimised during peak hours.
Operational *– traffic and transportation*	The potential traffic impact associated with the operational phase of the Proposed Development will be ***long-term neutral and imperceptible.*** The traffic impact during the operational phase is minimal and expected traffic flows will be significantly below the thresholds set out in the Transport Infrastructure Ireland (TII) document '*Traffic & Transport Assessment Guidelines May 2014'*. Therefore, no further mitigation measures are proposed on the public road to facilitate this phase of the development.
	Cultural heritage
Construction *– Cultural heritage*	As noted above, while the Proposed Development does not impact on any known archaeological sites or monuments, geophysical survey indicates that there is a high possibility that previously unrecorded material or finds may be encountered during ground disturbance associated with this development. Thus, a programme of archaeological investigations will be undertaken within the main site area.

	A suitably qualified archaeological consultant will be retained to advise on the logistical and financial requirements of the management of the archaeological mitigation, and on the programming of the required mitigation works. A programme of archaeological test excavations will be undertaken under license to the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht, to investigate these anomalies and assess the portions of the remainder of the site that are in greenfield areas. A comprehensive report outlining the results of the programme of archaeological test excavations will be prepared and should include a detailed method statement for the archaeological excavation of features identified, agreed in advance with the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht. The report will include a schedule of works detailing timeframes, personnel and logistical requirements. Any areas that require archaeological excavation will be cordoned off to facilitate the archaeological team to carry out the excavations. A buffer zone will be agreed with National Monuments Service and no construction works will be undertaken in these areas until archaeological excavations have been completed. Provision has been made by the applicant for all costs associated with archaeological testing, any required excavations and report of the results to the standards required by the National Monuments Service of the Department, Culture, Heritage and the Gaeltacht. The remedial or reductive measures outlined here are subject to the approval of the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht.
Operational phase *– cultural heritage*	No remedial or reductive measures are considered necessary during the operational phase of the Proposed Development, as the operational phase will not give rise to any adverse impacts.
	Waste management
Construction – *C&D WMP*	A project specific outline C&D WMP has been prepared in line with the requirements of the *Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects* guidance document issued by the Department of Environment, Heritage and Local Government (DoEHLG). Adherence to the high-level strategy presented in the C&D WMP enclosed in Appendix 14.1 will ensure effective waste management and minimisation, reuse, recycling, recovery and disposal of waste material generated during the construction phase of the proposed development. Prior to commencement of construction, the contractor(s) will be required to refine/update this document to detail specific measures to minimise waste generation and resource consumption and provide details of the proposed waste contractors and destinations of each waste stream. It is estimated that approximately 1,556m^3 of topsoil, subsoils, tarmacadam / hardcore fill will be excavated to facilitate construction of the proposed transmission lines component of the proposed development. It is currently envisaged that the majority of this excavated material will require removal offsite for reuse, recovery and/or disposal. In addition to the transmission lines, it is estimated that c. 24,700m^3 of topsoil and subsoils will be excavated for the substation, attenuation, and landscaping component of the proposed development. Suitable soils and stones will be reused on-site as backfill in the grassed and landscape / berming areas, where possible within the wider site. It is currently envisaged that all of the excavated material will be reused for ;andscaping on site, and will require an additional import of c. 22,000m^3 of soil to complete the landscaping aspects. In addition, the following mitigation measures will be implemented: • On-site segregation of waste materials will be carried out to increase opportunities for off-site reuse, recycling and recovery – it is anticipated that the following waste types, at a minimum, will be segregated; - Made ground - Soils and stones

	- Trees/shrubbery
	- In addition, the following wastes will be segregated at the site compound:
	  - Organic (food) waste
	  - Packaging (paper/card/plastic)
	  - Mixed dry recyclables
	  - Mixed non-recyclable waste
	• All excavations will be carefully monitored by a suitably qualified person to ensure that potentially contaminated soil is identified and segregated, if encountered. In the event that any potentially contaminated material is encountered, it will be segregated from clean/inert material, tested and classified as either non-hazardous or hazardous and further classified as clean, inert, non-hazardous or hazardous in accordance with the EC Council Decision 2003/33/EC, which establishes the criteria for the acceptance of waste at landfills;
	• Waste materials generated at the site compound will be stored in suitable receptacles in designated areas of the site compound;
	• Any hazardous wastes generated (such as chemicals, solvents, glues, fuels, oils) will also be segregated and will be stored in appropriate receptacles (in suitably bunded areas, where required);
	• A waste manager will be appointed by the main contractor to ensure effective management of waste during the excavation and construction works;
	• All construction staff will be provided with training regarding the waste management procedures;
	• All waste leaving site will be reused, recycled or recovered where possible to avoid material designated for disposal;
	• All waste leaving the site will be transported by suitable permitted contractors and taken to suitably registered, permitted or licenced facilities; and
	• All waste leaving the site will be recorded and copies of relevant documentation maintained.
	
	As surplus soils and stones will require removal from site, any nearby sites requiring clean fill material will be contacted to investigate reuse opportunities for clean and inert material, which requires removal off-site. If any of the material is to be reused on another site as by-product (and not as a waste), this will be done in accordance with Article 27 of the *EC (Waste Directive) Regulations (2011)* as detailed in the C&D WMP (Appendix 14.1).
	
	These mitigation measures will ensure that the waste arising from the construction phase of the development is dealt with in compliance with the provisions of the *Waste Management Act 1996*, as amended, associated Regulations, the *Litter Pollution Act 1997 to 2009* and the *EMR Waste Management Plan (2015 - 2021)*. It will also ensure optimum levels of waste reduction, reuse, recycling and recovery are achieved and will encourage sustainable consumption of resources.

Operational - *Waste*	Small volumes of waste will be generated at the proposed GIS substation. No waste will be generated from the operation of the proposed 110kV transmission lines.
	
	Any waste materials will be segregated into appropriate categories and will be temporarily stored in appropriate bins or other suitable receptacles in a designated, easily accessible areas of the substation.
	
	In addition, the following mitigation measures will be implemented:
	
	• On-site segregation of all waste materials into appropriate categories including (but not limited to):
	  - Dry Mixed Recyclables;
	  - Organic food/green waste;
	  - Mixed Non-Recyclable Waste;
	  - Batteries (non-hazardous and hazardous);
	  - Waste electrical and electronic equipment (WEEE) including computers, printers and other ICT equipment; and
	  - Cleaning chemicals (solvents, pesticides, paints, adhesives, resins, detergents, etc.).
	• All waste materials will be stored in colour coded bins or other suitable receptacles in

	designated, easily accessible locations. Bins will be clearly labelled with the approved waste type to ensure there is no cross contamination of waste materials; • All waste collected from the development will be reused, recycled or recovered where possible, with the exception of those waste streams where appropriate facilities are currently not available; • All waste leaving the site will be transported by suitable permitted contractors and taken to suitably registered, permitted or licensed facilities; and • All waste leaving the site will be recorded and copies of relevant documentation maintained. These mitigation measures will ensure the waste arising from the development is dealt with in compliance with the provisions of the *Waste Management Act 1996*, as amended, associated Regulations, the *Litter Pollution Act 1997* and the *EMR Waste Management Plan (2015 - 2021)*. It will also ensure optimum levels of waste reduction, reuse, recycling and recovery are achieved.
	Material assets
Construction – *Service providers*	Construction of the proposed GIS substation will require connections to power, telecommunications, drainage infrastructure and water supply but will not require any connections outside the Permitted Development site and Proposed Development site boundaries. Construction of the 110kV transmission lines will not require any power, telecommunications, drainage infrastructure and water supply from existing services. Completed surveys have identified where short term diversion of any services will be required. Ongoing consultation with EirGrid, ESB Networks, SDCC, Irish Water and other relevant utility providers within the locality and compliance with any requirements or guidelines they may have will ensure a smooth construction schedule without disruption to the local and business community. Such diversions are common practice.
Construction – *Power and Electricity supply*	The power demand for the construction phase will be relatively minor and the temporary connection works are entirely within the wider site, and there will therefore be no offsite impact. The excavation of trenches within the vicinity of existing electrical services will be carried out in consultation with ESB Networks to ensure there is no impact on existing users. Once the construction of the Proposed Development is completed, ESB Networks will be mobilised to complete the commissioning in accordance with the ESB Network requirements. As stated in Chapter 2, there is no requirement for chemicals usage and minimal access to the route by personnel and there is no likely environmental effect as a result of commissioning.
Construction - *Telecommunications*	The telecommunications will be extended from the Permitted Development granted under Reg. Ref. SD20A/0058 to accommodate the Proposed Development. As these works are entirely within permitted and proposed site boundaries, it is predicted that there will be no offsite impact as result of these works. No remedial or mitigation measures are required in relation to telecommunications.
Construction - *Surface water and foul water infrastructure*	Welfare facilities (canteens, toilets etc.) will be available within the construction compound of the Permitted Development and it is proposed that this will be in place for the construction of the Proposed Development. No remedial or mitigation measures are required in relation to foul drainage infrastructure and water supply. Surface water run-off water containing silt will be contained on site and treated (using a siltbuster or temporary on-site settlement ponds/tanks) to ensure adequate silt removal. The construction works will not require any interruptions to service in existing surface water sewers.
Operational *– Power and electricity supply*	The Proposed Development has been designed in accordance with ESB Networks requirements. Eirgrid has confirmed that there is sufficient capacity to export power under licence into the National Grid via the Castlebaggot-Kilmahud Circuit. The nature of the Proposed Development ensures that it will facilitate the export of power, and has the capacity to facilitate the continuity of supply of electricity to the concurrent application for the ICT Facility.No remedial or mitigation measures are required in relation to power and electricity supply.

Operational - *Telecommunications*	As there are no potential effects on telecommunications during the operational phase of the Proposed Development, no remedial or mitigation measures are required.
Operational - *surface water and foul water infrastructure*	There are no potential effects associated with surface water and foul drainage infrastructure or water supply for the Proposed Development for the operational phase and as such no remedial or mitigation measures are deemed necessary.

Appendix 2.4 Grange Castle 110kV ESB Trenchless Crossing Report

GEO DRILLING SOLUTIONS

GRANGE CASTLE 110KV ESB TRENCHLESS CROSSING

Feasibility assessment for the undergrounding of a 110kV cables using Horizontal Directional Drilling beneath the Baldonnel Road & Griffeen River, Clutterland, Lucan, County Dublin

Clifton Scannell Emerson Associates | Civil & Structural Consulting Engineers

Project Reference: GDS2073

Client: Clifton Scannell Emerson Associates

Mentec House (1st Floor), Bakers Point, Pottery Road, Dun Laoghaire, Co. Dublin, A96 K6P3

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GDS2073_CSEA_Feasbility Study Grange Castle

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NOMENCLATURE

AB – Auger Boring

BGL – Below Ground Level

BH – Borehole

CP – Cable Percussion

CSEA – Clifton Scammel Emerson & Associates

GDS – Geo Drilling Solutions

GI – Geotechnical Investigations

GL – Ground level

GSI – Geological Society Ireland

GWL – Ground Water Level

HDD – Horizontal Directional Drilling

ID – Internal Diameter

OD – Outside Diameter

PE – Polyethylene

RDX – Road Crossing

ROP – Rate of Penetration

RVX – River Crossing

RC – Rotary Core

SDC - Specialist Drilling Contractor

SPT – Standard Penetration Test

TD – Total Depth

INTRODUCTION

Clifton Scannell Emerson Associates (CSEA) have requested Geo Drilling Solutions (GDS) to examine the possibility of using trenchless technologies to underground part of a 110 kV ESB circuit on the Grange Castle site in Lucan, County Dublin. The specific areas of interest are beneath the Baldonnel Road – Old Nangor Road and the Griffeen river.

The site is located in Clutterland, Co. Dublin.

This feasibility study is exploring the possibility of using trenchless technologies as a methodology by reviewing the available local and regional information on the ground conditions, assessing any site constraints, and examining the project requirements.

SCOPE OF WORKS

Each location where a trenchless technique is proposed to underground the ducts is to be assessed under the following criteria:

1. Visit site and visually inspect each location.
2. Assess the feasibility of completing the crossings with a trenchless technique.
3. Review the geotechnical data.
4. Confirm the enabling works required.
5. Draft profile drawings.
6. Propose scope of works.

SITE VISIT

Site address: Baldonnel Road, Cluttertown, Lucan County Dublin.

A site visit was carried out on the 30th of January 2021.

The project involves crossing beneath a single carriageway and river, Figure 1.

Figure 1 – Site locations

Sensitivity: High, there can be no disturbance to the carriageway or drilling fluid discharge into the Griffeen river.

Methodology: HDD proposed due to the length of the crossings, ground conditions and the configuration of the ducts.

Observations:

- There is ample room to set up equipment on both entry and exit side, a hard standing will be required in the grass area. Figure 2 & Figure 5
- There is ample room for welding and stringing out the ducts.
- Access to the carriageway is only required for the steering of the pilot bore.
- The area is heavily congested with underground utilities, depths unknown, Figure 3.

- A HDD drilling contractor will require a water supply to be made available on site for mixing drilling fluids, depending on environmental constraints this can be abstracted from the river or a nearby hydrant.
-

Recommendations:

- Confirm access to a water supply, approximate usage will be 2 m^3/hr.
- The depth of third-party utilities needs to be confirmed.

Figure 2 – Location of launch area on the east site of the Baldonnel Road

Figure 3 – Baldonnel Rd., south bound

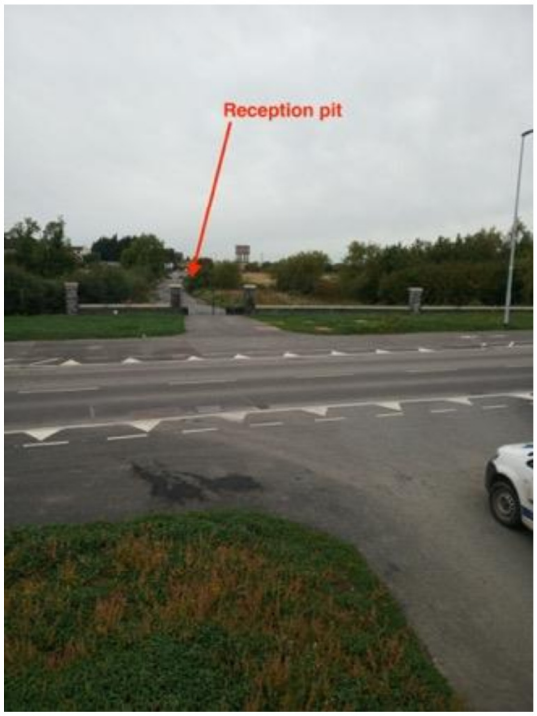

Figure 4 – Baldonnel Rd., east to west

Figure 5 – Reception area on the west site of the Baldonnel Road

Figure 6 – River Griffeen

METHODOLOGIES

The options available to complete the crossings are:

1. **Horizontal directional drilling (HDD).**
   - **1.1. Positives:**
     - 1.1.1. Working from ground level which avoids any risk of the artesian groundwater.
     - 1.1.2. Track mounted machines.
     - 1.1.3. Install product pipe without the need of a carrier duct.
     - 1.1.4. The total length of the crossings can be installed in a single pipe section if the ground conditions are favourable.
     - 1.1.5. Accurate location of the pipe along the profile.
     - 1.1.6. A wide range of tooling options, aggressive jetting assemblies, dual wall drill pipe rigs, DTH hammers and mud motors.
   - **1.2. Negatives:**
     - 1.2.1. Any formation anomalies such as a boulder and formation horizons will deviate the pilot bore, making it difficult to maintain the radius of curvature.
     - 1.2.2. Fluid losses into broken formations.
     - 1.2.3. Inadvertent drilling fluids returning to surface along a profile.
     - 1.2.4. Cheese wiring can occur when the formation is soft.
     - 1.2.5. Collapsing formations
     - 1.2.6. Tight formations making steering with a regular jetting assembly difficult.
     - 1.2.7. Pipe scouring against angular rock deposits in the till.
     - 1.2.8. Oversize borehole to install pipe which can result to slight subsidence.

For the following two options a deep excavation will be required.

2. **Auger boring rig** fitted with the **simultaneous casing system** to install a steel 457mm conductor.
   - **2.1. Positives:**
     - 2.1.1. Small annular space, avoiding any collapse.
     - 2.1.2. Quick installation because of the use of a DTH hammer.
     - 2.1.3. No drilling fluids, so cheap disposal of arising.
     - 2.1.4. Uses compressed air so minimal environmental impact.
     - 2.1.5. Capable of drilling most formations from gravels, to boulders clays through & solid rock because the borehole is cased as the drive bit advances.
   - **2.2. Negatives:**
     - 2.2.1. Cannot control direction, installed to line and level of the launch pit.
     - 2.2.2. Additional materials required, 457mm steel sleeve.
     - 2.2.3. Launch pit is approximately 10 metres long at line and level.
     - 2.2.4. Cost, expensive set up (construction of launch pit).
     - 2.2.5. The inclined section beneath to the north of the river will either be open cut or attempted with HDD.
     - 2.2.6. Unable to control the groundwater in the formations ahead of the drill bit.

3. **Micro Tunnelling**

3.1. Positives:

3.1.1. Small annular space avoiding the concern of subsidence.
3.1.2. Steerable to obtain the gradients required.
3.1.3. Positive pressure at the cutting face to control the groundwater
3.1.4. Overcome most formation anomalies.

3.2. Negatives:

3.2.1. Very Costly.
3.2.2. Slow.
3.2.3. Additional materials required, jacking pipes.
3.2.4. Costly thrust block and chamber to be construction to facilitate works.

Further details on all options can be found in Appendix C.

Summary:

HDD is ideally suited to installing conduits as a low disruptive trenchless methodology and if technically feasible is the logical solution. While other trenchless methods exist, specifically auger boring & micro tunnelling, the cost of these methods would be expected to be much greater than for a drilled installation by HDD.

GROUND CONDITIONS

Publicly-available mapping from the Geological Survey of Ireland (2016) identifies that the site is underlain by till derived from limestone, i.e. Dublin Boulder Clay. The bedrock underlying the site is indicated as Lucan formation thinly to thickly bedded limestone interbedded with soft black shale (mudstone), locally known as "Calp".

Site-specific ground investigations were undertaken on the instructions of Clifton Scannell Emerson Associates by Site Investigations Ltd. between July and September 2019 (S.I. Ltd Contract No: 5624). In general, the investigations revealed a stratigraphy summarised as follows:

- TOPSOIL.
- Firm/stiff brown sandy gravelly silty CL A Y with low cobble content [Dublin Boulder Clay].
- Stiff black sandy gravelly silty CLAY with low cobble content [Dublin Boulder Clay].
- Very strong light grey fine-grained muddy LIMESTONE interbedded with strong dark grey calcareous MUDSTONE with some fossils and occasional calcite veins [Lucan Formation limestone and shale].

The relevant exploratory holes to the location of the proposed directional drill are BH/RC40 and BH/RC41 which are in Appendix B. These were put down using cable percussive methods until refusal was met on presumed bedrock. Rotary coring was used to recover samples of bedrock.

BH40 found Made Ground to 0.6m bgl / 68.67mOD, being road construction material), over stiff brown slightly sandy gravelly silty CLAY with low cobble content to refusal at 3.0m bgl / 66.27mOD. Groundwater was not encountered. Rotary core follow on RC40 found strong to very strong LIMESTONE interbedded with strong MUDSTONE with some calcite veins to the termination depth of 7.0m bgl / 62.27mOD. The rock is described as fresh to slightly weathered and RQD varied from 31 to 64, indicating rock of poor to fair quality.

BH41 found 200mm of topsoil over stiff brown slightly sandy gravelly silty CLAY with low cobble content to 1.7m bgl / 67.83mOD over stiff black slightly sandy gravelly silty CLAY with low cobble content to refusal at 3.1m bgl / 66.43mOD. Rotary core follow on RC41 found very strong LIMESTONE interbedded with strong MUDSTONE with some calcite and pyrite veins to the termination depth of 6.3m bgl / 63.23mOD. The rock is described as fresh to slightly weathered and RQD varied from 40 to 43, indicating rock of poor quality.

Results of SPT tests are shown in Figure 7. The SPT profile was similar between BH40 and BH41, showing strong similarity in ground profile in the two boreholes.

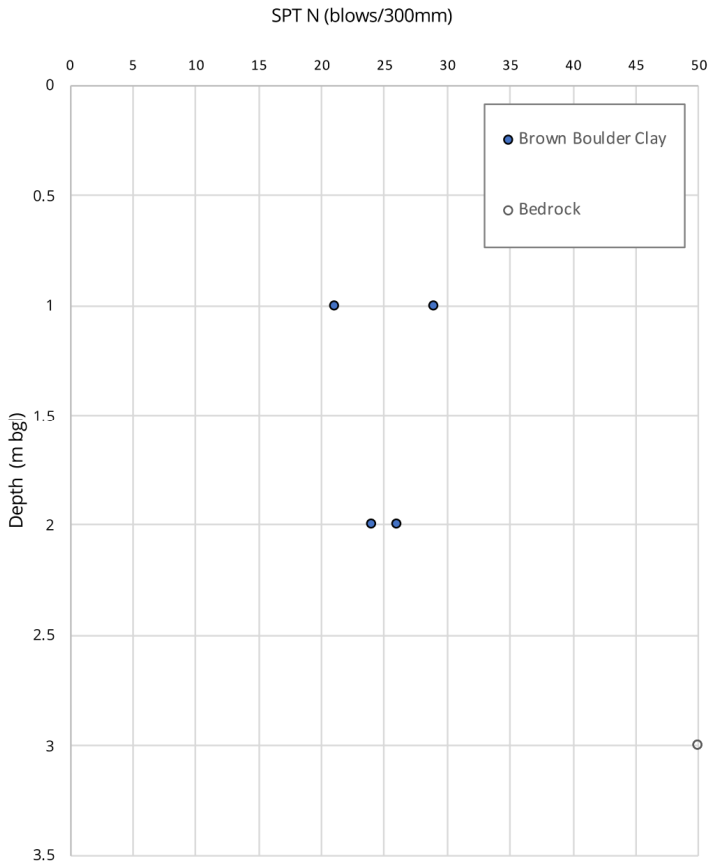

Figure 7 - SPT results for BH40 and BH41

Based on the results described above, a generalised ground model is interpreted as follows:

0.0	to 0.2/0.6m bgl	Topsoil or Made Ground
0.2/0.6	to 3.0/3.1m bgl	Stiff Dublin Boulder Clay
3.0/3.1	to >7.0m bgl	Lucan Formation limestone and mudstone bedrock

While the ground model proposed is considered uniform, it must be taken account of that there are only two exploratory holes along the proposed drilling profile, and the profile of the ground may be expected to change. In particular, bedrock may be higher or lower than anticipated. Mitigations should be developed to take account of this.

DESIGN RISKS

1. There are only two exploratory holes near the route of the drilling profile, spaced 99m apart. Interpretation of ground conditions between borehole locations is for guidance only and may vary significantly. Mitigations should be developed to take account of this.
2. Drilling in vicinity of BH/RC40 to be carefully monitored as the existing borehole may provide a preferential path for drilling fluid escape. It is noted that the borehole was backfilled with arisings rather than being grouted.
3. Drilling fluid or flush may be lost in locations along the drill profile if there is any historical geotechnical investigations or excavations.
4. The depths and locations of utilities have not been confirmed as of this date. Identification of utilities may require changes to the HDD profile to avoid same. Minimum 1.m cover is to be provided to all utilities.
5. Equipment suitable for drilling through strong to very strong limestone and mudstone should be specified by the successful contractor.

ENVIRONMENTAL AND ARCHEOLOGICAL SITE RISK

IMPACT OF GROUND CONDITIONS ON PROPOSED HDD WORKS

A number of risks to be considered during the proposed HDD works are considered in this section. These are:

1. Loss of drilling flush or escape of drilling fluid to the surface
2. Escape of drilling fluid to waterbodies
3. Excessive vibrations at the surface
4. Contaminated soil during surface preparation works and in spoil arisings
5. Contamination of groundwater sources
6. Obstructions to drilling
7. Damage to geological heritage.

These risks are considered in order hereunder.

LOSS OF DRILLING FLUSH OR ESCAPE OF DRILLING FLUID TO THE SURFACE

It is expected that the proposed HDD alignment for the Baldonnel Road & Griffeen river will pass through the boulder clay layer and into the underlying bedrock, and that the drill path will be within bedrock during the crossing directly under the Griffeen river. The extra confinement provided by the moderately strong to very strong bedrock will help mitigate risks to loss of drilling fluid or drilling fluid escape to the surface. However, these exists a risk of the migration or loss of drilling fluid through faults or fractures in the bedrock, and this will be considered further herein.

The Lucan formation was laid down in distinct beds of limestone and shale, with the limestone beds typically 100 to 400mm in thickness while the shale or mudstone beds are often less than 100mm thick. Calcite veins are also present. This distinct bedding sequence of materials of differing strengths may give rise to folding, faulting, and differential weathering between layers, and these features may give rise to an elevated risk of an escape of drilling fluid and loss of flush pressure during directional drilling. Farrell and Wall (1990) note that significant earth movements occurred at the end of the Lower Carboniferous period, but that the Dublin region was not affected to the same degree as the rest of the country. The latest bedrock mapping produced by the Geological Survey of Ireland (2016) has been plotted in Figure 8, with currently known faults shown in black. It can be seen from Figure 8 that current knowledge suggests that there are no known or mapped faults in the vicinity of the site. However, it is noted that identification of faults is difficult in the Dublin region due to the depth of overburden over bedrock and a scarcity of exposures and so this finding should be treated with caution.

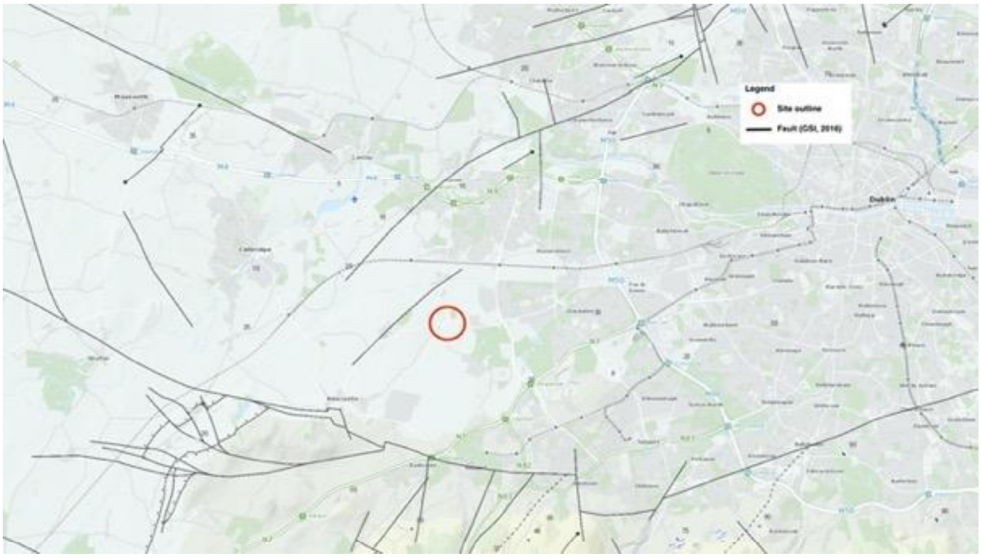

Figure 8 – Geological Survey of Ireland mapping showing known and mapped faults in black.

Considering local data available, the depth to bedrock and the dip of the bedding planes within the rock is relatively uniform, being recorded as horizontal to 30° and subvertical. In the absence of information on the dip direction, this is a preliminary indication of continuity in bedding. Combined with regional data suggesting an absence of faulting in the area, this further discounts the possibility of a fault zone in the works area. Further, solution features such as karst features are rare in the Lucan formation.

MITIGATING BREAKOUT RISK OF DRILLING FLUIDS.

Before any works commence, a mud engineer along with the driller will design a drilling programme to include a mud blend for the profile.

In order to minimize the risk of mud breakouts, care shall be taken to keep the mud pressures between the minimum and maximum calculated pressures.

The driller and mud engineer, from experience, will know when to increase the viscosity of the drilling fluid in formations that are prone to break out and reduce the ROP so not to overload the annulus with cuttings.

Monitoring the discharge of cuttings over the shale shakers is important, excessive material will indicate a wash out in formation.

It is important that any losses to formation are recorded and addressed as this is an early tell-tale sign of a potential breakout.

DOWNHOLE PRESSURE MONITORING OF DRILLING FLUIDS.

In addition to monitoring the steering tools, a Pressure While Drilling (PWD) Orienting Sub, can be utilised to measure downhole pressure. It gives real-time measurements of mud pressure both inside the drill pipe and in the annulus just behind the drill bit. Pressure measurements are taken behind the bit. When using a mud motor the pressure is measured directly behind the mud motor.

The pressure data is monitored and stored by software used with the tracking system. The pressure can be viewed in real time. The software allows easy graphical representations of pressure variations with time. Alarms can also be set in the software and will trigger if pressure limits are exceeded during drilling.

As it is capable of giving a rapid indication of an increase in downhole pressure, the measurement of pressure while drilling is an effective technique to reduce the risk of drilling fluid breakout during the drilling process. It can also help ensure that a drilled hole is kept clean and free of blockages, thus reducing operational risks

ESCAPE OF DRILLING FLUID TO WATERBODIES

The Griffeen River meanders across the site on the west side of the carriage way, Figure 9

Figure 9 – Griffeen River.

The Griffeen River rises on Saggart Hill in South Dublin. It flows towards Lucan until it reaches the Griffeen Valley Park. It flows under the Grand Canal through a siphon system and also passes through several housing estates, Lucan Village Park and Vessey Park before reaching Griffeen Valley

Park. After leaving the park it flows past Lucan house and demesne and enters the River Liffey at the Lucan Weir.

The Griffeen attracts many birds to the area particularly around the parks. Up to 86 different species of bird have been recorded in Griffeen Valley park. Trout, eels, herons and of course ducks are resident all year round.

The HDD is crossing beneath the river, therefore due care is required when managing the drilling fluids.

EXCESSIVE VIBRATIONS AT THE SURFACE

No particularly sensitive receptors to vibration have been identified at the proposed locations. If particularly sensitive receptors are identified, a vibration assessment should be carried out at detailed design stage. Based on the ground conditions expected and typical HDD operations, vibrations at the surface are not expected to be particularly severe in normal conditions.

CONTAMINATED SOIL DURING SURFACE PREPARATION WORKS AND IN SPOIL ARISINGS

Historical and present day mapping was reviewed to assess the likelihood of contamination at the site. Historical mapping (6" Ordnance Survey mapping, produced between 1829 and 1841 and 25" Ordnance Survey mapping, produced between 1897 and 1913) shows the lands in agricultural usage. Based on our current knowledge of operations at the site, it is not expected that there would be an unusual or exceptional risk of contaminated ground, however this should be confirmed during detailed design.

CONTAMINATION OF GROUNDWATER SOURCES

Groundwater vulnerability is classified is "moderate" to "high" across the site. The bedrock aquifer is categorised as "Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones".

Given usual precautions and good practice during design and construction, it is not anticipated that any unusual or exceptional risk of the contamination of groundwater sources exists at this site.

OBSTRUCTIONS TO DRILLING

Based on the mapping sources consulted and the ground conditions at the site, it is not expected that there are steel, concrete or timber piles along the proposed HDD alignments that would obstruct the progress of the HDD bore. In particular, it does not appear that there are piled structures associated with transport infrastructure along the proposed HDD alignments. However, this should be verified during detailed design.

DAMAGE TO GEOLOGICAL HERITAGE

Based on the latest information available from the GSI, the site is not a site of geological heritage interest.

REVIEW UTILITY DRAWING

The area is mapped in detail with utilities from all the providers recorded, the pathway proposed for the HDD being heavily congested. The depths of the underground utilities were unavailable at the time of writing this report.

The provisional profile drawing in Appendix A will require amending once the information is made available.

GDS2073_CSEA_Feasbility Study Grange Castle

HDD DESIGN PROFILE

Profile Summary

Continuous Green Line signifies the alignment of the HDD sections.

The information available for the design of the crossing:

- Topographical detail.
- Exit and Entry locations.
- Pipe material; 3 no. 160mm OD & 2 no. 125mm Pe red ducts.
- Geotechnical borehole data

GENERAL COMMENTS:

Summary of the drilling profile, Appendix A

- A horizontal bending radius of 250 metres.
- Total length of the crossing is ~150 metres.
- A depth of cover of ~6.4 metres beneath the river is proposed which will be ~4 metres into the bedrock. A frac out analysis will verify if these depths are acceptable.
- Little elevation difference between exit and entry point.
- An entry and exit angle of ~11 degrees from horizontal.

Recommendations

- The profile will require amending once the exact location of all utilities are identified.

BOREHOLE LAYOUT AND SPACING

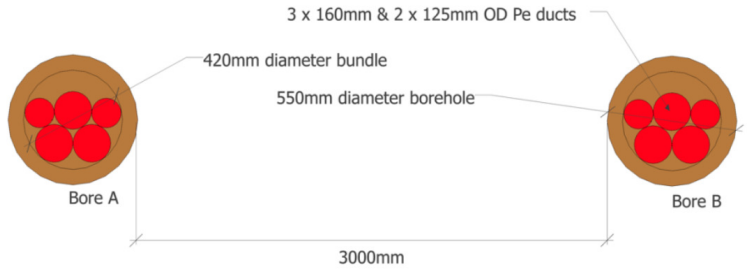

Figure 10: Configuration of the ducts and bores for the HDD crossings

Configuration: The design has allowed for two drills installing a bundle of 3 no. 160mm OD & 2 no. 125mm Pe red ducts.

Industry best practice would recommend enlarging the pilot hole to a minimum diameter of 550mm for installing the 3 no. 160mm OD & 2 no. 125mm Pe red ducts which measure 420mm bundled together.

A distance of 3 m is recommended between bundles.

CONCLUSION

HDD is the methodology envisaged by GDS for the crossings.

Based on a review of the local information and historical and present-day knowledge on the ground conditions near the site, it is not anticipated that any exceptional or unusual risks are posed by the ground conditions or land usages which would cause difficulties during HDD operations at the site.

It would be beneficial to review groundwater standpipe measurements during detailed design.

A detail design will require third party utility location/depths.

Equipment suitable for drilling through strong to very strong limestone and mudstone should be specified by the successful contractor.

REFERENCES

Farrell, E. & Wall, D. 1990. Soils of Dublin. *Transactions of the Institution of Engineers of Ireland,* 115, 78–97.

Geological Survey of Ireland. 2016. *Online Mapping.* Retrieved from https://www.gsi.ie/Mapping.htm. Accessed 4th April 2018.

Ask about Ireland. River Griffeenhttp://www.askaboutireland.ie/enfo/irelands-environment/county-focus/dublin-south/rivers/river-griffeen/

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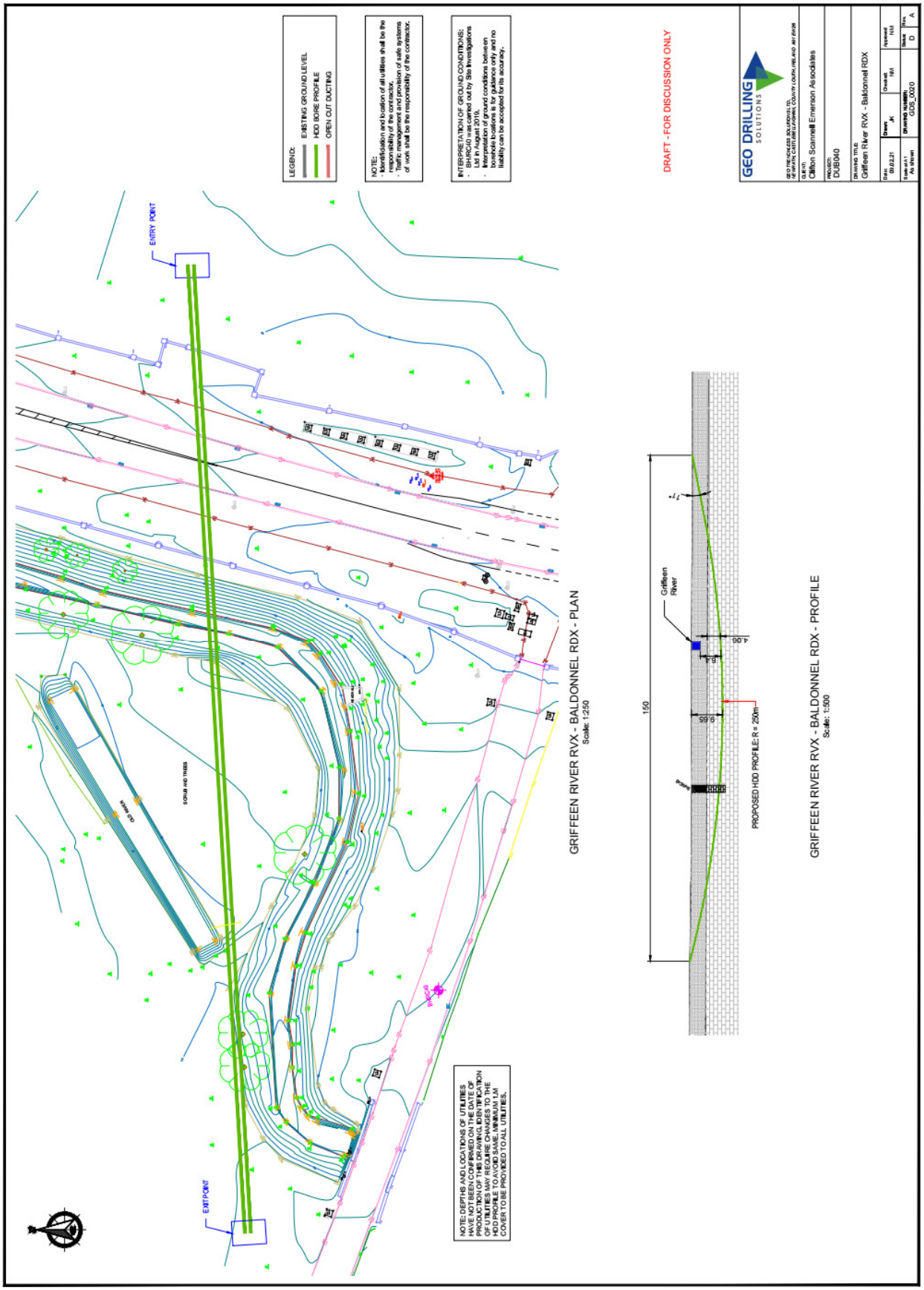
APPENDIX A DRAWINGS


LEGEND:
EXISTING GROUND LEVEL
HDD BORE PROFILE
OPEN CUT DUCTING
NOTE:
- Identification and location of all utilities shall be the responsibility of the contractor.
- Traffic management and provision of safe systems of work shall be the responsibility of the contractor.
INTERPRETATION OF GROUND CONDITIONS:
- BHRC40 was carried out by Site Investigations Ltd in August 2019.
- Material and ground conditions between borehole locations is for guidance only and no liability can be accepted for its accuracy.
DRAFT - FOR DISCUSSION ONLY
GEO DRILLING SOLUTIONS
Clifton Scannell Emerson Associates
DUB040
Griffeen River RVX - Baldonnel RDX
ENTRY POINT
EXIT POINT
NOTE: DEPTHS AND LOCATIONS OF UTILITIES HAVE NOT BEEN CONFIRMED ON THE DATE OF PRODUCTION OF THIS DRAWING. IDENTIFICATION OF UTILITIES MAY REQUIRE CHANGES TO THE LOCATION AND DEPTH OF BORE AND MAY ALSO COVER TO BE PROVIDED TO ALL UTILITIES.
GRIFFEEN RIVER RVX - BALDONNEL RDX - PLAN
Scale: 1:250
Griffeen River
PROPOSED HDD PROFILE: R = 250m
GRIFFEEN RIVER RVX - BALDONNEL RDX - PROFILE
Scale: 1:500

GDS2073_CSEA_Feasbility Study Grange Castle

APPENDIX B GEOTECHNICAL BOREHOLES AND RESULTS

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Contract No: 5624	**Rotary Corehole Log**				Corehole No: **RC40**
Contract:	Grange Castle West Access Road	Easting:		Date Started:	14/08/2019
Location:	Grange Castle, Co. Dublin	Northing:		Date Completed:	14/08/2019
Client:	South Dublin County Council	Elevation:		Drilled By:	MEDL
Engineer:	Clifton Scannell Emerson Associates	Rig Type:	Sondeq	Status:	FINAL

Depth (m) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples	Rock Indices TCR/%	SCR/%	RQD/%	FI/m	Backfill
0.5 1.0 1.5 2.0 2.5 3.0	3.00	Cable percussive borehole completed - see CP log.		-0.5 -1.0 -1.5 -2.0 -2.5 -3.0							
	3.10	Open hole drilling - driller reports returns of cobbles and boulders.									
3.5 4.0 4.5 5.0 5.5 6.0		Very strong light grey fine grained muddy LIMESTONE interbedded with moderately strong to strong dark grey calcareous MUDSTONE with some fossils and occasional calcite veins. Fresh to slightly weathered. *Discontinuities - rough occasionally smooth, planar to slightly undulating occasionally stepped, tight to open, subhorizontal to 20° dip, clean with occasional staining.*		-3.5 -4.0 -4.5 -5.0 -5.5 -6.0		3.10 - 4.60	57	55	31	10	
						4.60 - 6.10	99	93	64		
	6.10	Very strong light grey fine grained muddy LIMESTONE with occasional calcite veins. Fresh to slightly weathered. *Discontinuities - rough to smooth, planar to stepped, tight to open, subhorizontal to subvertical, clean with occasional staining.*				6.10 - 7.00	87	57	60	13	
6.5 7.0 7.5 8.0 8.5 9.0 9.5	7.00	End of Corehole at 7.00m		-6.5 -7.0 -7.5 -8.0 -8.5 -9.0 -9.5							

Installation: From:	To:	Pipe Type:	Backfill: From:	To:	Type:	Remarks:
			0.00	7.00	Arisings	Cable percussive borehole previously completed.

Contract No: 5624	**Rotary Corehole Log**				Corehole No: **RC41**
Contract:	Grange Castle West Access Road	Easting:		Date Started:	14/08/2019
Location:	Grange Castle, Co. Dublin	Northing:		Date Completed:	14/08/2019
Client:	South Dublin County Council	Elevation:		Drilled By:	MEDL
Engineer:	Clifton Scannell Emerson Associates	Rig Type:	Sondeq	Status:	FINAL

Depth (m) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples	Rock Indices TCR/%	SCR/%	RQD/%	FI/m	Backfill
0.5 1.0 1.5 2.0 2.5 3.0		Cable percussive borehole completed - see CP log.		-0.5 -1.0 -1.5 -2.0 -2.5 -3.0							
	3.10										
	3.20	Open hole drilling - driller reports returns of cobbles and boulders.									
3.5 4.0		Very strong light grey fine grained muddy LIMESTONE interbedded with moderately strong to strong dark grey calcareous MUDSTONE with some fossils and occasional calcite and pyrite veins. Fresh to slightly weathered. *Discontinuities - rough to smooth, planar to slightly undulating, tight to open, subhorizontal to 30° dip, clean with occasional staining.*		-3.5 -4.0		3.20 - 4.70	100	80	40	14	
4.5	4.60	Moderately strong to strong dark grey calcareous MUDSTONE with occasional calcite and pyrite veins. Fresh to slightly weathered.		-4.5						25	
5.0	5.15	*Discontinuities - smooth, planar, tight to open, 30° to 50° dip, clean with occasional staining.* Very strong light grey fine grained muddy LIMESTONE interbedded with moderately strong to strong dark grey calcareous MUDSTONE with some fossils and occasional calcite and pyrite veins. Fresh to slightly weathered. *Discontinuities - rough to smooth, planar to slightly undulating, tight to open, subhorizontal to 30° dip, clean with occasional staining.*		-5.0 -5.5		4.70 - 6.30	94	78	43	9	
6.0	6.30	End of Corehole at 6.30m		-6.0							
6.5 7.0 7.5 8.0 8.5 9.0 9.5				-6.5 -7.0 -7.5 -8.0 -8.5 -9.0 -9.5							

Installation: From:	To:	Pipe Type:	Backfill: From:	To:	Type:	Remarks:
			0.00	6.30	Arisings	Cable percussive borehole previously completed.

APPENDIX C REVIEW OF AVAILABLE METHODOLOGIES.

OPTIONS INCLUDE:

HDD

HDD is a steerable trenchless method of installing underground pipe, conduit, or cable in a shallow arc along a prescribed bore path by using a surface-launched drilling rig, with minimal impact on the surrounding area. It is suitable for a variety of soil and rock formations and applications including road, rail and river crossings. It is limited by formations such as cobbles, gravel, boulders, weathered and broken bedrock.

The HDD rig that best suits the crossings that are <300 metres, would have a pullback of approximately 20 tons, weigh approximately 13 tons, will be crawler mounted and self-contained, apart from the drilling fluid recycling system.

A mud motor, DTH hammer or a Dual pipe specific rig. For upsizing the borehole hole openers, either PDC or TCI cutters will be required.

Further details on the process of HDD can be found in Appendix D.

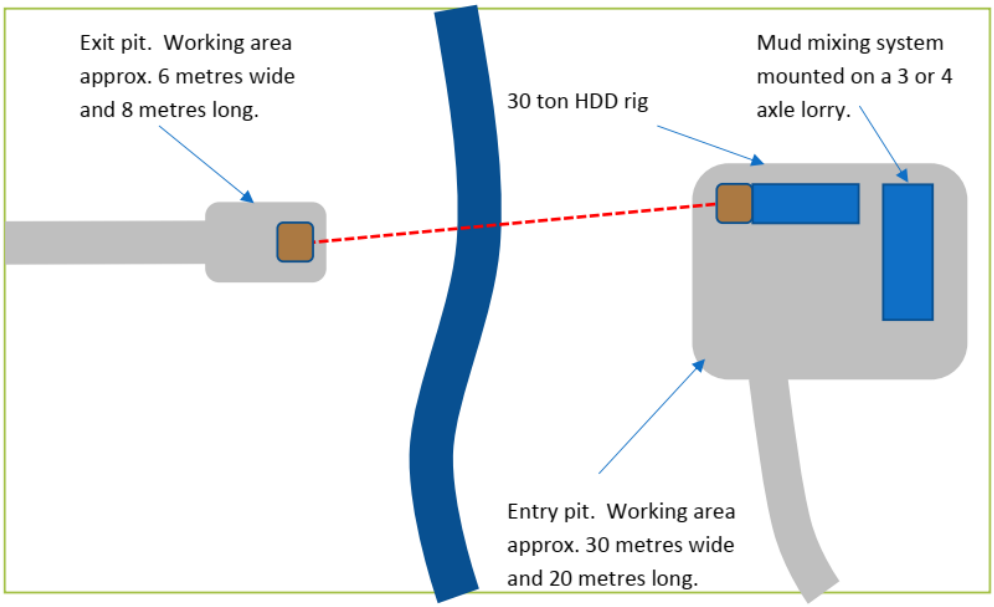

Figure 11 – A typical site layout for the 20 ton HDD rig.

GUIDANCE SYSTEMS.

WIRELINE LOCATION

Horizontal positioning accuracy requires careful control, especially where multiple closely spaced bores are required. Common practice where a high degree of accuracy is required is to use a surface coil/grid to induce a local magnetic field within which the downhole steering tool can be correctly orientated. When combined with a system employing inertial guidance the position of each bore can be accurately tracked. Alternatively, a gyro based steering tool may be deployed. Should a borehole become off position the downhole assembly is typically withdrawn some distance and then sent off on a revised course. In rock formation the unused section of hole may be grouted to enable the drilling bit to leave the old hole alignment.

Directional control is accomplished by rotating the drill string to orientate a bent housing on the BHA, thereby creating a steering bias in the direction and plane of the bent housing. If a change in direction is required, the drill string is rotated, thereby changing the bent housing to the desired orientation.

The trajectory of the pilot hole is determined by taking periodic surface readings of the inclination and azimuth of the BHA. These readings in conjunction with measurements of the distance drilled since the last survey are used to calculate the horizontal and vertical co-ordinates of the BHA relative to the entry point at the surface.

Surface readings are taken by a survey, which is placed in a non-magnetic drill collar connected to the BHA. Inclination and azimuth are obtained by sensing the angles between the reference frame in the down-hole survey package and the earth's magnetic and gravitational fields. This information is transmitted as a signal to the surface computation unit where it is reduced to the X, Y and Z coordinates of the down-hole sensors; i.e. the BHA. Directional surveys are taken every six meters when a joint of drill string is added, or more often if required. Survey co ordinates are plotted along the design plan and profile drawings to monitor the course of the drill bit. If unacceptable deviations occur, the drill string is withdrawn sufficiently to re-drill the pilot hole within acceptable limits. Deflections of the borehole path will be held to a tolerance equivalent to the minimum radius of curvature, allowable.

WALKOVER LOCATORS

A walkover location system uses a 3-dimensional field view with a single button user interface and graphically driven menu. It operates at depths up to 25 metres with 0.1 percent sensitive pitch. An active display enables look-ahead capability with target-in-the-box locating for Intuitive transmitter tracking. Includes basic locating capabilities of directional tracking and depth plus advanced features of Off-Trak locating and Target Steering to easily and accurately navigate the drill even when obstacles prevent tracking over the drill head. An enhanced Target Steering function on the menu

allows the operator to place the receiver in front of the drill head, along the bore path, using a target on the remote display to steer.

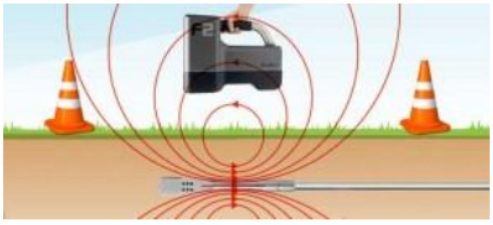

Figure 12 – Walkover location system

The operator can view in real-time the distance and depth of the transmitter relative to the receiver. A real-time, bird's-eye view provides operators with critical on-the-fly steering ability. A 4-channel radio enables multiple

The system is limited by interference from other utilises such as power and if rebar is buried in mass concrete.

DRILLING FLUIDS.

The Drilling Mud is typically a mixture of naturally occurring or Polymer modified Bentonite clays and water. Becoming more common now is environmentally friendly drilling fluids such as Clear bore. The drilling mud is pumped down to the BHA from the surface through hollow stem Drill Pipe. Individual sections of Drill Pipe are added at the Drilling Rig and pushed forward to advance the BHA from the Entry Point to the Exit Point. Ground cut by the drill bit is carried back in the annular space by the drilling mud and returned to the entry side where it is deposited in a shallow launch pit. The drilling mud is pumped from the pit to a Mud Recycling System that removes the cut solids enabling the cleaned Mud to be reused for drilling. Recycling reduces waste and limits the disposal costs.

The drilling fluid has several functions which include the following:

- Transportation of drilled solids and fluid out of the borehole.
- Keeping the solids in suspension when circulation stops to prevent deposition of solids.
- Stabilisation of borehole by static pressure against soil formation.
- Creation of a filter cake to minimize the penetration and loss of drilling fluid into the formation and the flow of groundwater into the borehole.
- Lubrication of the product pipe/ducts during pullback, reducing the pull force on the pipe /ducts.
- Cooling and lubrication of the drilling equipment, tools and drill pipe.

Additional requirements:

- Minimum impact on surrounding soil formations.
- No harmful impact on environment and groundwater.
- No harmful impact on drilling equipment and product pipes /ducts.

DTH DRILLING WITH AN AUGER BORING RIG

DTH drilling with a auger boring rig is a trenchless method for installation of steel pipes using a simultaneous drilling/casing system. Distances of 50 m or more, and diameters of over 610 mm are achievable. The method is useful for pipe installations under railway lines and roads, where other trenchless methods have failed because of boulders, cobbles or weathered bedrock.

The process includes a DTH hammer with a simultaneous casing bit, a cutting shoe attached to the lead steel casing, specially manufactured augers, a high pressure air compressor, and a auger boring rig.

A pit is excavated to line and level, approximately 10 metres long and finished with a solid base.

Figure 13 – Auger boring rig setting up to drill a 508mm steel casing with a DTH hammer.

MICROTUNNELLING

The system combines the use of remote-controlled tunnel boring machines and pipe jacking - the mechanised process of pushing sections of pipe through the ground to create a tunnel.

Microtunneling machines can operate from pits or shafts and can be equipped with different cutting heads to accommodate a variety of ground conditions. The spoil is removed from the cutting face inside the machine either by conveyor belt, or in the form of slurry, depending on the type of machine used. Where pressurised slurry machines are deployed, a slurry separation plant is located adjacent to the launch pit.

Diameters range from 600mm upwards and distances span lengths of up to 450m for larger diameter pipes.

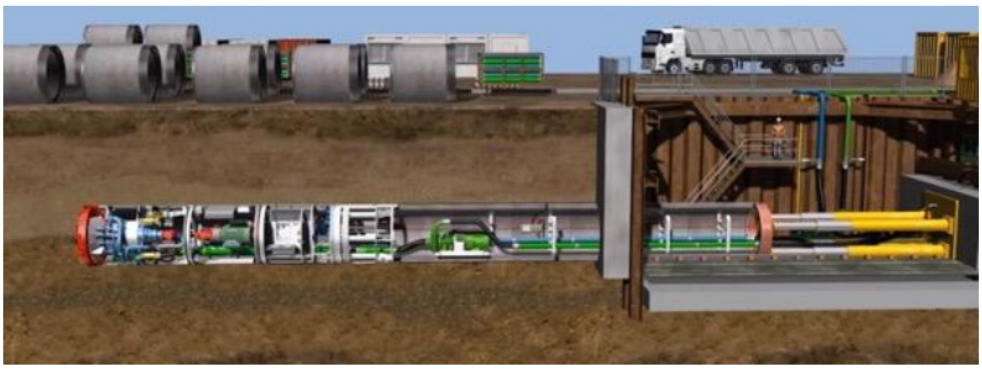

Figure 14 – Typical micro tunnelling set up.

CHAPTER 6 - BIODIVERSITY

Appendix 6.1 – Legislation, policy and Guidelines

National and International Legislation

- Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora; hereafter, referred to as the 'Habitats Directive'. The Habitats Directive is the legislation under which the Natura 2000 network3 was established and special areas of conservation (SACs) are designated for the protection of natural habitat types listed in Annex I, and habitats of the species listed in Annex II, of that directive.
- Directive 2009/147/EEC; hereafter, referred to as the 'Birds Directive'. The Birds Directive is the legislation under which special protection areas are designated for the protection of endangered species of wild birds listed in Annex I of that directive.
- Wildlife Acts 1976 to 2019; hereafter collectively referred to as the 'Wildlife Acts'. The Wildlife Acts are the principal pieces of legislation at national level for the protection of wildlife and for the control of activities that may harm wildlife. All bird species, 22 other animal species or groups of species, and 86 species of flora are protected under this legislation.
- Planning and Development Acts 2000 to 2020; hereafter collectively referred to as the 'Planning and Development Acts'. This piece of legislation is the basis for Irish planning. Under the legislation, development plans (usually implemented at local authority level) must include mandatory objectives for the conservation of natural heritage and for the conservation of European sites. It also sets out the requirements in relation to environmental assessment with respect to planning matters, including transposition of the Habitats and Birds Directive into Irish law.
- European Communities (EC) (Birds and Natural Habitats) Regulations 2011 to 2015; hereafter the 'Birds and Habitats Regulations'. This legislation transposes the Habitats and Birds Directives into Irish law. It also contains regulations (49 and 50) that deal with invasive species (those included within the Third Schedule of the regulations).
- Flora (Protection) Order, 2015. This lists species of plant protected under Section 21 of the Wildlife Acts.

Relevant Policies and Plans

- *National Biodiversity Action Plan 2017 – 2021;*
- *South Dublin County Development Plan 2016 – 2022;*
- *South Dublin County Heritage Plan 2010 – 2015.*
- *Draft Biodiversity Action Plan for South Dublin County - Connecting with Nature 2020 – 2026.*

Relevant Guidelines

- *Advice Notes on Current Practice (in preparation of Environmental Impact Statements)* (EPA, 2003 and Draft update 2015);
- *Guidelines on the Information to be contained in Environmental Impact Statements* (EPA, 2002 and Draft update 2015);
- *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal, and Marine. Chartered Institute of Ecology and Environmental Management, Winchester*. (CIEEM (2018);
- *Guidelines for Assessment of Ecological Impacts of National Roads Schemes. National Roads Authority, Dublin*. (National Roads Authority, 2009);
- *Best Practice Guidance for Habitat Survey and Mapping* (Heritage Council, 2011); and
- *A Guide to Habitats in Ireland* (Fossitt, 2000).

[3] The Natura 2000 network is a European network of important ecological sites, as defined under Article 3 of the Habitats Directive 92/43/EEC, which comprises both special areas of conservation and special protection areas. Special conservation areas are sites hosting the natural habitat types listed in Annex I, and habitats of the species listed in Annex II, of the Habitats Directive, and are established under the Habitats Directive itself. Special protection areas are established under Article 4 of the Birds Directive 2009/147/EC for the protection of endangered species of wild birds. The aim of the network is to aid the long-term survival of Europe's most valuable and threatened species and habitats.
In Ireland these sites are designed as *European sites* - defined under the Planning Acts and/or the Birds and Habitats Regulations as (a) a candidate site of Community importance, (b) a site of Community importance, (c) a candidate special area of conservation, (d) a special area of conservation, (e) a candidate special protection area, or (f) a special protection area. They are commonly referred to in Ireland as Special Areas of Conservation (SACs) and Special Protection Areas (SPAs).

Appendix 6.2 Criteria for ecological evaluation

International Importance:

- 'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation.
- Proposed Special Protection Area (pSPA).
- Site that fulfils the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended).
- Features essential to maintaining the coherence of the Natura 2000 Network.[4]
- Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive.
- Resident or regularly occurring populations (assessed to be important at the national level)[5] of the following:
  - Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or
  - Species of animal and plants listed in Annex II and/or IV of the Habitats Directive.
- Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971).
- World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage, 1972).
- Biosphere Reserve (UNESCO Man & The Biosphere Programme).
- Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979).
- Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979).
- Biogenetic Reserve under the Council of Europe.
- European Diploma Site under the Council of Europe.
- Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 1988).[6]

National Importance:

- Site designated or proposed as a Natural Heritage Area (NHA).
- Statutory Nature Reserve.
- Refuge for Fauna and Flora protected under the Wildlife Acts.
- National Park.
- Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park.
- Resident or regularly occurring populations (assessed to be important at the national level)[7] of the following:
  - Species protected under the Wildlife Acts; and/or
  - Species listed on the relevant Red Data list.
- Site containing 'viable areas'[8] of the habitat types listed in Annex I of the Habitats Directive

County Importance:

- Area of Special Amenity.[9]
- Area subject to a Tree Preservation Order.
- Area of High Amenity, or equivalent, designated under the County Development Plan.
- Resident or regularly occurring populations (assessed to be important at the County level)[10] of the following:
  - Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
  - Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;
  - Species protected under the Wildlife Acts; and/or
  - Species listed on the relevant Red Data list.
- Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the

[4] See Articles 3 and 10 of the Habitats Directive

[5] It is suggested that, in general, 1% of the national population of such species qualifies as an internationally important population. However, a smaller population may qualify as internationally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

[6] Note that such waters are designated based on these waters' capabilities of supporting salmon (Salmo salar), trout (Salmo trutta), char (Salvelinus) and whitefish (Coregonus)

[7] It is suggested that, in general, 1% of the national population of such species qualifies as a nationally important population. However, a smaller population may qualify as nationally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

[8] A 'viable area' is defined as an area of a habitat that, given the particular characteristics of that habitat, was of a sufficient size and shape, such that its integrity (in terms of species composition, and ecological processes and function) would be maintained in the face of stochastic change (for example, as a result of climatic variation).

[9] It should be noted that whilst areas such as Areas of Special Amenity, areas subject to a Tree Preservation Order and Areas of High Amenity are often designated on the basis of their ecological value, they may also be designated for other reasons, such as their amenity or recreational value. Therefore, it should not be automatically assumed that such sites are of County importance from an ecological perspective.

[10] It is suggested that, in general, 1% of the County population of such species qualifies as a County important population. However, a smaller population may qualify as County important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

criteria for valuation as of International or National importance.
- County important populations of species, or viable areas of semi-natural habitats or natural heritage features identified in the National or Local Biodiversity Action Plan, if this has been prepared.
- Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county.
- Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.

Local Importance (higher value):
- Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared;
- Resident or regularly occurring populations (assessed to be important at the Local level)[11] of the following:
  - Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
  - Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;
  - Species protected under the Wildlife Acts; and/or
  - Species listed on the relevant Red Data list.
- Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality;
- Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.

Local Importance (lower value):
- Sites containing small areas of semi-natural habitat that are of some local importance for wildlife;
- Sites or features containing non-native species that are of some importance in maintaining habitat links.

[11] It is suggested that, in general, 1% of the local population of such species qualifies as a locally important population. However, a smaller population may qualify as locally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

Appendix 6.3 Flora species list

Improved agricultural grassland (GA1)

Common Name	Scientific Name
Perennial Ryegrass	*Lolium perenne*
Ribwort Plantain	*Plantago lanceolata*
Greater Plantain	*Plantago major*
Nettles	*Urtica dioica*
White Clover	*Trifolium repens*
Red Clover	*Trifolium pratense*
Yarrow	*Achillea millefolium*
Chickweed Species	*Stellaria sp.*
Common Field Speedwell	*Veronica persica*
Meadow Buttercup	*Ranunculus acris*
Creeping Buttercup	*Ranunculus repens*
Red Deadnettle	*Lamium purpureum*
Spurge Species	*Euphorbia sp.*

Improved amenity grassland (GA2)

Common Name	Scientific Name
Annual meadowgrass	*Poa annua*
Red fescue	*Festuca rubra*
Meadow buttercup	*Ranunculus acris*
Broad-leaved dock	*Rumex obtusifolius*
Creeping bent	*Agrostis stolonifera*
Sweet vernal grass	*Anthoxanthum odoratum*
White clover	*Trifolium repens*
Pointed Spear-moss	*Calliergonella cuspidata*
Rough-stalked Feather-moss	*Brachythecium rutabulum*

Dry meadows and grassy verges (GS2)

Common Name	Scientific Name
Bush vetch	*Vicia sepium*
Yorkshire fog	*Holcus lanatus*
Ribwort plantain	*Plantago lanceolata*
Wild teasel	*Dipsacus fullonum*
Common hogweed	*Heracleum sphondyllium*
Dandelion	*Taraxacum vulgare agg.*
Ragwort	*Senecio jacobaea*
Red fescue	*Festuca rubra*
Cock's-foot	*Dactylis glomerata*
Bramble	*Rubus fruticosus*
Cleavers	*Galium aparine*
Meadow buttercup	*Ranunculus acris*
Creeping thistle	*Cirsium arvense*
Creeping buttercup	*Ranunculus repens*
Broad-leaved dock	*Rumex obtusifolius*
False oat-grass	*Arrhenatherum elatius*
Rough-stalked Feather-moss	*Brachythecium rutabulum*

Recolonising bare ground (ED3)

Common Name	Scientific Name
Annual meadow-grass	*Poa annua*
Cleavers	*Galium aparine*
Dandelion	*Taraxacum vulgare agg.*
White clover	*Trofiloium repens*
Greater plantain	*Plantago major*
Perennial ryegrass	*Lolium perenne*
Ribwort plantain	*Plantago lanceolata*
Broadleaved dock	*Rumex obtusifolius*

Hedgerows (WL1)

Common Name	Scientific Name
Bramble	*Rubus fruticosus agg.*
Hawthorn	*Crataegus monogyna*
Ivy	*Hedera helix*
Ragwort	*Senecio jacobaea*
Cock's-foot	*Dactylis glomerata*

Treeline (WL2)

Common Name	Scientific Name
White willow	*Salix alba*
Cypress species	*Cupressus sp.*
Hawthorn	*Crataegus monogyna*
Bramble	*Rubus fruticosus*
Sycamore	*Acer pseudoplatanus*
Ivy	*Hedera helix*
Domestic apple	*Malus variety*
Domestic plum	*Prunus sp.*
Cherry	*Prunus variety*
Wild cherry	*Prunus avium*
Laburnum	*Laburnum anagyroides*
Grey poplar	*Populus canescens*
Monterey cypress	*Cupressus macrocarpa*
Lawson cypress	*Chamaecyparis lawsoniana*
Leyland cypress	*Cuprocyparis leylandii*

Depositing/ lowland rivers (FW2)

Common Name	Scientific Name
Great willowherb	*Epilobium hirsutum*
Soft rush	*Juncus effusus*
Creeping bent	*Agrostis stolonifera*

Immature Woodland (WS2)

Common Name	Scientific Name
Hazel	*Corylus avellana*
Oak species	*Quercus sp.*
Ash	*Fraxinus excelsior*
Willow species	*Salix sp.*
Nettle	*Urtica dioica*
Ivy	*Hedera helix*

Scrub (WS1)

Common Name	Scientific Name
Willow species	*Salix sp.*
Dogwood species	*Cornus sp.*
Bramble	*Rubus fruticosus*

Appendix 6.4 Records of Protected, Red-Listed or Notable Fauna from the desktop study in the vicinity of the Study Area

Common Name	Scientific Name	Protection[12]	Red-Listing Status[13]
Mammals			
Brown Long-eared Bat	*Plecotus auritus*	HD IV, WA	Least Concern
Daubenton's Bat	*Myotis daubentonii*	HD IV, WA	Least Concern
Leisler's Bat	*Nyctalus leisleri*	HD IV, WA	Least Concern
Pipistrelle sp.	*Pipistrellus sp.*	HD IV, WA	Least Concern
Soprano Pipistrelle	*Pipistrellus pygmaeus*	HD IV, WA	Least Concern
Hedgehog	*Erinaceus europaeus*	WA	Least Concern
Birds			
Black-Headed Gull	*Larus ridibundus*	WA	Red Listed
Cormorant	*Phalacrocorax carbo*	WA	Amber Listed
Great-Black Backed Gull	*Larus marinus*	WA	Amber Listed
Herring Gull	*Larus argentatus*	WA	Red Listed
Lapwing	*Vanellus vanellus*	BD II (II), WA	Red Listed
Lesser Black-Backed Gull	*Larus fuscus*	WA	Amber Listed
Little Grebe	*Tachybaptus ruficollis*	WA	Amber Listed
Mallard	*Anas platyrhynchos*	BD II (I), WA	Green Listed
Mute Swan	*Cygnus olor*	WA	Amber Listed
Tufted Duck	*Aythya fuligula*	BD II (I), WA	Amber Listed

[12] HDII/IV/V = Habitats Directive Annexes II/IV/V; FPO = Flora Protection Order; WA = Wildlife Acts; BD I = Birds Directive Annex I.
[13] Mammal Red-list from Marnell et al., Birds from Birds of Conservation Concern in Ireland (Colhoun & Cummings 2013); Vascular Flora from the Irish Red Data Book 1
Vascular Plants (Curtis & McGough 2005); Fish and Amphibians from King et al., 2011; Non-Marine Molluscs from Byrne et.al, 2009.

Appendix 6.5 Buildings with potential roosting features (PRFs) within the Proposed Development site

Building	PRFs	PRF Suitability	Photograph
Little Acre residential property	Wooden eaves, roofing felt, gaps in brick work, gaps under tiles	Low	
Bulmer residential property	Wooden eaves, roofing felt, gaps behind fascia, and gaps behind brickwork	Low	

Stable block	Wooden eaves and loose roofing felt	Low	
Corrugated tin shed	Wooden eaves	Low	

Little Acre outbuilding 1	Cracked cement and roof tiles, potential gap between lead flashing and gutter	Low	
Little Acre outbuilding 2	Potential entry points beneath roof tile gaps and behind ivy	Low	

Little Acre outbuilding 3	Potential entry points behind ivy	Low	
Little Acre outbuilding 4	Potential small entry point below apex of roof behind satellite dish, Potential entry points in gaps between brickwork and behind gutter	Low	

Appendix 6.6 Bird friendly planting list

Common Name	*Scientific Name*	*Suitability*
Cotoneasters	*Cotoneaster spp.*	These provide dense cover for nesting and an abundant supply of red/orange berries in the winter months. A particular favourite of Blackbirds.
Pyracantha	*Pyracantha crenulata*	Grown against a wall, this evergreen shrub produces white flowers in spring and an abundant supply of bright orange berries in autumn, great for attracting a whole host of bird species.
Ivy	*Hedera helix*	Climbs up trees and walls. The fruit is eaten in late winter and early spring by Woodpigeons, thrushes, Robins and Blackcaps. Ivy also provides good cover for nests, and its flowers are attractive to insects in the autumn.
Honeysuckle	*Lonicera periclymenum*	A range of different varieties provide a long flowering and long fruiting season. Attracts warblers as well as thrushes and Bullfinches. The dense growth of this climber provides ample cover for nesting and the nectar is great for other wildlife such as butterflies and bees.
Holly	*Ilex aquifolium*	For a good crop of berries, plant female trees of the normal wild form: note that to ensure good fruiting there should be a male Holly tree nearby. Trees defended by territorial Mistle Thrushes may hold their berries until the spring. Larger Holly trees also provide good secure nesting sites.
Rowan/Mountain Ash (the normal, red-berried form)	*Sorbus aucuparia*	The large clusters of red berries attract winter thrushes such as Redwings and Fieldfares. These berries are also the main source of food for the rare Waxwing.
Hawthorn	*Crataegus monogyna*	Although slow-growing, its berries are a great favourite with Redwings and Blackbirds. A dense hedge will provide plenty of nesting cover for a wide range of species and beautiful blossoms each spring.
Crab Apples	*Malus sylvestris*	The small fruits on these trees are much welcomed by wintering Blackcaps and thrushes and are great for making crab apple jelly.

CHAPTER 7 - LAND, SOIL, GEOLOGY AND HYDROGEOLOGY

Appendix 7.1 Criteria for Rating Site Attributes – Estimation of Importance of Hydrogeological Attributes (National Roads Authority (NRA, 2009))

Table 1 Criteria for rating site importance of Geological Features (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 impact magnitude 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
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
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
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

The NRA criteria for estimation of the importance of hydrogeological attributes at the site during the EIA stage are summarised in Table 4 below.

Table 3 Criteria for rating Site Attributes - Estimation of Importance of Hydrogeology Attributes (NRA)

Magnitude of Impact	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
	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 4 Criteria for Rating Impact Significance at EIS Stage – Estimation of Magnitude of Impact on Hydrogeology 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			
	Neglible	**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 7.2 Borehole logs and trial pits results undertaken by Ground Investigations Ireland

Contract No: 5624	**Cable Percussion Borehole Log**				Borehole No: **BH40**
Contract:	Grange Castle West Access Road	Easting:	702710.883	Date Started:	16/08/2019
Location:	Grange Castle, Co. Dublin	Northing:	730988.730	Date Completed:	16/08/2019
Client:	South Dublin County Council	Elevation:	69.27	Drilled By:	T. Tindall
Engineer:	Clifton Scannell Emerson Associates	Borehole Diameter:	200mm	Status:	FINAL

Depth (m) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples and Insitu Tests Depth	Type	Result	Water Strike	Backfill
0.5	0.30	MADE GROUND: tarmacadam.		69.0	68.97					
		MADE GROUND: grey slightly clayey very sandy gravel.				0.50	B	TT05		
	0.60	Stiff brown slightly sandy gravelly silty CLAY with low cobble content.			68.67	0.50	ES	TT06		
1.0				68.5		1.00	C	N=29 (5,6/8,11,5,5)		
1.5				68.0		1.50	B	TT07		
2.0				67.5		2.00	C	N=26 (4,7/9,6,5,6)		
2.5				67.0		2.50	B	TT08		
	2.90	Obstruction - possible boulder.		66.5	66.37					
3.0	3.00	Borehole terminated due to obstructions. End of Borehole at 3.00m			66.27	3.00	C	50 (25 for 5mm/50 for 0mm)		
3.5				66.0						
4.0				65.5						
4.5				65.0						
				64.5						

Chiselling: From:	To:	Time:	Water Strikes: Strike:	Rose:	Depth Sealed	Water Details: Date:	Hole Depth:	Water Depth:	Installation: From:	To:	Pipe:	Backfill: From:	To:	Type:	Remarks:
2.90	3.00	01:00				16/08	3.00	Dry				0.00	3.00	Arisings	Borehole terminated due to obstruction.

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

Contract No: 5624	**Cable Percussion Borehole Log**				Borehole No: **BH41**
Contract:	Grange Castle West Access Road	Easting:	702802.897	Date Started:	16/08/2019
Location:	Grange Castle, Co. Dublin	Northing:	730947.907	Date Completed:	16/08/2019
Client:	South Dublin County Council	Elevation:	69.53	Drilled By:	T. Tindall
Engineer:	Clifton Scannell Emerson Associates	Borehole Diameter:	200mm	Status:	FINAL

Depth (m) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples and Insitu Tests Depth	Type	Result	Water Strike	Backfill
0.5	0.20	TOPSOIL.		69.0	69.33	0.50 0.50	B ES	TT01 TT02		
1.0		Stiff brown slightly sandy gravelly silty CLAY with low cobble content.		68.5		1.00	C	N=21 (3,3/5,6,5,5)		
1.5				68.0		1.50	B	TT03		
2.0	1.70	Stiff black slightly sandy gravelly silty CLAY with low cobble content.		67.5	67.83	2.00	C	N=24 (4,4/6,7,5,6)		
2.5				67.0		2.50	B	TT04		
3.0				66.5		3.00	C	50 (25 for 5mm/50 for 0mm)		
	3.10	Obstruction - possible boulder. Borehole terminated due to obstructions. End of Borehole at 3.10m			66.43					
3.5				66.0						
4.0				65.5						
4.5				65.0						

Chiselling: From:	To:	Time:	Water Strikes: Strike:	Rose:	Depth Sealed	Water Details: Date:	Hole Depth:	Water Depth:	Installation: From:	To:	Pipe:	Backfill: From:	To:	Type:	Remarks:	Legend:
3.10	3.10	01:00				16/08	3.10	Dry				0.00	3.10	Arisings	Borehole terminated due to obstruction.	B: Bulk D: Disturbed U: Undisturbed ES: Environmental W: Water C: Cone SPT S: Split spoon SPT

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Site DUB40 Grangecastle			**Borehole Number** MW01
Machine : Beretta T44 **Flush :** Water **Core Dia :** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 8.30m	**Ground Level (mOD)** 76.09	**Client** FT Squared	**Job Number** 10109-10-20
	Location 702053.8 E 731189 N	**Dates** 20/11/2020	**Engineer**	**Sheet** 1/1

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00	47	5	0				(1.70)	OVERBURDEN: Driller notes: Clay to weathered rock. Recovery consists of brown slightly sandy slightly gravelly Clay with occasional subangular cobbles.			
1.70	66	13	13	NI		74.39	1.70	Medium strong dark grey fine grained thinly laminated LIMESTONE. Distinctly weathered with calcite veins.			
2.50	83	12	8				(2.00)	1.70-3.70m BGL - Non Intact			
3.70	100	72	20	5		72.39	3.70	Strong dark grey fine grained thinly laminated LIMESTONE interbedded with calcaerous mudstone bands. partially weathered with calcite veins.			
4.30	70	43	43				(2.00)	4.45-4.65m BGL - Clay infilled cavity. 3.70-5.70m BGL- One fracture set. F1: Closely spaced, 0-20 degrees, undulating smooth, tight to open, clay infill on fracture surfaces.			
5.30	100	43	29	4		70.39	5.70	Weak to medium strong dark grey fine grained thinly laminated LIMESTONE. Distinctly weathered with calcite veins.			
5.70				NI			(1.10)	5.70-5.80m BGL - Clay infilled cavity. 5.70-6.80m BGL - Non Intact			
6.80	100	87	45	5		69.29	6.80	Strong dark grey fine grained thinly laminated LIMESTONE. Partially weathered with calcite veins.			
8.30							(1.50)	7.0-7.25m BGL - Clay infilled cavity. 6.80-8.30m BGL- Two fracture sets. F1: Closely spaced, 0-20 degrees, undulating smooth, tight to open, clay infill on fracture surfaces. F2: Medium spaced, 50-70 degrees, planar smooth, tight to open, clean fracture surfaces.			
						67.79	8.30	Complete at 8.30m			

Remarks
Borehole terminated at 8.30m BGL.
50mm slotted standpipe installed from 8.30m to 1.0m with pea gravel surround, plain pipe installed from 1.0m to ground level with bentonite seal and flush cover.

Scale (approx)	Logged By
1:50	NM

Figure No. 10109-10-20.MW01

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Site DUB40 Grangecastle			**Borehole Number** MW02
Machine : Beretta T44 **Flush :** Water **Core Dia :** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 6.00m	**Ground Level (mOD)** 76.60	**Client** FT Squared	**Job Number** 10109-10-20
	Location 702141 E 731118.5 N	**Dates** 23/11/2020	**Engineer**	**Sheet** 1/1

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00											
	23	0					(2.40)	OVERBURDEN: Driller notes: Clay to rock. Recovery consists of brown slightly sandy slightly gravelly Clay.			
2.40						74.20	2.40				
	33	25	23					Strong dark grey fine grained thinly laminated LIMESTONE. Partially weathered with calcite veins.			
2.90								1.70-3.70m BGL - Non Intact			
	87	87	49	7				2.40-4.80m BGL- One fracture set. F1: Closely spaced, 0-20 degrees, undulating smooth, tight to open, clay smearing on fracture surfaces.			
							(3.60)				
4.40								5.10-5.20m BGL - Clay infilled cavity.			
	100	68	60	4							
5.20								4.80-6.0m BGL- Two fracture sets. F1: Closely spaced, 0-20 degrees, undulating smooth, tight to open, clay smearing on fracture surfaces. F2: Medium to widely spaced, 70-90 degrees, planar smooth, tight to open, clay infill on fracture surfaces.			
	84	81	50	5							
6.00						70.60	6.00	Complete at 6.00m			

Remarks
Borehole terminated at 6.0m BGL.
50mm slotted standpipe installed from 6.0m to 1.0m with pea gravel surround, plain pipe installed from 1.0m to ground level with bentonite seal and flush cover.

Scale (approx)	Logged By
1:50	NM

Figure No. 10109-10-20.MW02

Ground Investigations Ireland Ltd
www.gii.ie

Site DUB40 Grangecastle			**Borehole Number** MW03
Machine : Beretta T44 **Flush :** Water **Core Dia :** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 6.00m	**Ground Level (mOD)** 76.61	**Client** FT Squared	**Job Number** 10109-10-20
	Location 702291.5 E 731066.1 N	**Dates** 23/11/2020	**Engineer**	**Sheet** 1/1

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00	29	0	0				(1.50)	OVERBURDEN: Driller notes: Clay to rock. Recovery consists of brown slightly sandy gravelly Clay.			
1.50	85	13	0	NI		75.11	1.50	Weak to medium strong dark grey fine grained thinly laminated LIMESTONE. Distinctly weathered.			
2.30	100	33	0				(1.40)	1.50-2.90m BGL - Non Intact			
2.90	100	87	67	8		73.71	2.90	Strong to very strong dark grey fine grained thinly laminated LIMESTONE. Partially weathered with calcite veins. 2.90-4.40m BGL- Two fracture sets. F1: Closely spaced, 0-20 degrees, undulating rough, tight to open, clay smearing on fracture surfaces. F2: Medium to closely spaced, 20-45 degrees, planar smooth, tight to open, clean fracture surfaces.			
4.40				NI			(3.10)	4.40-4.80m BGL - Non Intact			
4.80	100	56	53	5				4.80-6.0m BGL- One fracture set. F1: Closely spaced, 0-20 degrees, undulating smooth, tight to open, clay smearing on fracture surfaces.			
6.00						70.61	6.00	Complete at 6.00m			

Remarks
Borehole terminated at 6.0m BGL.
50mm slotted standpipe installed from 6.0m to 1.0m with pea gravel surround, plain pipe installed from 1.0m to ground level with bentonite seal and flush cover.

Scale (approx)	Logged By
1:50	NM

Figure No. 10109-10-20.MW03

Ground Investigations Ireland Ltd
www.gii.ie

Site DUB40 Grangecastle			**Borehole Number** MW04
Machine : Beretta T44 **Flush :** Water **Core Dia :** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 6.20m	**Ground Level (mOD)** 76.38	**Client** FT Squared	**Job Number** 10109-10-20
	Location 702237.3 E 730976.6 N	**Dates** 23/11/2020	**Engineer**	**Sheet** 1/1

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00	35	0	0				(2.40)	OVERBURDEN: Driller notes: Clay to rock. Recovery consists of brown slightly sandy gravelly Clay.			
2.40	100	29	0	NI		73.98	2.40	Medium strong to strong dark grey fine grained thinly laminated LIMESTONE. Distinctly weathered. 2.40-3.70m BGL - Non Intact 3.70-5.20m BGL- Two fracture sets. F1: Closely spaced, 0-20 degrees, undulating rough, tight to open, clay smearing on fracture surfaces. F2: Medium spaced, 70-90 degrees, planar smooth, tight to open, clean fracture surfaces.			
3.70	100	80	25	9		72.68	3.70	Strong dark grey fine grained thinly laminated LIMESTONE. Partially weathered with calcite veins. 5.20-6.20m BGL- Two fracture sets. F1: Closely spaced, 0-20 degrees, undulating rough, tight to open, clay smearing on fracture surfaces. F2: Medium spaced, 70-90 degrees, planar smooth, tight to open, clean fracture surfaces.			
5.20	100	70	44	8		71.18	5.20	Medium strong to strong dark grey fine grained thinly laminated LIMESTONE. Partially weathered.			
6.20						70.18	6.20	Complete at 6.20m			

Remarks
Borehole terminated at 6.20m BGL.
50mm slotted standpipe installed from 6.20m to 1.0m with pea gravel surround, plain pipe installed from 1.0m to ground level with bentonite seal and flush cover.

Scale (approx)	Logged By
1:50	NM

Figure No. 10109-10-20.MW04

Ground Investigations Ireland Ltd
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Site DUB40 Grangecastle			**Trial Pit Number** SA01
Machine : 8 Tonne Excavator **Method :** Trial Pit	**Dimensions** 0.6m W x 3.50m L	**Ground Level (mOD)** 76.50	**Client** FT Squared	**Job Number** 10109-10-20
	Location 702171.3 E 730941.8 N	**Dates** 28/10/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	Brown slightly sandy slightly gravelly TOPSOIL.		
				76.30	0.20	Firm to stiff brown slightly sandy slightly gravelly CLAY.		
					(0.80)			
				75.50	1.00	Brown grey clayey coarse angular GRAVEL with frequent subangular cobbles.		
					(0.20)			
				75.30	1.20	Complete at 1.50m		

Plan

Remarks

Trial pit stable.
No groundwater encountered.
Trial pit terminated at 1.20m BGL due to possible bedrock.

Scale (approx)	Logged By	Figure No.
1:25	NM	10109-10-20.SA01

Ground Investigations Ireland Ltd
www.gii.ie

Site DUB40 Grangecastle			**Trial Pit Number** SA02
Machine : 8 Tonne Excavator **Method :** Trial Pit	**Dimensions** 0.6m W x 3.10m L	**Ground Level (mOD)** 76.08	**Client** FT Squared	**Job Number** 10109-10-20
	Location 702386 E 731039.9 N	**Dates** 28/10/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	Brown slightly sandy slightly gravelly TOPSOIL.		
				75.88	0.20	Firm to stiff brown slightly sandy slightly gravelly CLAY.		
					(0.80)			
				75.08	1.00	Brown grey clayey coarse angular GRAVEL with frequent subangular cobbles.		
					(0.50)			
				74.58	1.50	Complete at 1.50m		

Plan

Remarks

Trial pit stable.
No groundwater encountered.
Trial pit terminated at 1.50m BGL due to possible bedrock.

Scale (approx)	Logged By	Figure No.
1:25	NM	10109-10-20.SA01

Ground Investigations Ireland Ltd
www.gii.ie

Site DUB40 Grangecastle			**Trial Pit Number** TP01
Machine : 8 Tonne Excavator **Method :** Trial Pit	**Dimensions** 0.6m W x 3.2m L	**Ground Level (mOD)** 75.22	**Client** FT Squared	**Job Number** 10109-10-20
	Location 702027.6 E 731225.7 N	**Dates** 28/10/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	Brown slightly sandy slightly gravelly TOPSOIL.		
				75.02	0.20			
					(0.60)	Firm brown slightly sandy slightly gravelly CLAY.		
0.70	EN			74.42	0.80			
					(0.70)	Grey clayey coarse angular GRAVEL with frequent subangular cobbles.		
				73.72	1.50			
						Complete at 1.50m		

Plan

Remarks

Trial pit stable.
No groundwater encountered.
Trial pit terminated at 1.50m BGL due to possible bedrock.

Scale (approx)	Logged By	Figure No.
1:25	NM	10109-10-20.TP01

Ground Investigations Ireland Ltd
www.gii.ie

Site DUB40 Grangecastle			**Trial Pit Number** TP02
Machine : 8 Tonne Excavator **Method :** Trial Pit	**Dimensions** 0.6m W x 3.0m L	**Ground Level (mOD)** 75.96	**Client** FT Squared	**Job Number** 10109-10-20
	Location 702017.9 E 731158.6 N	**Dates** 28/10/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	Brown slightly sandy slightly gravelly TOPSOIL.		
				75.76	0.20			
						Firm brown slightly sandy slightly gravelly CLAY.		
					(0.70)			
0.70	EN							
				75.06	0.90			
						Grey clayey coarse angular GRAVEL with frequent subangular cobbles.		
					(0.70)			
				74.36	1.60			
						Complete at 1.60m		

Plan

Remarks

Trial pit stable.
No groundwater encountered.
Trial pit terminated at 1.60m BGL due to possible bedrock.

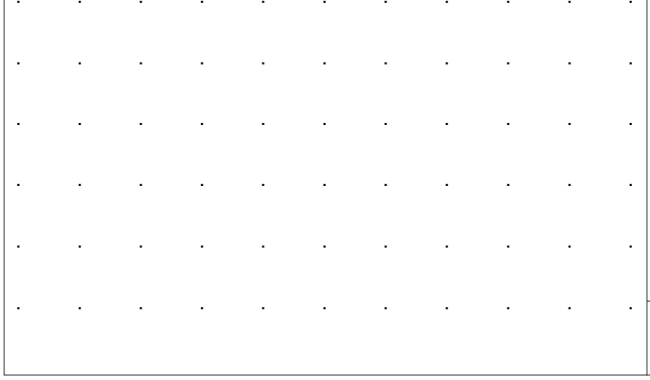
Scale (approx)	Logged By	Figure No.
1:25	NM	10109-10-20.TP02

Ground Investigations Ireland Ltd
www.gii.ie

Site DUB40 Grangecastle			**Trial Pit Number** TP03
Machine : 8 Tonne Excavator **Method :** Trial Pit	**Dimensions** 0.6m W x 3.0m L	**Ground Level (mOD)** 76.69	**Client** FT Squared	**Job Number** 10109-10-20
	Location 702101.4 E 731192.4 N	**Dates** 28/10/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	Brown slightly sandy slightly gravelly TOPSOIL.		
				76.49	0.20	Firm brown slightly sandy slightly gravelly CLAY.		
					(0.60)			
0.70	EN			75.89	0.80	Grey clayey coarse angular GRAVEL with frequent subangular cobbles.		
					(0.70)			
1.50	EN			75.19	1.50	Complete at 1.50m		

Plan



Remarks

Trial pit stable.
No groundwater encountered.
Trial pit terminated at 1.50m BGL due to possible bedrock.

Scale (approx)	Logged By	Figure No.
1:25	NM	10109-10-20.TP03

Ground Investigations Ireland Ltd
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Site DUB40 Grangecastle			**Trial Pit Number** TP04
Machine : 8 Tonne Excavator **Method :** Trial Pit	**Dimensions** 0.6m W x 3.0m L	**Ground Level (mOD)** 77.32	**Client** FT Squared	**Job Number** 10109-10-20
	Location 702067.7 E 731117.8 N	**Dates** 28/10/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	Brown slightly sandy slightly gravelly TOPSOIL.		
				77.12	0.20	Firm brown slightly sandy slightly gravelly CLAY.		
					(0.60)			
0.70	EN			76.52	0.80	Grey clayey coarse angular GRAVEL with frequent subangular cobbles.		
					(0.70)			
				75.82	1.50	Complete at 1.50m		

Plan

Remarks

Trial pit stable.
No groundwater encountered.
Trial pit terminated at 1.50m BGL due to possible bedrock.

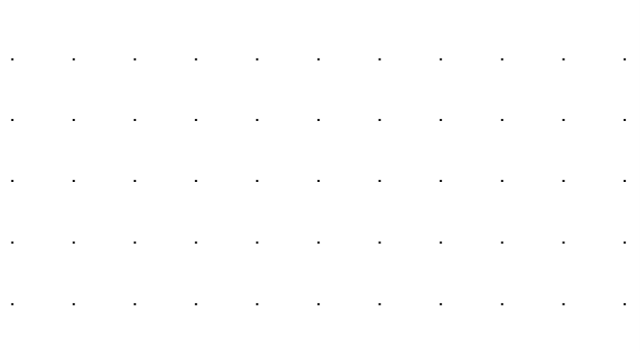
Scale (approx)	Logged By	Figure No.
1:25	NM	10109-10-20.TP04

Ground Investigations Ireland Ltd
www.gii.ie

Site DUB40 Grangecastle			**Trial Pit Number** TP05
Machine : 8 Tonne Excavator **Method :** Trial Pit	**Dimensions** 0.6m W x 3.0m L	**Ground Level (mOD)** 76.13	**Client** FT Squared	**Job Number** 10109-10-20
	Location 702196.9 E 731142.4 N	**Dates** 28/10/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	Brown slightly sandy slightly gravelly TOPSOIL.		
				75.93	0.20			
					(0.70)	Firm to stiff brown slightly sandy slightly gravelly CLAY.		
0.70	EN							
				75.23	0.90	Brown grey clayey coarse angular GRAVEL with frequent subangular cobbles.		
					(0.70)			
				74.53	1.60	Complete at 1.60m		

Plan



Remarks

Trial pit stable.
No groundwater encountered.
Trial pit terminated at 1.60m BGL due to possible bedrock.

Scale (approx)	Logged By	Figure No.
1:25	NM	10109-10-20.TP05

Ground Investigations Ireland Ltd
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Site DUB40 Grangecastle			**Trial Pit Number** TP06
Machine : 8 Tonne Excavator **Method :** Trial Pit	**Dimensions** 0.6m W x 3.2m L	**Ground Level (mOD)** 76.88	**Client** FT Squared	**Job Number** 10109-10-20
	Location 702125.4 E 731090.4 N	**Dates** 28/10/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	Brown slightly sandy slightly gravelly TOPSOIL.		
				76.68	0.20			
					(0.70)	Firm to stiff brown slightly sandy slightly gravelly CLAY.		
0.70	EN							
				75.98	0.90	Brown grey clayey coarse angular GRAVEL with frequent subangular cobbles.		
					(0.60)			
				75.38	1.50	Complete at 1.50m		

Plan

Remarks

Trial pit stable.
No groundwater encountered.
Trial pit terminated at 1.50m BGL due to possible bedrock.

Scale (approx)	Logged By	Figure No.
1:25	NM	10109-10-20.TP05

Ground Investigations Ireland Ltd
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Site DUB40 Grangecastle			**Trial Pit Number** TP07
Machine : 8 Tonne Excavator **Method :** Trial Pit	**Dimensions** 0.6m W x 3.2m L	**Ground Level (mOD)** 76.65	**Client** FT Squared	**Job Number** 10109-10-20
	Location 702287.4 E 731094.4 N	**Dates** 28/10/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	Brown slightly sandy slightly gravelly TOPSOIL.		
				76.45	0.20	Firm to stiff brown slightly sandy slightly gravelly CLAY.		
					(0.60)			
0.70	EN			75.85	0.80	Brown grey clayey coarse angular GRAVEL with frequent subangular cobbles.		
					(0.60)			
				75.25	1.40	Complete at 1.40m		

Plan

Remarks

Trial pit stable.
No groundwater encountered.
Trial pit terminated at 1.40m BGL due to possible bedrock.

Scale (approx)	Logged By	Figure No.
1:25	NM	10109-10-20.TP07

Ground Investigations Ireland Ltd
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Site DUB40 Grangecastle			**Trial Pit Number** TP08
Machine : 8 Tonne Excavator **Method :** Trial Pit	**Dimensions** 0.6m W x 3.2m L	**Ground Level (mOD)** 76.52	**Client** FT Squared	**Job Number** 10109-10-20
	Location 702236.9 E 731062.4 N	**Dates** 28/10/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	Brown slightly sandy slightly gravelly TOPSOIL.		
				76.32	0.20			
						Firm to stiff brown slightly sandy slightly gravelly CLAY.		
					(0.60)			
0.70	EN							
				75.72	0.80			
					(0.20)	Brown grey clayey coarse angular GRAVEL with frequent subangular cobbles.		
				75.52	1.00			
						Complete at 1.20m		

Plan

Remarks

Trial pit stable.
No groundwater encountered.
Trial pit terminated at 1.2m BGL due to possible bedrock.

Scale (approx)	Logged By	Figure No.
1:25	NM	10109-10-20.TP08

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Site DUB40 Grangecastle			**Trial Pit Number** TP09
Machine : 8 Tonne Excavator **Method :** Trial Pit	**Dimensions** 0.6m W x 3.2m L	**Ground Level (mOD)** 76.59	**Client** FT Squared	**Job Number** 10109-10-20
	Location 702183 E 731011.8 N	**Dates** 28/10/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	Brown slightly sandy slightly gravelly TOPSOIL.		
				76.39	0.20			
						Firm to stiff brown slightly sandy slightly gravelly CLAY.		
					(0.60)			
0.70	EN							
				75.79	0.80			
					(0.20)	Brown grey clayey coarse angular GRAVEL with frequent subangular cobbles.		
				75.59	1.00			
						Complete at 1.00m		

Plan

Remarks

Trial pit stable.
No groundwater encountered.
Trial pit terminated at 1.0m BGL due to possible bedrock.

Scale (approx)	Logged By	Figure No.
1:25	NM	10109-10-20.TP07

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Site DUB40 Grangecastle			**Trial Pit Number** TP10
Machine : 8 Tonne Excavator **Method :** Trial Pit	**Dimensions** 0.6m W x 3.0m L	**Ground Level (mOD)** 76.53	**Client** FT Squared	**Job Number** 10109-10-20
	Location 702198 E 730960.1 N	**Dates** 28/10/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				76.33	(0.20) 0.20	Brown slightly sandy slightly gravelly TOPSOIL.		
						Firm to stiff brown slightly sandy slightly gravelly CLAY.		
0.70	EN			75.53	(0.80) 1.00	Brown grey clayey coarse angular GRAVEL with frequent subangular cobbles.		
1.50	EN			75.03	(0.50) 1.50	Complete at 1.50m		

Plan

Remarks

Trial pit stable.
No groundwater encountered.
Trial pit terminated at 1.50m BGL due to possible bedrock.

Scale (approx)	Logged By	Figure No.
1:25	NM	10109-10-20.TP10

Ground Investigations Ireland Ltd
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Site DUB40 Grangecastle			**Trial Pit Number** TP11
Machine : 8 Tonne Excavator **Method :** Trial Pit	**Dimensions** 0.6m W x 3.0m L	**Ground Level (mOD)** 76.38	**Client** FT Squared	**Job Number** 10109-10-20
	Location 702341.6 E 731050.3 N	**Dates** 28/10/2020	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	Brown slightly sandy slightly gravelly TOPSOIL.		
				76.18	0.20	Firm to stiff brown slightly sandy slightly gravelly CLAY.		
0.70	EN				(0.70)			
				75.48	0.90	Brown grey clayey coarse angular GRAVEL with frequent subangular cobbles.		
					(0.30)			
				75.18	1.20	Complete at 1.20m		

Plan

Remarks

Trial pit stable.
No groundwater encountered.
Trial pit terminated at 1.20m BGL due to possible bedrock.

Scale (approx)	Logged By	Figure No.
1:25	NM	10109-10-20.TP11

Contract No: 5624	Trial Pit Log				Trial Pit No: TP31
Contract:	Grange Castle West Access Road	Easting:	702631.495	Date:	30/07/2019
Location:	Grange Castle, Co. Dublin	Northing:	731032.236	Excavator:	JCB 3CX
Client:	South Dublin County Council	Elevation:	69.14	Logged By:	M. Kaliski
Engineer:	Clifton Scannell Emerson Associates	Dimensions (LxWxD) (m):	3.80 x 0.70 x 3.20	Status:	FINAL

Level (mbgl) Scale:	Level (mbgl) Depth	Stratum Description	Legend	Level (mOD) Scale:	Level (mOD) Depth:	Samples / Field Tests Depth	Type	Result	Water Strike
0	0.30	TOPSOIL.		69.0	68.84				
0.5	0.60	Grey brown silty gravelly fine to coarse SAND with medium cobble content. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles are angular to subangular of limestone.		68.5	68.54	0.50	CBR	MK48	
	0.80	Grey brown silty gravelly fine to coarse SAND with high cobble content. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles are angular to subangular of limestone.			68.34				
1.0		Firm grey brown slightly sandy gravelly silty CLAY with high cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles are angular to subrounded of limestone.		68.0		1.00	B	MK49	
1.5	1.40	Stiff dark grey slightly sandy gravelly silty CLAY with high cobble and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded of limestone. Cobbles and boulders are angular to subrounded of limestone (up to 400mm diameter).		67.5	67.74				
2.0				67.0		2.00 2.00	B D	MK50 MK51	
2.5	2.30	Grey silty sandy fine to coarse angular to subangular GRAVEL of limestone with high cobble and medium boulder content. Sand is fine to coarse. Cobbles and boulders are angular to subangular of limestone (up to 400mm diameter).		66.5	66.84				▼
3.0				66.0		3.00	B	MK52	
3.5	3.20	Pit terminated at 3.20m		65.5	65.94				
4.0				65.0					
4.5				64.5					

Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Obstruction - possible boulders.	Pit walls stable.	2.30 Medium	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Appendix 7.3 Soil chemical test analysis results

Element Materials Technology
Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

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F: +44 (0) 1244 833781
W: www.element.com

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

Attention :	Barry Scxton
Date :	13th November, 2020
Your reference :	10109-10-20
Our reference :	Test Report 20/15128 Batch 1
Location :	DUB40 Grange Castle
Date samples received :	2nd November, 2020
Status :	Final report
Issue :	1

Thirteen samples were received for analysis on 2nd November, 2020 of which eight 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:

Lucas Halliwell
Project Co-ordinator

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

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 10109-10-20
Location: DUB40 Grange Castle
Contact: Barry Sexton
EMT Job No: 20/15128

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	7-9	13-15	16-18	19-21	22-24	28-30	34-36			LOD/LOR	Units	Method No.
Sample ID	TP01	TP03	TP04	TP05	TP06	TP07	TP09	TP10					
Depth	0.70	0.70	0.70	0.70	0.70	0.70	0.70	1.50					
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T					
Sample Date	28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020					
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil					
Batch Number	1	1	1	1	1	1	1	1					
Date of Receipt	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020					
Antimony	1	4	3	3	4	3	3	2			<1	mg/kg	TM30/PM15
Arsenic #	9.9	19.0	16.0	17.2	21.5	14.4	18.0	11.3			<0.5	mg/kg	TM30/PM15
Barium #	51	119	88	104	142	83	134	37			<1	mg/kg	TM30/PM15
Cadmium #	2.2	6.6	2.1	3.6	6.7	3.0	5.6	1.5			<0.1	mg/kg	TM30/PM15
Chromium #	27.7	39.9	44.1	43.6	38.8	31.0	48.4	29.8			<0.5	mg/kg	TM30/PM15
Copper #	28	61	51	40	58	43	52	23			<1	mg/kg	TM30/PM15
Lead #	12	26	24	24	27	23	24	24			<5	mg/kg	TM30/PM15
Mercury #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM30/PM15
Molybdenum #	2.2	8.6	3.9	3.4	5.4	3.5	4.4	1.8			<0.1	mg/kg	TM30/PM15
Nickel #	46.7	105.3	64.0	86.5	116.8	72.5	98.2	40.0			<0.7	mg/kg	TM30/PM15
Selenium #	1	3	2	2	4	2	3	1			<1	mg/kg	TM30/PM15
Zinc #	90	190	141	176	200	136	162	89			<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	<0.04	<0.04 SV	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03 SV	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03			<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05 SV	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05			<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	<0.04 SV	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	<0.03 SV	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03			<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	<0.04 SV	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03	<0.03 SV	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03			<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	<0.03 SV	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03			<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	<0.06 SV	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06			<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	<0.02 SV	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02			<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	<0.07 SV	<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 SV	<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 SV	<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 SV	<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 SV	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.04 SV	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
PAH 6 Total #	<0.22	<0.22 SV	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22			<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64 SV	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64			<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05 SV	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05			<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02 SV	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02			<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	<1 SV	<1	<1	<1	<1	<1	<1			<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	92	50 SV	77	80	71	81	78	85			<0	%	TM4/PM8
Mineral Oil (C10-C40)	<30	<30	<30	<30	<30	<30	<30	<30			<30	mg/kg	TM5/PM8/PM16

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 10109-10-20
Location: DUB40 Grange Castle
Contact: Barry Sexton
EMT Job No: 20/15128

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	7-9	13-15	16-18	19-21	22-24	28-30	34-36			LOD/LOR	Units	Method No.
Sample ID	TP01	TP03	TP04	TP05	TP06	TP07	TP09	TP10					
Depth	0.70	0.70	0.70	0.70	0.70	0.70	0.70	1.50					
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T					
Sample Date	28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020					
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil					
Batch Number	1	1	1	1	1	1	1	1					
Date of Receipt	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020					
TPH CWG													
Aliphatics													
>C5-C6 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM36/PM12
>C6-C8 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM36/PM12
>C10-C12 #	<0.2	<0.2	<0.2 SV	<0.2	<0.2	<0.2	<0.2	<0.2			<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 #	<4	<4	<4 SV	<4	<4	<4	<4	<4			<4	mg/kg	TM5/PM8/PM16
>C16-C21 #	<7	<7	<7 SV	<7	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
>C21-C35 #	<7	<7	<7 SV	<7	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
>C35-C40	<7	<7	<7 SV	<7	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40	<26	<26	<26	<26	<26	<26	<26	<26			<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM36/PM12
>C10-C25	<10	<10	<10 SV	<10	<10	<10	<10	<10			<10	mg/kg	TM5/PM8/PM16
>C25-C35	<10	<10	<10 SV	<10	<10	<10	<10	<10			<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM36/PM12
>EC7-EC8 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM36/PM12
>EC8-EC10 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM36/PM12
>EC10-EC12 #	<0.2	<0.2	<0.2 SV	<0.2	<0.2	<0.2	<0.2	<0.2			<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 #	<4	<4	<4 SV	<4	<4	<4	<4	<4			<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 #	<7	<7	<7 SV	<7	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 #	<7	<7	<7 SV	<7	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
>EC35-EC40	<7	<7	<7 SV	<7	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40	<26	<26	<26	<26	<26	<26	<26	<26			<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40)	<52	<52	<52	<52	<52	<52	<52	<52			<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM36/PM12
>EC10-EC25	<10	<10	<10 SV	<10	<10	<10	<10	<10			<10	mg/kg	TM5/PM8/PM16
>EC25-EC35	<10	<10	<10 SV	<10	<10	<10	<10	<10			<10	mg/kg	TM5/PM8/PM16
MTBE #	<5	<5	<5	<5	<5	<5	<5	<5			<5	ug/kg	TM36/PM12
Benzene #	<5	<5	<5	<5	<5	<5	<5	<5			<5	ug/kg	TM36/PM12
Toluene #	<5	<5	<5	<5	<5	<5	<5	<5			<5	ug/kg	TM36/PM12
Ethylbenzene #	<5	<5	<5	<5	<5	<5	<5	<5			<5	ug/kg	TM36/PM12
m/p-Xylene #	<5	<5	<5	<5	<5	<5	<5	<5			<5	ug/kg	TM36/PM12
o-Xylene #	<5	<5	<5	<5	<5	<5	<5	<5			<5	ug/kg	TM36/PM12
PCB 28 #	<5	<5	<5	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 52 #	<5	<5	<5	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 101 #	<5	<5	<5	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 118 #	<5	<5	<5	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 138 #	<5	<5	<5	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 153 #	<5	<5	<5	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 180 #	<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	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: 10109-10-20
Location: DUB40 Grange Castle
Contact: Barry Sexton
EMT Job No: 20/15128

Report : Solid

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

EMT Sample No.	1-3	7-9	13-15	16-18	19-21	22-24	28-30	34-36			LOD/LOR	Units	Method No.
Sample ID	TP01	TP03	TP04	TP05	TP06	TP07	TP09	TP10					
Depth	0.70	0.70	0.70	0.70	0.70	0.70	0.70	1.50					
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T					
Sample Date	28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020					
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil					
Batch Number	1	1	1	1	1	1	1	1					
Date of Receipt	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020					
Natural Moisture Content	12.9	27.8	20.6	29.9	29.7	23.6	26.4	14.9			<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	11.4	21.8	17.1	23.0	22.9	19.1	20.9	13.0			<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3			<0.3	mg/kg	TM38/PM20
Chromium III	27.7	39.9	44.1	43.6	38.8	31.0	48.4	29.8			<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	0.40	0.80	0.71	0.77	0.71	0.67	0.86	0.35			<0.02	%	TM21/PM24
pH #	8.52	7.95	8.32	7.84	7.81	8.14	7.79	8.59			<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1057	0.1132	0.1103	0.1202	0.113	0.1129	0.1118	0.1082				kg	NONE/PM17
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09				kg	NONE/PM17

Please see attached notes for all abbreviations and acronyms

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Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 10109-10-20
Location: DUB40 Grange Castle
Contact: Barry Sexton
EMT Job No: 20/15128

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	13-15	16-18	19-21	22-24	28-30	34-36			LOD/LOR	Units	Method No.
Sample ID	TP01	TP03	TP04	TP05	TP06	TP07	TP09	TP10					
Depth	0.70	0.70	0.70	0.70	0.70	0.70	0.70	1.50					
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T					
Sample Date	28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020					
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil					
Batch Number	1	1	1	1	1	1	1	1					
Date of Receipt	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020					
Dissolved Antimony #	<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	mg/kg	TM30/PM17
Dissolved Arsenic #	<0.0025	<0.0025	<0.0025	<0.0025	<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	<0.025	<0.025	<0.025			<0.025	mg/kg	TM30/PM17
Dissolved Barium #	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003			<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03			<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005			<0.0005	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	mg/kg	TM30/PM17
Dissolved Chromium #	<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	mg/kg	TM30/PM17
Dissolved Copper #	<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	mg/kg	TM30/PM17
Dissolved Lead #	<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	mg/kg	TM30/PM17
Dissolved Molybdenum #	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002			<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02			<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<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	mg/kg	TM30/PM17
Dissolved Selenium #	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003			<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10) #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03			<0.03	mg/kg	TM30/PM17
Dissolved Zinc #	<0.003	0.003	<0.003	<0.003	0.006	0.003	0.004	0.004			<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	<0.03	0.03	<0.03	<0.03	0.06	<0.03	0.04	0.04			<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	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	mg/kg	TM61/PM0
Phenol	<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	mg/kg	TM26/PM0
Fluoride	<0.3	<0.3	0.3	<0.3	<0.3	<0.3	<0.3	<0.3			<0.3	mg/l	TM173/PM0
Fluoride	<3	<3	<3	<3	<3	<3	<3	<3			<3	mg/kg	TM173/PM0
Sulphate as SO4 #	0.6	0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5			<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	6	5	<5	<5	6	<5	<5	<5			<5	mg/kg	TM38/PM0
Chloride #	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0.5	0.6			<0.3	mg/l	TM38/PM0
Chloride #	<3	<3	<3	<3	<3	<3	5	6			<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	<2	3	3	3	6	4	4	4			<2	mg/l	TM60/PM0
Dissolved Organic Carbon	<20	30	30	30	60	40	40	40			<20	mg/kg	TM60/PM0
pH	8.32	8.06	8.21	8.21	7.58	8.18	8.20	8.22			<0.01	pH units	TM73/PM0
Total Dissolved Solids #	46	61	72	72	<35	89	79	59			<35	mg/l	TM20/PM0
Total Dissolved Solids #	460	610	720	720	<350	890	790	590			<350	mg/kg	TM20/PM0

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Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 10109-10-20
Location: DUB40 Grange Castle
Contact: Barry Sexton
EMT Job No: 20/15128

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	13-15	16-18	19-21	22-24	28-30	34-36			Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Sample ID	TP01	TP03	TP04	TP05	TP06	TP07	TP09	TP10								
Depth	0.70	0.70	0.70	0.70	0.70	0.70	0.70	1.50								
COC No / misc																
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T								
Sample Date	28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020	28/10/2020								
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1	1	1	1								
Date of Receipt	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020	02/11/2020								
Solid Waste Analysis																
Total Organic Carbon #	0.40	0.80	0.71	0.77	0.71	0.67	0.86	0.35			3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025			6	-	-	<0.025	mg/kg	TM36/PM12
Sum of 7 PCBs #	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035			1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	<30	<30	<30	<30	<30	<30	<30	<30			500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 6 #	<0.22	<0.22 [SV]	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22			-	-	-	<0.22	mg/kg	TM4/PM8
PAH Sum of 17	<0.64	<0.64 [SV]	<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	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025			0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03			20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005			0.04	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			0.5	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			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			0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02			0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<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			0.5	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			0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Selenium #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03			0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc #	<0.03	0.03	<0.03	<0.03	0.06	<0.03	0.04	0.04			4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	460	610	720	720	<350	890	790	590			4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	<20	30	30	30	60	40	40	40			500	800	1000	<20	mg/kg	TM60/PM0
Mass of raw test portion	0.1057	0.1132	0.1103	0.1202	0.113	0.1129	0.1118	0.1082			-	-	-		kg	NONE/PM17
Dry Matter Content Ratio	85.3	79.4	81.3	74.9	79.5	79.9	80.8	83.3			-	-	-	<0.1	%	NONE/PM4
Leachant Volume	0.884	0.877	0.879	0.87	0.877	0.877	0.879	0.882			-	-	-		l	NONE/PM17
Eluate Volume	0.6	0.6	0.6	0.6	0.8	0.8	0.7	0.79			-	-	-		l	NONE/PM17
pH #	8.52	7.95	8.32	7.84	7.81	8.14	7.79	8.59			-	-	-	<0.01	pH units	TM73/PM11
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			1	-	-	<0.1	mg/kg	TM26/PM0
Fluoride	<3	<3	<3	<3	<3	<3	<3	<3			-	-	-	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	6	5	<5	<5	6	<5	<5	<5			1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	<3	<3	<3	<3	<3	<3	5	6			800	15000	25000	<3	mg/kg	TM30/PM0

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

Element Materials Technology

EPH Interpretation Report

Client Name: Ground Investigations Ireland
Reference: 10109-10-20
Location: DUB40 Grange Castle
Contact: Barry Sexton

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	EPH Interpretation
20/15128	1	TP01	0.70	1-3	No interpretation possible
20/15128	1	TP03	0.70	7-9	No interpretation possible
20/15128	1	TP04	0.70	13-15	No interpretation possible
20/15128	1	TP05	0.70	16-18	No interpretation possible
20/15128	1	TP06	0.70	19-21	No interpretation possible
20/15128	1	TP07	0.70	22-24	No interpretation possible
20/15128	1	TP09	0.70	28-30	No interpretation possible
20/15128	1	TP10	1.50	34-36	No interpretation possible

Element Materials Technology

Asbestos Analysis

Client Name: Ground Investigations Ireland
Reference: 10109-10-20
Location: DUB40 Grange Castle
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
20/15128	1	TP01	0.70	2	11/11/2020	**General Description (Bulk Analysis)**	soil.stones
					11/11/2020	**Asbestos Fibres**	NAD
					11/11/2020	**Asbestos ACM**	NAD
					11/11/2020	**Asbestos Type**	NAD
					11/11/2020	**Asbestos Level Screen**	NAD
20/15128	1	TP03	0.70	8	11/11/2020	**General Description (Bulk Analysis)**	Soil/Stones
					11/11/2020	**Asbestos Fibres**	NAD
					11/11/2020	**Asbestos ACM**	NAD
					11/11/2020	**Asbestos Type**	NAD
					11/11/2020	**Asbestos Level Screen**	NAD
20/15128	1	TP04	0.70	14	11/11/2020	**General Description (Bulk Analysis)**	Soil/Stones
					11/11/2020	**Asbestos Fibres**	NAD
					11/11/2020	**Asbestos ACM**	NAD
					11/11/2020	**Asbestos Type**	NAD
					11/11/2020	**Asbestos Level Screen**	NAD
20/15128	1	TP05	0.70	17	11/11/2020	**General Description (Bulk Analysis)**	Soil/Stones
					11/11/2020	**Asbestos Fibres**	NAD
					11/11/2020	**Asbestos ACM**	NAD
					11/11/2020	**Asbestos Type**	NAD
					11/11/2020	**Asbestos Level Screen**	NAD
20/15128	1	TP06	0.70	20	11/11/2020	**General Description (Bulk Analysis)**	soil/stones
					11/11/2020	**Asbestos Fibres**	NAD
					11/11/2020	**Asbestos ACM**	NAD
					11/11/2020	**Asbestos Type**	NAD
					11/11/2020	**Asbestos Level Screen**	NAD
20/15128	1	TP07	0.70	23	11/11/2020	**General Description (Bulk Analysis)**	soil/stones
					11/11/2020	**Asbestos Fibres**	NAD
					11/11/2020	**Asbestos ACM**	NAD
					11/11/2020	**Asbestos Type**	NAD
					11/11/2020	**Asbestos Level Screen**	NAD
20/15128	1	TP09	0.70	29	11/11/2020	**General Description (Bulk Analysis)**	soil/stones
					11/11/2020	**Asbestos Fibres**	NAD
					11/11/2020	**Asbestos ACM**	NAD

Element Materials Technology

Asbestos Analysis

Client Name: Ground Investigations Ireland
Reference: 10109-10-20
Location: DUB40 Grange Castle
Contact: Barry Sexton

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
20/15128	1	TP09	0.70	29	11/11/2020	**Asbestos Type**	NAD
					11/11/2020	**Asbestos Level Screen**	NAD
20/15128	1	TP10	1.50	35	11/11/2020	**General Description (Bulk Analysis)**	Soil/Stones
					11/11/2020	**Asbestos Fibres**	NAD
					11/11/2020	**Asbestos ACM**	NAD
					11/11/2020	**Asbestos Type**	NAD
					11/11/2020	**Asbestos Level Screen**	NAD

Element Materials Technology **Notification of Deviating Samples**

Client Name: Ground Investigations Ireland
Reference: 10109-10-20
Location: DUB40 Grange Castle
Contact: Barry Sexton

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 20/15128						

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

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/15128

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.

EMT Job No.: 20/15128

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

Element Materials Technology

Method Code Appendix

EMT Job No: 20/15128

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

Element Materials Technology

Method Code Appendix

EMT Job No: 20/15128

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

Element Materials Technology **Method Code Appendix**

EMT Job No: 20/15128

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	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.				
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	

Appendix 7.4 Groundwater Chemical Test Analysis results

Element Materials Technology
Unit 3 Deeside Point
Zone 3
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Deeside
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Ground Investigations Ireland
Catherinestown House
Hazelhatch Road
Newcastle
Co. Dublin
Ireland

Attention :	Barry Scxton
Date :	1st December, 2020
Your reference :	10109-10-20
Our reference :	Test Report 20/16596 Batch 1
Location :	DUB40 Grangecastle
Date samples received :	26th November, 2020
Status :	Final report
Issue :	1

Four samples were received for analysis on 26th November, 2020 of which four were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Bruce Leslie
Project Manager

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

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 10109-10-20
Location: DUB40 Grangecastle
Contact: Barry Sexton
EMT Job No: 20/16596

Report : Liquid

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

EMT Sample No.	1-9	10-18	19-27	28-36							LOD/LOR	Units	Method No.
Sample ID	MW01	MW02	MW03	MW04									
Depth													
COC No / misc													
Containers	V HNaF HCL N Z P BOD G	V HNaF HCL N Z P BOD G	V HNaF HCL N Z P BOD G	V HNaF HCL N Z P BOD G									
Sample Date	25/11/2020	25/11/2020	25/11/2020	25/11/2020									
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water									
Batch Number	1	1	1	1									
Date of Receipt	26/11/2020	26/11/2020	26/11/2020	26/11/2020									
Dissolved Arsenic #	6.3	6.3	3.4	10.8							<2.5	ug/l	TM30/PM14
Dissolved Boron	39	38	45	47							<12	ug/l	TM30/PM14
Dissolved Cadmium #	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM30/PM14
Total Dissolved Chromium #	<1.5	<1.5	<1.5	<1.5							<1.5	ug/l	TM30/PM14
Dissolved Copper #	<7	<7	<7	<7							<7	ug/l	TM30/PM14
Dissolved Lead #	<5	<5	<5	<5							<5	ug/l	TM30/PM14
Dissolved Manganese #	75	54	20	71							<2	ug/l	TM30/PM14
Dissolved Mercury #	<1	<1	<1	<1							<1	ug/l	TM30/PM14
Dissolved Nickel #	6	6	7	10							<2	ug/l	TM30/PM14
Dissolved Zinc #	6	<3	3	9							<3	ug/l	TM30/PM14
PAH MS													
Naphthalene #	<0.1	<0.1	<0.1	<0.1							<0.1	ug/l	TM4/PM30
Acenaphthylene #	<0.013	<0.013	<0.013	<0.013							<0.013	ug/l	TM4/PM30
Acenaphthene #	<0.013	<0.013	<0.013	<0.013							<0.013	ug/l	TM4/PM30
Fluorene #	<0.014	<0.014	<0.014	<0.014							<0.014	ug/l	TM4/PM30
Phenanthrene #	<0.011	<0.011	<0.011	0.021							<0.011	ug/l	TM4/PM30
Anthracene #	<0.013	<0.013	<0.013	<0.013							<0.013	ug/l	TM4/PM30
Fluoranthene #	<0.012	<0.012	0.016	0.014							<0.012	ug/l	TM4/PM30
Pyrene #	<0.013	<0.013	<0.013	0.018							<0.013	ug/l	TM4/PM30
Benzo(a)anthracene #	<0.015	<0.015	<0.015	<0.015							<0.015	ug/l	TM4/PM30
Chrysene #	<0.011	<0.011	<0.011	<0.011							<0.011	ug/l	TM4/PM30
Benzo(bk)fluoranthene #	<0.018	<0.018	<0.018	<0.018							<0.018	ug/l	TM4/PM30
Benzo(a)pyrene #	<0.016	<0.016	<0.016	<0.016							<0.016	ug/l	TM4/PM30
Indeno(123cd)pyrene #	<0.011	<0.011	<0.011	<0.011							<0.011	ug/l	TM4/PM30
Dibenzo(ah)anthracene #	<0.01	<0.01	<0.01	<0.01							<0.01	ug/l	TM4/PM30
Benzo(ghi)perylene #	<0.011	<0.011	<0.011	<0.011							<0.011	ug/l	TM4/PM30
PAH 16 Total #	<0.195	<0.195	<0.195	<0.195							<0.195	ug/l	TM4/PM30
Benzo(b)fluoranthene	<0.01	<0.01	<0.01	<0.01							<0.01	ug/l	TM4/PM30
Benzo(k)fluoranthene	<0.01	<0.01	<0.01	<0.01							<0.01	ug/l	TM4/PM30
PAH Surrogate % Recovery	69 SV	78	72	80							<0	%	TM4/PM30
EPH (C8-C40) #	<10	<10	<10	<10							<10	ug/l	TM5/PM30
PCB 28	<0.1	<0.1	<0.1	<0.1							<0.1	ug/l	TM17/PM30
PCB 52	<0.1	<0.1	<0.1	<0.1							<0.1	ug/l	TM17/PM30
PCB 101	<0.1	<0.1	<0.1	<0.1							<0.1	ug/l	TM17/PM30
PCB 118	<0.1	<0.1	<0.1	<0.1							<0.1	ug/l	TM17/PM30
PCB 138	<0.1	<0.1	<0.1	<0.1							<0.1	ug/l	TM17/PM30
PCB 153	<0.1	<0.1	<0.1	<0.1							<0.1	ug/l	TM17/PM30
PCB 180	<0.1	<0.1	<0.1	<0.1							<0.1	ug/l	TM17/PM30
Total 7 PCBs	<0.7	<0.7	<0.7	<0.7							<0.7	ug/l	TM17/PM30
Chloride #	4.4	2.4	9.7	21.5							<0.3	mg/l	TM38/PM0

Please see attached notes for all abbreviations and acronyms

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: 10109-10-20
Location: DUB40 Grangecastle
Contact: Barry Sexton
EMT Job No: 20/16596

Report : Liquid

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

EMT Sample No.	1-9	10-18	19-27	28-36							LOD/LOR	Units	Method No.
Sample ID	MW01	MW02	MW03	MW04									
Depth													
COC No / misc													
Containers	V HNaF HCL N Z P BOD G	V HNaF HCL N Z P BOD G	V HNaF HCL N Z P BOD G	V HNaF HCL N Z P BOD G									
Sample Date	25/11/2020	25/11/2020	25/11/2020	25/11/2020									
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water									
Batch Number	1	1	1	1									
Date of Receipt	26/11/2020	26/11/2020	26/11/2020	26/11/2020									
Ortho Phosphate as PO4 #	<0.06	<0.06	<0.06	<0.06							<0.06	mg/l	TM38/PM0
Ammoniacal Nitrogen as NH3 #	0.04	0.04	0.15	0.04							<0.03	mg/l	TM38/PM0
Hexavalent Chromium	<0.006	<0.006	<0.006	<0.006							<0.006	mg/l	TM38/PM0
Total Dissolved Chromium III	<6	<6	<6	<6							<6	ug/l	TM0/PM0
Electrical Conductivity @25C #	580	634	406	841							<2	uS/cm	TM76/PM0
pH #	7.47	7.41	7.80	7.48							<0.01	pH units	TM73/PM0
Total Nitrogen	1.7	2.2	1.4	3.2							<0.5	mg/l	TM38/TM125/PM0

Please see attached notes for all abbreviations and acronyms

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

Element Materials Technology

Client Name: Ground Investigations Ireland **SVOC Report :** **Liquid**
Reference: 10109-10-20
Location: DUB40 Grangecastle
Contact: Barry Sexton
EMT Job No: 20/16596

EMT Sample No.	1-9	10-18	19-27	28-36							Please see attached notes for all abbreviations and acronyms		
Sample ID	MW01	MW02	MW03	MW04									
Depth													
COC No / misc													
Containers	V HNAF HCL N Z P 500 G	V HNAF HCL N Z P 500 G	V HNAF HCL N Z P 500 G	V HNAF HCL N Z P 500 G									
Sample Date	25/11/2020	25/11/2020	25/11/2020	25/11/2020									
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water									
Batch Number	1	1	1	1									
Date of Receipt	26/11/2020	26/11/2020	26/11/2020	26/11/2020							LOD/LOR	Units	Method No.
SVOC MS													
Phenols													
2-Chlorophenol #	<1	<1	<1	<1							<1	ug/l	TM16/PM30
2-Methylphenol #	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
2-Nitrophenol	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
2,4-Dichlorophenol #	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
2,4-Dimethylphenol	<1	<1	<1	<1							<1	ug/l	TM16/PM30
2,4,5-Trichlorophenol #	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
2,4,6-Trichlorophenol	<1	<1	<1	<1							<1	ug/l	TM16/PM30
4-Chloro-3-methylphenol #	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
4-Methylphenol	<1	<1	<1	<1							<1	ug/l	TM16/PM30
4-Nitrophenol	<10	<10	<10	<10							<10	ug/l	TM16/PM30
Pentachlorophenol	<1	<1	<1	<1							<1	ug/l	TM16/PM30
Phenol	<1	<1	<1	<1							<1	ug/l	TM16/PM30
PAHs													
2-Chloronaphthalene #	<1	<1	<1	<1							<1	ug/l	TM16/PM30
2-Methylnaphthalene #	<1	<1	<1	<1							<1	ug/l	TM16/PM30
Naphthalene #	<1	<1	<1	<1							<1	ug/l	TM16/PM30
Acenaphthylene #	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Acenaphthene #	<1	<1	<1	<1							<1	ug/l	TM16/PM30
Fluorene #	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Phenanthrene #	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Anthracene #	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Fluoranthene #	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Pyrene #	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Benzo(a)anthracene #	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Chrysene #	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Benzo(bk)fluoranthene #	<1	<1	<1	<1							<1	ug/l	TM16/PM30
Benzo(a)pyrene	<1	<1	<1	<1							<1	ug/l	TM16/PM30
Indeno(123cd)pyrene	<1	<1	<1	<1							<1	ug/l	TM16/PM30
Dibenzo(ah)anthracene #	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Benzo(ghi)perylene #	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Phthalates													
Bis(2-ethylhexyl) phthalate	<5	<5	<5	<5							<5	ug/l	TM16/PM30
Butylbenzyl phthalate	<1	<1	<1	<1							<1	ug/l	TM16/PM30
Di-n-butyl phthalate #	<1.5	<1.5	<1.5	<1.5							<1.5	ug/l	TM16/PM30
Di-n-Octyl phthalate	<1	<1	<1	<1							<1	ug/l	TM16/PM30
Diethyl phthalate #	<1	<1	<1	<1							<1	ug/l	TM16/PM30
Dimethyl phthalate	<1	<1	<1	<1							<1	ug/l	TM16/PM30

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

Element Materials Technology

Client Name: Ground Investigations Ireland **SVOC Report :** **Liquid**
Reference: 10109-10-20
Location: DUB40 Grangecastle
Contact: Barry Sexton
EMT Job No: 20/16596

EMT Sample No.	1-9	10-18	19-27	28-36							Please see attached notes for all abbreviations and acronyms		
Sample ID	MW01	MW02	MW03	MW04									
Depth													
COC No / misc													
Containers	V HNaF HCL N Z P 500 G	V HNaF HCL N Z P 500 G	V HNaF HCL N Z P 500 G	V HNaF HCL N Z P 500 G									
Sample Date	25/11/2020	25/11/2020	25/11/2020	25/11/2020									
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water									
Batch Number	1	1	1	1									
Date of Receipt	26/11/2020	26/11/2020	26/11/2020	26/11/2020							LOD/LOR	Units	Method No.
SVOC MS													
Other SVOCs													
1,2-Dichlorobenzene #	<1	<1	<1	<1							<1	ug/l	TM16/PM30
1,2,4-Trichlorobenzene #	<1	<1	<1	<1							<1	ug/l	TM16/PM30
1,3-Dichlorobenzene #	<1	<1	<1	<1							<1	ug/l	TM16/PM30
1,4-Dichlorobenzene #	<1	<1	<1	<1							<1	ug/l	TM16/PM30
2-Nitroaniline	<1	<1	<1	<1							<1	ug/l	TM16/PM30
2,4-Dinitrotoluene #	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
2,6-Dinitrotoluene	<1	<1	<1	<1							<1	ug/l	TM16/PM30
3-Nitroaniline	<1	<1	<1	<1							<1	ug/l	TM16/PM30
4-Bromophenylphenylether #	<1	<1	<1	<1							<1	ug/l	TM16/PM30
4-Chloroaniline	<1	<1	<1	<1							<1	ug/l	TM16/PM30
4-Chlorophenylphenylether #	<1	<1	<1	<1							<1	ug/l	TM16/PM30
4-Nitroaniline	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Azobenzene #	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Bis(2-chloroethoxy)methane #	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Bis(2-chloroethyl)ether #	<1	<1	<1	<1							<1	ug/l	TM16/PM30
Carbazole #	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Dibenzofuran #	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Hexachlorobenzene #	<1	<1	<1	<1							<1	ug/l	TM16/PM30
Hexachlorobutadiene #	<1	<1	<1	<1							<1	ug/l	TM16/PM30
Hexachlorocyclopentadiene	<1	<1	<1	<1							<1	ug/l	TM16/PM30
Hexachloroethane #	<1	<1	<1	<1							<1	ug/l	TM16/PM30
Isophorone #	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
N-nitrosodi-n-propylamine #	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM16/PM30
Nitrobenzene #	<1	<1	<1	<1							<1	ug/l	TM16/PM30
Surrogate Recovery 2-Fluorobiphenyl	102	112	99	37 SV							<0	%	TM16/PM30
Surrogate Recovery p-Terphenyl-d14	108	116	102	39 SV							<0	%	TM16/PM30

Element Materials Technology

Client Name: Ground Investigations Ireland **VOC Report :** **Liquid**
Reference: 10109-10-20
Location: DUB40 Grangecastle
Contact: Barry Sexton
EMT Job No: 20/16596

EMT Sample No.	1-9	10-18	19-27	28-36							LOD/LOR	Units	Method No.
Sample ID	MW01	MW02	MW03	MW04									
Depth													
COC No / misc													
Containers	V HNAF HCL N Z P 500 G	V HNAF HCL N Z P 500 G	V HNAF HCL N Z P 500 G	V HNAF HCL N Z P 500 G									
Sample Date	25/11/2020	25/11/2020	25/11/2020	25/11/2020									
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water									
Batch Number	1	1	1	1									
Date of Receipt	26/11/2020	26/11/2020	26/11/2020	26/11/2020									
VOC MS													
Dichlorodifluoromethane	<2	<2	<2	<2							<2	ug/l	TM15/PM10
Methyl Tertiary Butyl Ether #	<0.1	<0.1	<0.1	<0.1							<0.1	ug/l	TM15/PM10
Chloromethane #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
Vinyl Chloride #	<0.1	<0.1	<0.1	<0.1							<0.1	ug/l	TM15/PM10
Bromomethane	<1	<1	<1	<1							<1	ug/l	TM15/PM10
Chloroethane #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
Trichlorofluoromethane #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
1,1-Dichloroethene (1,1 DCE) #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
Dichloromethane (DCM) #	<5	<5	<5	<5							<5	ug/l	TM15/PM10
trans-1-2-Dichloroethene #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
1,1-Dichloroethane #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
cis-1-2-Dichloroethene #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
2,2-Dichloropropane	<1	<1	<1	<1							<1	ug/l	TM15/PM10
Bromochloromethane #	<2	<2	<2	<2							<2	ug/l	TM15/PM10
Chloroform #	<2	<2	<2	<2							<2	ug/l	TM15/PM10
1,1,1-Trichloroethane #	<2	<2	<2	<2							<2	ug/l	TM15/PM10
1,1-Dichloropropene #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
Carbon tetrachloride #	<2	<2	<2	<2							<2	ug/l	TM15/PM10
1,2-Dichloroethane #	<2	<2	<2	<2							<2	ug/l	TM15/PM10
Benzene #	<0.5	<0.5	<0.5	<0.5							<0.5	ug/l	TM15/PM10
Trichloroethene (TCE) #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
1,2-Dichloropropane #	<2	<2	<2	<2							<2	ug/l	TM15/PM10
Dibromomethane #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
Bromodichloromethane #	<2	<2	<2	<2							<2	ug/l	TM15/PM10
cis-1-3-Dichloropropene	<2	<2	<2	<2							<2	ug/l	TM15/PM10
Toluene #	<5	<5	<5	<5							<5	ug/l	TM15/PM10
trans-1-3-Dichloropropene	<2	<2	<2	<2							<2	ug/l	TM15/PM10
1,1,2-Trichloroethane #	<2	<2	<2	<2							<2	ug/l	TM15/PM10
Tetrachloroethene (PCE) #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
1,3-Dichloropropane #	<2	<2	<2	<2							<2	ug/l	TM15/PM10
Dibromochloromethane #	<2	<2	<2	<2							<2	ug/l	TM15/PM10
1,2-Dibromoethane #	<2	<2	<2	<2							<2	ug/l	TM15/PM10
Chlorobenzene #	<2	<2	<2	<2							<2	ug/l	TM15/PM10
1,1,1,2-Tetrachloroethane #	<2	<2	<2	<2							<2	ug/l	TM15/PM10
Ethylbenzene #	<1	<1	<1	<1							<1	ug/l	TM15/PM10
m/p-Xylene #	<2	<2	<2	<2							<2	ug/l	TM15/PM10
o-Xylene #	<1	<1	<1	<1							<1	ug/l	TM15/PM10
Styrene	<2	<2	<2	<2							<2	ug/l	TM15/PM10
Bromoform #	<2	<2	<2	<2							<2	ug/l	TM15/PM10
Isopropylbenzene #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
1,1,2,2-Tetrachloroethane	<4	<4	<4	<4							<4	ug/l	TM15/PM10
Bromobenzene #	<2	<2	<2	<2							<2	ug/l	TM15/PM10
1,2,3-Trichloropropane #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
Propylbenzene #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
2-Chlorotoluene #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
1,3,5-Trimethylbenzene #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
4-Chlorotoluene #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
tert-Butylbenzene #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
1,2,4-Trimethylbenzene #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
sec-Butylbenzene #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
4-Isopropyltoluene #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
1,3-Dichlorobenzene #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
1,4-Dichlorobenzene #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
n-Butylbenzene #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
1,2-Dichlorobenzene #	<3	<3	<3	<3							<3	ug/l	TM15/PM10
1,2-Dibromo-3-chloropropane	<2	<2	<2	<2							<2	ug/l	TM15/PM10
1,2,4-Trichlorobenzene	<3	<3	<3	<3							<3	ug/l	TM15/PM10
Hexachlorobutadiene	<3	<3	<3	<3							<3	ug/l	TM15/PM10
Naphthalene	<2	<2	<2	<2							<2	ug/l	TM15/PM10
1,2,3-Trichlorobenzene	<3	<3	<3	<3							<3	ug/l	TM15/PM10
Surrogate Recovery Toluene D8	98	101	101	101							<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	102	102	101	103							<0	%	TM15/PM10

Please see attached notes for all abbreviations and acronyms

Element Materials Technology **Notification of Deviating Samples**

Client Name: Ground Investigations Ireland
Reference: 10109-10-20
Location: DUB40 Grangecastle
Contact: Barry Sexton

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 20/16596						

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

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/16596

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.

EMT Job No.: 20/16596

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

Element Materials Technology

Method Code Appendix

EMT Job No: 20/16596

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM0	Not available	PM0	No preparation is required.				
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.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	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			
TM16	Modified USEPA 8270D v5:2014. Quantitative determination of Semi-Volatile Organic compounds (SVOCs) by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM16	Modified USEPA 8270D v5:2014. Quantitative determination of Semi-Volatile Organic compounds (SVOCs) by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
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				

Element Materials Technology

Method Code Appendix

EMT Job No: 20/16596

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009. SOILS by Modified USEP	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			
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM0	No preparation is required.				
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM0	No preparation is required.	Yes			
TM38/TM125	Total Nitogen/Organic Nitrogen by calculation	PM0	No preparation is required.				
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			

CHAPTER 8 – HYDROLOGY

Appendix 8.1 Criteria for rating Site Attributes - Estimation of Importance of Hydrology Attributes (TII)

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

CHAPTER 9 - NOISE AND VIBRATION

Appendix 9.1 Glossary of acoustic terminology (prepared by AWN Consulting Ltd.)

ambient noise The totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, near and far.

background noise The steady existing noise level present without contribution from any intermittent sources. The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 per cent of a given time interval, T ($L_{AF90,T}$).

broadband Sounds that contain energy distributed across a wide range of frequencies.

dB Decibel - The scale in which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micro-pascals (20 µPa).

dB L_{pA} An 'A-weighted decibel' - a measure of the overall noise level of sound across the audible frequency range (20 Hz – 20 kHz) with A-frequency weighting (i.e. 'A'–weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

Hertz (Hz) The unit of sound frequency in cycles per second.

impulsive noise A noise that is of short duration (typically less than one second), the sound pressure level of which is significantly higher than the background.

$L_{Aeq,T}$ This is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period (T). The closer the L_{Aeq} value is to either the L_{AF10} or L_{AF90} value indicates the relative impact of the intermittent sources and their contribution. The relative spread between the values determines the impact of intermittent sources such as traffic on the background.

L_{AFN} The A-weighted noise level exceeded for N% of the sampling interval. Measured using the "Fast" time weighting.

L_{AFmax} is the instantaneous slow time weighted maximum sound level measured during the sample period (usually referred to in relation to construction noise levels).

$L_{Ar,T}$ The Rated Noise Level, equal to the L_{Aeq} during a specified time interval (T), plus specified adjustments for tonal character and impulsiveness of the sound.

L_{AF90} Refers to those A-weighted noise levels in the lower 90 percentile of the sampling interval; it is the level which is exceeded for 90% of the measurement period. It will therefore exclude the intermittent features of traffic and is used to estimate a background level. Measured using the "Fast" time weighting.

L_{AT}(DW) equivalent continuous downwind sound pressure level.

L_{fT}(DW) equivalent continuous downwind octave-band sound pressure level.

L_{day} L_{day} is the average noise level during the daytime period of 07:00hrs to 19:00hrs

L_{night} L_{night} is the average noise level during the night-time period of 23:00hrs to 07:00hrs.

low frequency noise LFN - noise which is dominated by frequency components towards the lower end of the frequency spectrum.

noise Any sound, that has the potential to cause disturbance, discomfort or psychological stress to a person exposed to it, or any sound that could cause

actual physiological harm to a person exposed to it, or physical damage to any structure exposed to it, is known as noise.

noise sensitive location NSL – Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.

octave band A frequency interval, the upper limit of which is twice that of the lower limit. For example, the 1,000Hz octave band contains acoustical energy between 707Hz and 1,414Hz. The centre frequencies used for the designation of octave bands are defined in ISO and ANSI standards.

rating level See $L_{Ar,T}$.

sound power level The logarithmic measure of sound power in comparison to a referenced sound intensity level of one picowatt (1pW) per m^2 where:

$$Lw = 10Log\frac{P}{P_0}\ \text{dB}$$

Where: p is the rms value of sound power in pascals; and
P_0 is 1 pW.

sound pressure level The sound pressure level at a point is defined as:

$$Lp = 20Log\frac{P}{P_0}\ \text{dB}$$

specific noise level A component of the ambient noise which can be specifically identified by acoustical means and may be associated with a specific source. In BS 4142, there is a more precise definition as follows: 'the equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval ($L_{Aeq, T}$)'.

tonal Sounds which cover a range of only a few Hz which contains a clearly audible tone i.e. distinguishable, discrete or continuous noise (whine, hiss, screech, or hum etc.) are referred to as being 'tonal'.

$^1/_3$ octave analysis Frequency analysis of sound such that the frequency spectrum is subdivided into bands of one–third of an octave each.

Appendix 9.2 Noise Modelling Parameters and assumptions

Prepared by AWN Consulting Limited

Noise Model

A 3D computer-based prediction model has been prepared in order to quantify the noise level associated with the proposed development. This section discusses the methodology behind the noise modelling process.

DGMR iNoise

Proprietary noise calculation software has been used for the purposes of this modelling exercise. The selected software, DGMR iNoise, calculates noise levels in accordance with *ISO 9613: Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation, 1996*.

iNoise is a proprietary noise calculation package for computing noise levels in the vicinity of noise sources. Predictor calculates noise levels in different ways depending on the selected prediction standard. In general, however, the resultant noise level is calculated taking into account a range of factors affecting the propagation of sound, including:

- the magnitude of the noise source in terms of A weighted sound power levels (L_{WA});
- the distance between the source and receiver;
- the presence of obstacles such as screens or barriers in the propagation path;
- the presence of reflecting surfaces;
- the hardness of the ground between the source and receiver;
- Attenuation due to atmospheric absorption; and
- Meteorological effects such as wind gradient, temperature gradient and humidity (these have significant impact at distances greater than approximately 400m).

Brief Description of ISO9613-2: 1996

ISO9613-2:1996 calculates the noise level based on each of the factors discussed previously. However, the effect of meteorological conditions is significantly simplified by calculating the average downwind sound pressure level, $L_{AT}(DW)$, for the following conditions:

- wind direction at an angle of ±45° to the direction connecting the centre of the dominant sound source and the centre of the specified receiver region with the wind blowing from source to receiver, and;
- wind speed between approximately $1ms^{-1}$ and $5ms^{-1}$, measured at a height of 3m to 11m above the ground.

The equations and calculations also hold for average propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs on clear calm nights. The basic formula for calculating $L_{AT}(DW)$ from any point source at any receiver location is given by:

$$L_{fT}(DW) = LW + Dc - A \qquad \textbf{Eqn. A}$$

Where:

$L_{fT}(DW)$ is an octave band centre frequency component of $L_{AT}(DW)$ in dB relative to $2x10^{-5}Pa$;
L_W is the octave band sound power of the point source;
D_c is the directivity correction for the point source;
A is the octave band attenuation that occurs during propagation, namely attenuation due to geometric divergence, atmospheric absorption, ground effect, barriers and miscellaneous other effects.

The estimated accuracy associated with this methodology is shown in Table 9.3.1 below:

Table A9.2.1 Estimated Accuracy for Broadband Noise of $L_{AT}(DW)$

Height, h*	Distance, d†	
	0 < d < 100m	100m < d < 1,000m
0<h<5m	±3dB	±3dB
5m<h<30m	±1dB	±3dB

* h is the mean height of the source and receiver. † d is the mean distance between the source and receiver.

N.B. These estimates have been made from situations where there are no effects due to reflections or attenuation due to screening.

Sound propagation through the atmosphere is attenuated by the conversion of the sound energy into heat. This attenuation is dependent on the temperature and relative humidity of the air through which the sound is travelling and is frequency dependent with increasing attenuation towards higher frequencies. In these predictions a temperature of 10°C and a relative humidity of 70% have been used, which give relativity low levels of atmosphere attenuation and corresponding worst case noise predictions.

Table A9.2.2 Atmospheric Attenuation Assumed for Noise Calculations (dB per km)

Temp (°C)	% Humidity	Octave Band Centre Frequencies (Hz)							
		63	125	250	500	1k	2k	4k	8k
10	70	0.12	0.41	1.04	1.92	3.66	9.70	33.06	118.4

Appendix 9.3 Noise modelling details for ICT Facility

Prepared by AWN Consulting Limited

Input Data and Assumptions

The noise model has been constructed using data from various source as follows:

Site Layout The general site layout has been obtained from the drawings forwarded by ARC:MC.

Local Area The location of noise sensitive locations has been obtained from a combination of site drawings provided by ARC:MC and others obtained from Ordinance Survey Ireland (OSI).

Heights The heights of buildings on site have been obtained from site drawings forwarded by ARC:MC. Off-site buildings have been assumed to be 8m high for houses and 16m for apartments with the exception of industrial buildings where a default height of 15m has been assumed.

Contours Site ground contours/heights have been obtained from site drawings forwarded by ARC:MC where available.

The final critical aspect of the noise model development is the inclusion of the various plant noise sources. Details are presented in the following section.

Source Sound Power Data

The noise modelling competed indicates the following limits in relation to various items of plant associated with the overall site development. Plant items will be selected in order to achieve the stated noise levels and or appropriate attenuation will be incorporated into the design of the plant/building in order that the plant noise emission levels are achieved on site (including any system regenerated noise). In addition, plant will be selected such that noise emissions are not tonal or impulsive in nature at nearby noise sensitive locations.

The following tables present the noise data assumed for the various buildings. Data has been supplied by the operator unless otherwise stated.

Table A9.2.2 Summary of Noise Data for Building 1 and 2

Type	Description	Octave Band Sound Power Level dB L_w								dB L_{wA}
		63	125	250	500	1k	2k	4k	8k	
AHU Note A	AHU Air Intake	85	86	78	66	58	55	55	65	74
	AHU Air Exhaust	80	83	76	71	65	61	59	70	75
Chillers Note B	Outdoor Unit	86	85	88	91	91	78	68	60	93
Standby Generators Note C	Dry Air Coolers	--	--	--	--	84	--	--	--	84
	Casing Sides	77	92	83	88	87	88	84	79	96
	Casing Front	61	76	75	82	76	72	68	71	85
	Air Intake	76	81	73	77	77	77	71	76	86
	Breakout Roof	67	87	76	82	80	80	78	76	90
	Air Discharge	70	84	65	60	62	58	57	72	84
	Engine Exhaust	76	74	70	70	70	64	61	66	80

Acoustically Rated Louvres (all Buildings)

The louvre surrounding the outdoor plant areas of the buildings is to be formed from proprietary acoustic louvre which offers the following insertion loss:

Table A9.2.3 Recommend Lourve SIL

Element	Sound Insertion Loss dB – Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Louvre	5	8	12	16	22	18	15	14

Appendix 9.4 Noise modelling details for Power Generation Facility

Prepared by AWN Consulting Limited

Input Data and Assumptions

The noise model has been constructed using data from various source as follows:

Site Layout The general site layout has been obtained from drawings issued by ARC:MC.
Local Area The location of noise sensitive locations has been obtained from drawings issued by ARC:MC.
Contours Site ground contours/heights have been obtained from site drawings issued by ARC:MC.

The final critical aspect of the noise model development is the inclusion of the various plant noise sources. Details are presented in the following section.

Source Sound Power Data
Sound power levels for the various items of plant have been provided by Centrica. Details are shown in the table below:

Table A9.4.1 L_{wA} levels Utilised in Noise Model

Sound Source	Sound Power Level dB(Z)									Overall
	31.5	63	125	250	500	1k	2k	4k	8k	dB(A)
Engine air-borne noise (per engine)	140	139	136	135	137	134	134	127	124	140
Exhaust flue outlet (silenced)	108	99	89	81	75	72	71	71	73	81
Intake air opening (silenced)	106	93	82	74	69	66	64	65	67	75
Radiator cooler (day)	-	103	97	93	92	91	86	81	83	95
Radiator cooler (night)	-	93	88	86	86	82	77	72	73	85
Gas PRS [A]	115	107	92	99	96	79	76	77	70	95
Transformer [B]	75	78	79	79	79	77	75	72	67	75
Ventilation unit [C]	-	103	96	87	77	73	70	62	58	84

Note A Overall level of 95 dB(A) provided by Centrica. Octave band values based on AWN data for a similar item.
Note B Overall level of 75 dB(A) provided by Centrica. Octave band values based on AWN data for a similar item.
Note C Overall level of 95 dB(A) provided by Centrica. Octave band values based on AWN data for a similar item.

Powerhouse Building Envelope
A number of assumptions have been made in respect of the Powerhouse building envelope. Due to the high internal noise levels, it will be necessary for the building to provide the following sound reduction indices. For the walls, the SRI values in Table B3 have been assumed:

Table A9.4.2 Sound Insulation Performance Requirements Powerhouse Walls, SRI (dB)

Octave Band Centre Frequency (Hz)								
31.5	63	125	250	500	1k	2k	4k	8k
35	41	45	49	59	69	75	75	75

This performance can be obtained by the following construction:

110mm dense concrete block – 94mm cavity with 50mm Moy Isover insulation – 200mm concrete panel

For the roof, the SRI values in Table A9.3.3 have been assumed:

Table A9.4.3 Sound Insulation Performance Requirements Powerhouse Roof, SRI (dB)

Octave Band Centre Frequency (Hz)								
31.5	63	125	250	500	1k	2k	4k	8k
40	45	52	58	60	65	69	73	77

This performance can be obtained by the following construction:

200mm concrete roof – 500mm air void – 100mm Moy Isover Insulation – 2 x 15mm SoundBloc on propriety steel spring neoprene acoustic hangers

It is also assumed internal surfaces of the powerhouse building are acoustically treated to provide a reverberation time of no more than 2 seconds.

Ventilation Outlets

In order to reduce noise breakout from the powerhouse via the ventilation outlets on the roof, the following acoustic insertion losses have been assumed:

Table A9.4.4 Acoustic Insertion Loss required at Ventilation Outlets, SRI (dB)

Octave Band Centre Frequency (Hz)								
31.5	63	125	250	500	1k	2k	4k	8k
3	5	12	21	38	42	34	22	13

Acoustic Louvre around Roof Area

The 21m high louvred screen is assumed to have the following performance which, in particular, reduces noise levels due to the radiators.

Table A9.4.5 Acoustic Insertion Loss required at louvre screen, SRI (dB)

Octave Band Centre Frequency (Hz)								
31.5	63	125	250	500	1k	2k	4k	8k
3	4	5	8	9	12	9	7	6

Appendix 9.5 Indicative construction noise and vibration management plan

Prepared by AWN Consulting Limited

This Noise and Vibration Management Plan (NVMP) details a *'Best Practice'* approach to dealing with potential noise and vibration emissions during the construction phase of the development. The Plan should be adopted by all contractors and sub-contractors involved in construction activities on the site. The Site Manager should ensure that adequate instruction is provided to contractors regarding the noise and vibration control measures contained within this document.

The environmental impact assessment (EIA) Report conducted for the construction activity has highlighted that the construction noise and vibration levels can be controlled to within the adopted criteria. However, mitigation measures should be implemented, where necessary, in order to control impacts to nearby sensitive areas within acceptable levels.

Nearby sensitive properties in the vicinity of the proposed development are summarised in Figure A9.4.1 below:

Figure A9.5.1 Sensitive Receptors

Construction Noise Criteria

As referenced in the EIA Report prepared for the proposed development, appropriate criteria relating to permissible construction noise levels for a development of this scale may be found in the Transport Infrastructure Ireland (TII) publication *Guidelines for the Treatment of Noise and Vibration in National Road Schemes*[14] which indicates the following criteria and hours of operation' which should not be exceeded at noise sensitive locations during the construction phase of the development.

The predicted external construction noise levels for the site preparation phase are within the relevant noise criterion of 65 dB $L_{Aeq,12hr}$ over the construction noise at all locations at distances of 40m or greater, subject to the implementation of the mitigation measures.

[14] *Guidelines for the Treatment of Noise and Vibration in National Road Schemes, Revision 1, 25 October 2004*, Transport Infrastructure Ireland

Table A9.5.1 Construction Noise Limit Values

Days and Times	Noise Levels (dB re. 2x10-5 Pa)	
	$L_{Aeq(1hr)}$	L_{Amax}
Monday to Friday 07:00hrs to 19:00hrs	70	80
Monday to Friday 19:00 to 22:00hrs	60*	65*
Saturdays 08:00hrs to 13:00hrs	65	75

Note * Construction activity at these times, other than that required for emergency works, will normally require the explicit permission of the relevant local authority.

Construction Vibration Criteria

It is recommended in this EIA Report that vibration from construction activities to off-site residences be limited to the values set out in Table 9.5.2. It should be noted that these limits are not absolute, but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage these limits may need to be reduced by up to 50%.

Table A9.5.2 Construction Vibration Limit Values

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of		
Less than 10Hz	10 to 50Hz	50 to 100Hz (and above)
8 mm/s	12.5 mm/s	20 mm/s

Hours of Work

The proposed general construction hours are 07:00 to 18:00hrs, Monday to Friday and 08:00 to 14:00 on Saturdays. However, weekday evening works may also be required from time to time. Weekday evening activities should be significantly reduced and generally only involve internal activities and concrete pouring which will be required during certain phases of the development. As a result, noise emissions from evening activities are expected to be significantly lower than for other general daytime activities.

Best Practice Guidelines for the Control of Noise & Vibration

BS5228 includes guidance on several aspects of construction site mitigation measures, including, but not limited to:

- selection of quiet plant;
- control of noise sources;
- screening;
- hours of work;
- liaison with the public, and;
- monitoring.

Detailed comment is offered on these items in the following paragraphs. Noise and vibration control measures that will be considered include the selection of suitable plant, enclosures and screens around noise sources, limiting the hours of work and monitoring.

Selection of Quiet Plant

This practice is recommended in relation to sites with static plant such as compressors and generators. It is recommended that these units be supplied with manufacturers' proprietary acoustic enclosures where possible. The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the site. The least noisy item should be selected wherever possible. Should a particular item of plant already on the site be found to generate high noise levels, the first action should be to identify whether or not said item can be replaced with a quieter alternative.

General Comments on Noise Control at Source
If replacing a noisy item of plant is not a viable or practical option, consideration should be given to noise control "at source". This refers to the modification of an item of plant or the application of improved sound reduction methods in consultation with the supplier. For example, resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises can often be controlled by fixing resilient materials in between the surfaces in contact.

BS5228 states that *"as far as reasonably practicable sources of significant noise should be enclosed"*. In applying this guidance, constraints such as mobility, ventilation, access and safety must be taken into account. Items suitable for enclosure include pumps and generators. Demountable enclosures will also be used to screen operatives using hand tools and will be moved around site as necessary.

In practice, a balance may need to be struck between the use of all available techniques and the resulting costs of doing so. As with Ireland's Environmental Protection Act legislation, we propose that the concept of *"best available techniques not entailing excessive cost "*(BATNEEC) be adopted. Furthermore, proposed noise control techniques should be evaluated in light of their potential effect on occupational safety etc.

BS5228 makes a number of recommendations in relation to "use and siting of equipment". These are all directly relevant and hence are reproduced in full. These recommendations will be adopted on site.

"Plant should always be used in accordance with manufacturers' instructions. Care should be taken to site equipment away from noise-sensitive areas. Where possible, loading and unloading should also be carried out away from such areas. Special care will be necessary when work has to be carried out at night.

Circumstances can arise when night-time working is unavoidable. Bearing in mind the special constraints under which such work has to be carried out, steps should be taken to minimise disturbance to occupants of nearby premises.

Machines such as cranes that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum. Machines should not be left running unnecessarily, as this can be noisy and waste energy.

Plant known to emit noise strongly in one direction should, when possible, be orientated so that the noise is directed away from noise-sensitive areas. Attendant operators of the plant can also benefit from this acoustical phenomenon by sheltering, when possible, in the area with reduced noise levels.

Acoustic covers to engines should be kept closed when the engines are in use and idling. The use of compressors that have effective acoustic enclosures and are designed to operate when their access panels are closed is recommended.
Materials should be lowered whenever practicable and should not be dropped. The surfaces on to which the materials are being moved could be covered by resilient material."

All items of plant should be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures.

Screening
Typically, screening is an effective method of reducing the noise level at a receiver location and can be used successfully as an additional measure to all other forms of noise control. The effectiveness of a noise screen will depend on the height and length of the screen and its position relative to both the source and receiver.

The length of the screen should in practice be at least five times the height, however, if shorter sections are necessary then the ends of the screen should be bent around the source. The height of any screen should be such that there is no direct line of sight between the source and the receiver.

BS5228 states that on level sites the screen should be placed as close as possible to either the source or the receiver. The construction of the barrier should be such that there are no gaps or openings at joints in the screen material. In most practical situations the effectiveness of the screen is limited by the sound transmission over the top of the barrier rather than the transmission through the barrier itself. In practice screens constructed of materials with a mass per unit of surface area greater than 7 kg/m^2 will give adequate sound insulation performance.

In addition, careful planning of the site layout should also be considered. The placement of site buildings such as offices and stores and in some instances, materials such as topsoil or aggregate can provide a degree of noise screening if placed between the source and the receiver.

Vibration
The vibration from construction activities will be limited to the values set out in Table 2. It should be noted that these limits are not absolute but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage, these limits may need to be reduced by up to 50%.

Liaison with the Public
The Contractor will provide proactive community relations and will notify the public and sensitive premises before the commencement of any works forecast to generate appreciable levels of noise or vibration, explaining the nature and duration of the works. The Contractor will distribute information circulars informing people of the progress of works and any likely periods of significant noise and vibration.

A designated noise liaison should be appointed to site during construction works. Any complaints should be logged and followed up in a prompt fashion. In addition, prior to particularly noisy construction activity, e.g. rock breaking, piling, etc., the site contact should inform the nearest noise sensitive locations of the time and expected duration of the works.

Noise Monitoring
During the construction phase consideration should be given to noise monitoring at the nearest sensitive locations.

Noise monitoring should be conducted in accordance with the International Standard ISO 1996: 2017: *Acoustics – Description, measurement and assessment of environmental noise* and be located a distance of greater than 3.5m away from any reflective surfaces, e.g. walls, in order to ensure a free-field measurement without any influence from reflected noise sources.

Vibration Monitoring
During the construction phase consideration should be given to vibration monitoring at the nearest sensitive locations.

Vibration monitoring should be conducted in accordance with BS7385-1 (1990) *Evaluation and measurement for vibration in buildings — Part 1: Guide for measurement of vibrations and evaluation of their effects on buildings* or BS6841 (1987) *Guide to measurement and evaluation of human exposure to whole-body mechanical vibration and repeated shock*.

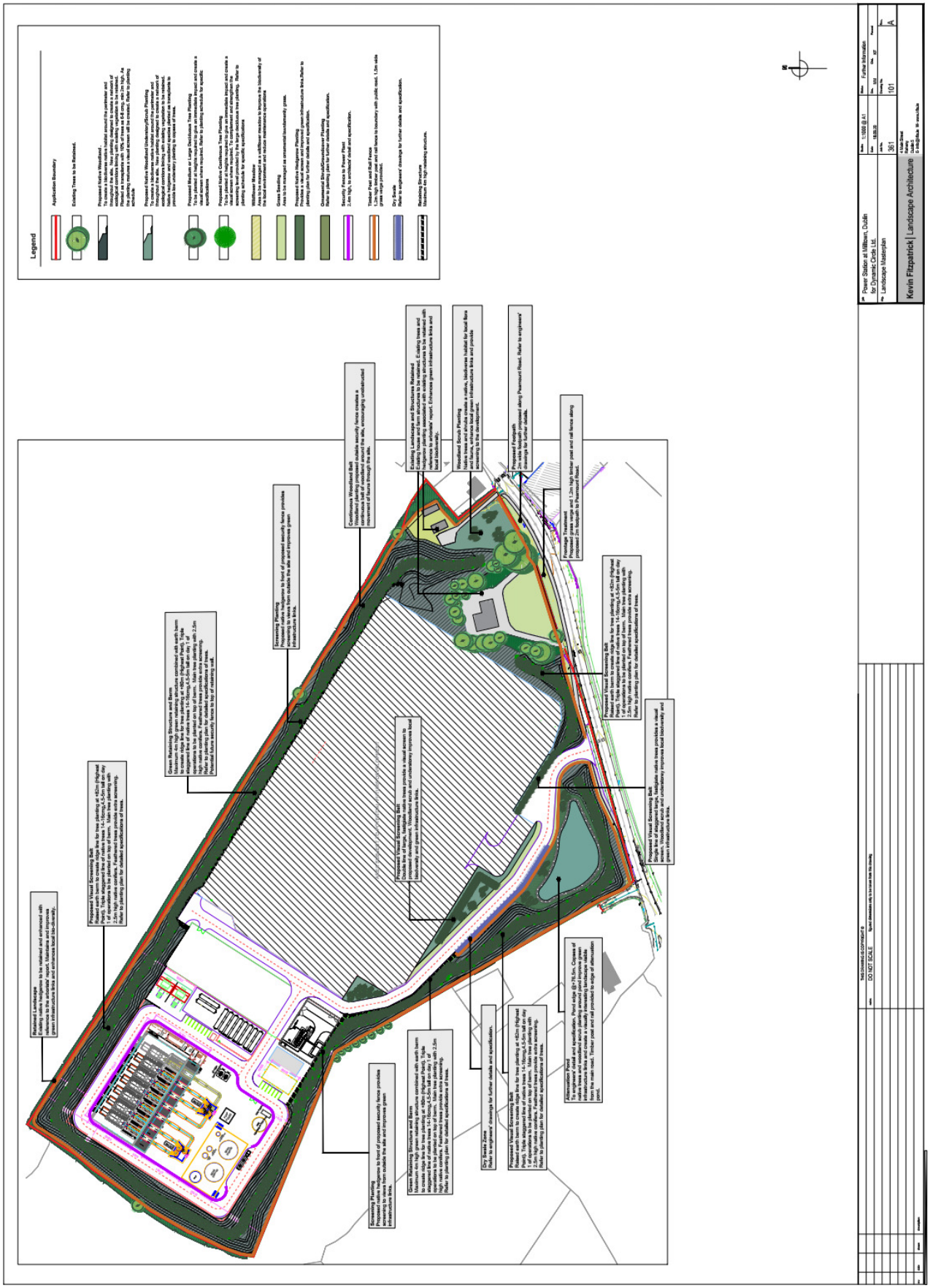
The mounting of the transducer to the vibrating structure should comply with BS ISO 5348:1998 *Mechanical vibration and shock – Mechanical mounting of accelerometers*. In summary, the following ideal mounting conditions apply:

- the transducer and its mountings are as rigid as possible;
- the mounting surfaces should be as clean and flat as possible;
- simple symmetric mountings are best, and;
- the mass of the mounting should be small in comparison to that of the structure under test.

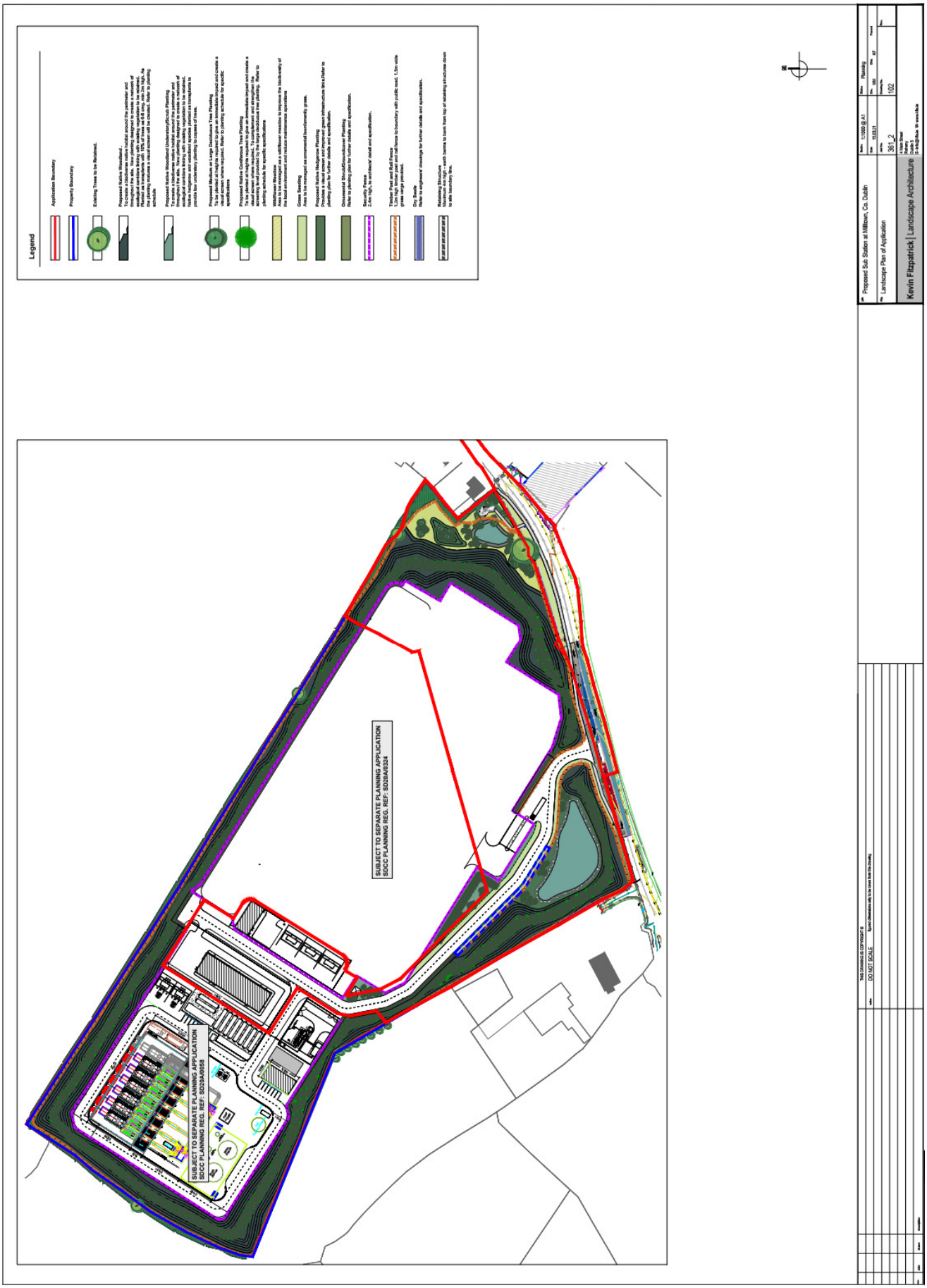
In general, the transducer will be fixed to the floor of a building or concrete base on the ground using expansion bolts. In instances where the vibration monitor will be placed outside of a building a flat and level concrete base with dimensions of approximately 1m x 1m x 0.1m will be required.

CHAPTER 11 - LANDSCAPE AND VISUAL IMPACT

Appendix 11.1 Permitted Landscape master plan as permitted under SDCC Reg. Ref. SD20A/0058



Appendix 11.2 Proposed Landscape master plan under the Proposed Development



Grange Castle Sub Station

Method Statement - Photo-montage production.

1. Photographs are taken from locations as advised by client with a full frame SLR digital camera and prime lens. The photographs are taken horizontally with a survey level attached to the camera. The photographic positions are marked (for later surveying), the height of the camera and the focal length of the image recorded.

2. In each photograph, a minimum of 3no. visible fixed points are marked for surveying. These are control points for model alignment within the photograph. All surveying is carried out by a qualified topographical surveyor using Total Station / GPS devices.

3. The photographic positions and the control points are geographically surveyed and this survey is tied in to the site topographical survey supplied by the Architect / client.

4. The buildings are accurately modelled in 3D cad software from cad drawings supplied by the Architect. Material finishes are applied to the 3D model and scene element are place like trees and planting to represent the proposed landscaping.

5. Virtual 3D cameras are positioned according to the survey co-ordinates and the focal length is set to match the photograph. Pitch and rotation are adjusted using the survey control points to align the virtual camera to the photograph. Lighting is set to match the time of day the photograph is taken.

6. The proposed development is output from the 3D software using this camera and the image is then blended with the original photograph to give an accurate image of what the proposed development will look like in its proposed setting.

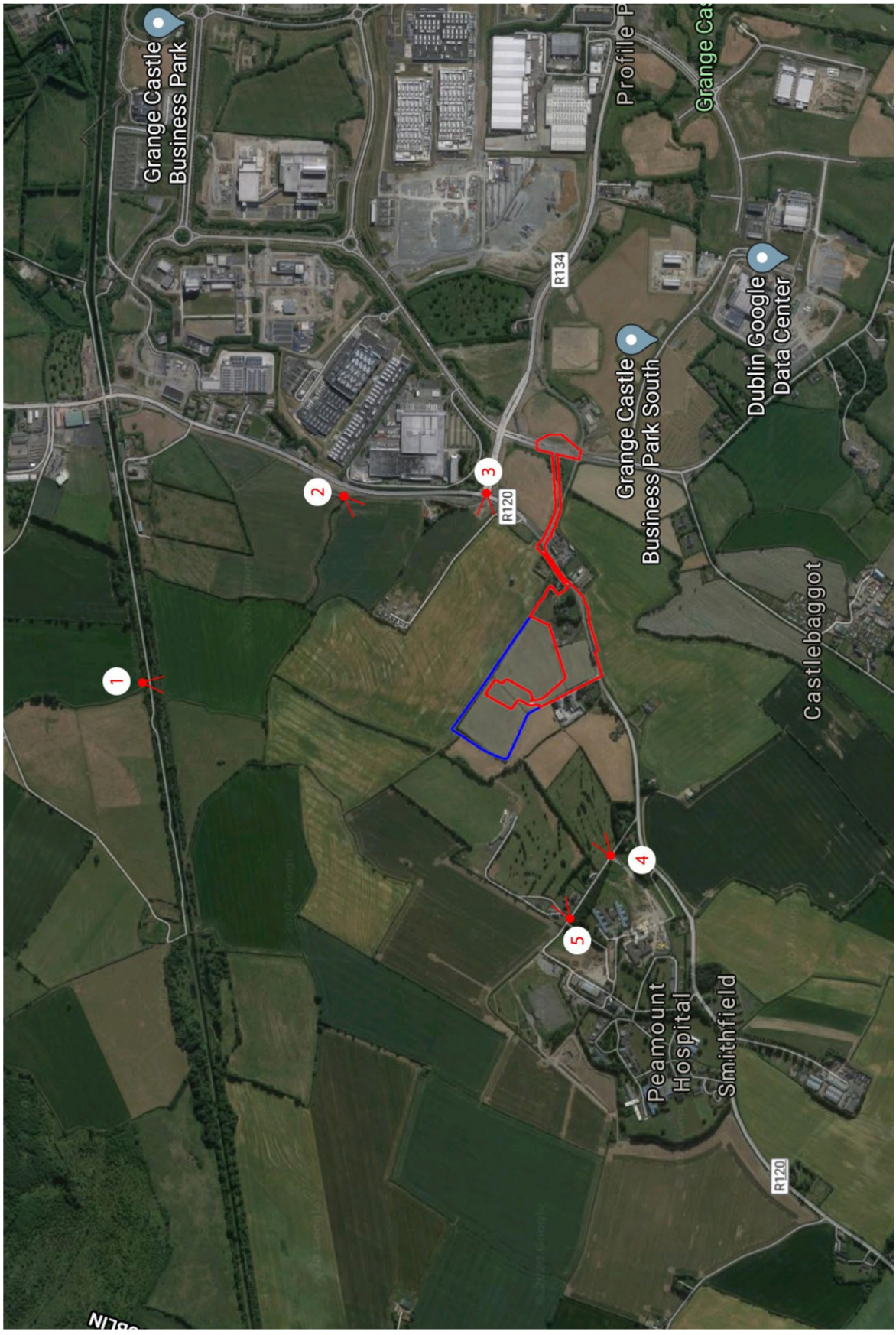
7. In the event of the development not being visible, the roof line of the development will be outlined in red if re-quested.

8. The document contains:

a) Site location map with view locations plotted.
b) Photo-montage sheet with existing or proposed conditions.
c) Reference information including field of view/focal length, range to site / development, date of photograph.

Project: Grange Castle Sub Station

digital dimensions
architectural visualisation


Grange Castle Business Park
Profile P
Grange Ca
R134
Dublin Google Data Center
Grange Castle Business Park South
R120
Castlebaggot
Peamount Hospital
Smithfield
R120
1
2
3
4
5
digital dimensions
architectural visualisation
Location Map
Project: Grange Castle Sub Station

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 1 Existing	04-02-2020	65°	28mm	931m	Canon EOS 5DS

digital dimensions
architectural visualisation

Project: Grange Castle Sub Station

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 1 Proposed	04-02-2020	65°	28mm	931m	Canon EOS 5DS

showing: Proposed Development Power Generation Facility outlined in red. Permitted Development outlined in blue

digital dimensions
architectural visualisation

Project: Grange Castle Sub Station

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 1 Proposed	04-02-2020	65°	28mm	931m	Canon EOS 5DS

showing: Proposed Development Power Generation Facility outlined in red. Permitted Development outlined in blue Potential Future Development outlined in green

digital dimensions
architectural visualisation

Project: Grange Castle Sub Station

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 2 Existing	04-02-2020	73°	24mm	612m	Canon EOS 5DS

digital dimensions
architectural visualisation

Project: Grange Castle Sub Station

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 2 Proposed	04-02-2020	73°	24mm	612m	Canon EOS 5DS

showing: Proposed Development Power Generation Facility outlined in red and Permitted Development

digital dimensions
architectural visualisation

Project: Grange Castle Sub Station

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 2 Proposed	04-02-2020	73°	24mm	612m	Canon EOS 5DS

showing: Proposed Development Power Generation Facility outlined in red, Permitted Development and Potential Future Development

Project: Grange Castle Sub Station

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 3 Existing	04-02-2020	73°	24mm	312m	Canon EOS 5DS

digital dimensions
architectural visualisation

Project: Grange Castle Sub Station

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 3 Proposed	04-02-2020	73°	24mm	312m	Canon EOS 5DS

showing: Proposed Development Power Generation Facility outlined in red and Permitted Development

Project: Grange Castle Sub Station

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 3 Proposed	04-02-2020	73°	24mm	312m	Canon EOS 5DS

showing: Proposed Development Power Generation Facility outlined in red, Permitted Development and Potential Future Development

digital dimensions
architectural visualisation

Project: Grange Castle Sub Station

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 4 Existing	04-02-2020	73°	24mm	394m	Canon EOS 5DS

digital dimensions
architectural visualisation

Project: Grange Castle Sub Station

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 4 Proposed	04-02-2020	73°	24mm	394m	Canon EOS 5DS

showing: Proposed Development Power Generation Facility outlined in red and Permitted Development

Project: Grange Castle Sub Station

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 4 Proposed	04-02-2020	73°	24mm	394m	Canon EOS 5DS

showing: Proposed Development Power Generation Facility outlined in red, Permitted Development and Potential Future Development

Project: Grange Castle Sub Station

digital dimensions
architectural visualisation

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 5 Existing	24-08-2020	73°	24mm	471m	Canon EOS 5DS

digital dimensions
architectural visualisation

Project: Grange Castle Sub Station

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 5 Proposed	24-08-2020	73°	24mm	471m	Canon EOS 5DS

showing: Proposed Development Power Generation Facility outlined in red. Permitted Development outlined in blue

digital dimensions
architectural visualisation

Project: Grange Castle Sub Station

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 5 Proposed	24-08-2020	73°	24mm	471m	Canon EOS 5DS

showing: Proposed Development Power Generation Facility outlined in red. Permitted Development outlined in blue Potential Future Development outlined in green

digital dimensions
architectural visualisation

Project: Grange Castle Sub Station

Appendix 11.4 Tree survey

The Tree File
Consulting Arborists

Base-line Tree Survey and Report
Trees at Proposed Site at
Milltown
Newcastle
Co Dublin

February 2020

The Tree File Ltd
Consulting Arborists
Ashgrove House
Kill Avenue
Dun Laoghaire
Co Dublin
01-2804839

Contents

This report should be read in conjunction with the "Tree Constraints Plan" drawing "D1-Milltown-TCP-02-20"

Report Context

This survey has been undertaken at the instruction of: -

Dynamic Circle Ltd
O/C Fichtner Consulting Engineers
92 George's Street Lower
Dun Laoghaire
Co. Dublin
A96 VR66

The survey has been prepared by-
Andy Worsnop Tech Arbor A, NCH Arb (PTI LANTRA)
The Tree File Ltd
Brookfield House
Carysfort Avenue
Blackrock
Co Dublin

Report Brief

In accordance with the request for information, the intention of the tree survey is to register, describe and evaluate the trees regarding their current health status and current condition within their current context. The survey is based upon and has been compiled considering the recommendations of BS5837: 2012 Trees in Relation to Design, Demolition and Construction – Recommendations.

Report Context

In line with the recommendations of "BS5837: 2012 Trees in Relation to Design, Demolition and Construction – Recommendations", this assessment has been advised by the results and findings of a tree survey, the findings of which are included as "Appendix 1" to this report.

In line with client instructions, this report comprises a simple qualitative tree survey and a summary report describing the material of Arboricultural interest, upon and adjoining the subject site.

This information has been provided without any review of possible construction or development works. Accordingly, this information does not include any "Arboricultural Implication Assessment", nor does not provide an "Arboricultural Method Statement" or "Tree Protection Plan" and therefore is not a full Arboricultural report.

It does however provide some of the basic information that would assist in the compilation of such information and documentation, should it be requested/required in the future.

This tree report should be read in conjunction with the combined tree constraints plan "D1-Milltown-TCP-02-20". This drawing provides a graphic representation of the tree survey depicting the constraints and the spatial retention requirements of the trees, as well as colour coded categorisation their condition and potential value.

Accordingly, and in line with BS5837:2012 Trees in Relation to Design, Demolition and Construction – Recommendations, this documentation does provide an invaluable "design tool" in respect of the review of potentially sustainable trees on any particular site.

Report Limitations

This report is based on the Arborists interpretation of information provided to his prior to report compilation and gained from the site during the undertaking of the site review. The site review data is subject to the limitation as set out under "Inspection and Evaluation Limitations and Disclaimers" in "Appendix 1" to this report. The findings and recommendations made within this report are based upon the knowledge and expertise of the inspecting Arborist.

Summary of Findings

Review of the site has identified no trees of vegetation of interest. The greater area of the site that comprises open fields to the north supports very little vegetation other than that about its north-western and north-eastern boundaries where there exists a relic of an agricultural field hedge. This hedge is dominated by Hawthorn but now includes numerous invasive species as well as emergent trees including Ash and Elm. Note should be made that the Elm population across the site is particularly poor with most trees being completely dead, having been killed by Dutch Elm disease.

The two existing dwellings to the south of the site see a dramatic difference in landscape and vegetation. These areas have been defined and ornamented using trees, shrubbery and hedges. Much of this material is commonplace and a lot is of small stature rendering it of limited interest or visual impact. Nonetheless, the area supports several larger items including and particularly several alignments of evergreens, presumed to have been installed with an intention to create hedges. These alignments typically dominated by Lawson and Leyland cypress are now of typically poor quality and offer dubious sustainability with some evidence of deterioration and mechanical failure already existing.

The area supports a more diverse vegetation type including many ornamentals and fruit trees. Note is made of the large Grey Poplar located close to the entrance to the site that would effectively be the largest tree on the site. Additionally and as near neighbours to the Poplar, note is made of the large Monterey Cypresses located close to the roadside boundary. These trees again will be regarded as being visually significant but, in line with their natural species predispositions, offer limited sustainability through their reputation towards mechanical failure in later life that tends to render them unsuitable for attention other than within the largest of open spaces.

Management Recommendations

Preliminary management recommendations have been put forward within the context of the survey table (see column PMR). Such recommendations are based on the current and “do nothing” site scenario. They do not consider any possible construction activity or site developments that may affect the trees.

In the case of construction or development works, it will be necessary for the project Arborist to re-assess all trees in respect of development impacts and implications, including shelter loss and exposure and any other changes in site context.

Regardless of any possible site development, it is advised that all retained trees be reviewed on regular basis and particularly, after any actions that may affect the trees, be those site development works, or tree management works that involve tree removal or pruning.

It should be appreciated that some of the concerns raised in the tree survey were based on evidence suggesting ongoing decline or mechanical failure. Such deterioration may well continue to a point where additional trees need to be removed. For this reason, trees must be reviewed regularly so that early intervention and action can be applied in a timely manner.

Additionally, many of the sites larger trees were affected by Ivy development. Whilst itself not an indicator of ill-health, Ivy cover can readily obscure signs and symptoms of ill-health or physical defect. Therefore, and whilst nominal assessments have been made for the purposes of this survey, the true condition of trees affected by Ivy cover might not be fully known until Ivy cover has been dealt with, either by cutting resulting in shedding or by the undertaking of climbing inspections.

Development Implications

This document comprises only a review of trees that exist upon or adjoining the site in respect to its existing context and relating to the “do nothing” scenario. It is appreciated that site development works may alter this scenario or may affect the suitability of various trees to be retained.

In respect of this, any development proposals must be reviewed under the auspices of an “Arboricultural

Implication Assessment" that will review the development proposals and provide an assessment of the potential for tree retention within the new context. This information can then be used to develop an "Arboricultural Method Statement" and a "Tree Protection Plan" to control and guide site works in a manner that will be least detrimental to tree health and thus may maximise tree sustainability.

Appendix 1 – Tree Survey

Nature of Survey

This survey has been based upon many of the criteria put forward in BS 5837: 2012 – Trees in Relation to Design, Demolition and Construction – Recommendations. The data collected has been represented in table form as "Table 1" within "Appendix 1" to this report. This appendix includes a Survey Methodology, Survey Key, Survey Abbreviations, Condition Category Definitions.

The survey relates to the site and the conditions thereon at the time of the survey. It is likely that changes in site usage, development or other environmental changes will require an amendment of recommendations and in some instances, may require the re-classification of a tree's category and/or suitability for retention.

Drawing References

The survey must be read in conjunction with drawing "D1-Milltown-TCP-02-20". This provides a scaled graphic representation of tree positions, crown forms, "RPA" (root protection area) extents and a colour reference to category systems. Where tree positions were not indicated on the supplied topographical drawing, their positions may have been given a "sketched" location within "D1-Milltown-TCP-02-20". It is advised that any such trees are accurately located by professional means so that the constraints such trees have upon the site can be accurately gauged.

Each tree is represented by a coloured spline, scaled to represent the north, east, south and west crown radii as denoted in the survey table. Each tree (categories A-green, B-blue and C-grey only) have been apportioned a "Root Protection Area" (RPA) denoted as a dashed orange circle. This circle represents the nominal minimum area requiring protection from the effects of development activity. It should, for the purposes of design, be considered, as approximating the position of the tree protection fencing that must be erected prior to the commencement of any site works, thus excluding all site activities other than those dealt with by way of the "Arboricultural Implication Assessment" and "Arboricultural Method Statement"

Survey Intent and Context

Intention of this document is to describe the extent, nature and quality of material of Arboricultural interest on the site in question.

Site Description

The site in question combines differing areas including to the North, open agricultural grazing land, together with to domiciliary plots including gardens to the south and adjoining the road.

The site appears to be broadly level and at the time of review exhibited no signs of drainage issues. Boundaries of the site combine fences and or hedges with the sites northern and north-eastern boundary is being defined by substantial hedges and fences existing elsewhere. To the south of the site, the review area includes the 2 existing dwellings and associated gardens, drives, access and outbuildings. These areas have undergone ornamental planting over time and include mixed collections of shrubbery, trees, tree lines and hedges.

Survey Data Collection and Methodology

The Survey

The primary survey was carried out in February of 2020. This survey is not an Implication Assessment though but provided some of the basic information regarding its compilation. The survey has been undertaken under the recommendations of BS 5837: 2012. This survey includes only tree of a stem diameter exceeding 150mm at approximately 1.50 metres from ground level. The survey relates to current site conditions, setting and context.

Identification

Each of the trees described within the text has been affixed with a consecutively numbered, alloy disk that relates directly to the survey text, positioned at approximately 1.50m from ground level.

Measurements

Measurements are metric and defined in metres and millimetres. All trees referred to in the survey text have been measured to provide information regarding canopy height and canopy spread (north, east, south and west radii), level of canopy base and stem diameter at 1.50 meters from ground level. The dimensions provided are intended to provide a reasonable representation of a trees size and form. Whilst efforts are made to maintain accuracy, visual obstruction, especially regarding trees in groups, requires that some tree dimensions are estimated only.

Inspection and Evaluation Limitations and Disclaimers

The information set out in this report relates to the review of a tree population on the site in question. As such, the information provided is based on a general review of trees and does not constitute a detailed review of any one of the individual specimens. Such an evaluation (tree report) would require the gathering of substantially more information than that dealt with in this survey.

The survey is not a safety assessment and the parameters reviewed within this survey context would be substantially deficient in extent to provide for a reliable safety assessment. The survey is intended to provide a general and qualitative review to assist in gauging the suitability of an individual tree for retention within a development context. All trees are subject to impromptu failure and damage and the assessment of risk as may be presented by a tree requires the review of numerous factors more than those noted herein and as such, remains outside the scope of this document and any attempt to use the information herein for such proposes will render the information invalid.

A competent and experienced Arborist has completed all inspection and tree assessment. The inspection involves visual assessment only, which has been carried out from ground level. No below ground, internal, invasive or aerial (climbing) inspection has been carried out.

Trees are living organisms whose health, condition and safety can change rapidly. It is recommended that all trees should be re-evaluated regarding their condition on an annual basis or after substantial trauma such a storm event, other damage or injury. It is advised that the results and recommendations of this survey will require review and reassessment after one year from the date of execution. This survey does not constitute a review of tree or site safety. Attempts to use the contents herein for such purposes will render the contents invalid.

Throughout the undertaking of the survey, several factors acted against the inspectors, contriving to reduce the accuracy of the survey.

Seasonality

The survey was commenced during the winter period. Some of the signs, typically symptomatic of ill-health or defect within a tree, may not have been available to view at the time of the survey or may have been obscured by seasonality related factors. Some of the fruiting bodies of various fungi, parasitic upon or causing decay or disease in trees, may have been out of season and unavailable to view. This survey can only comment upon symptoms of ill-health or defects visible at the time of the inspection.

Survey Key

Species.....	Refers to the specific tree species
Age……	Referred to in generalized categories including: -
Y - Young……	A young and typically small tree specimen.
S/M - Semi-Mature……..	A young tree, having attained dimensions that allow it to be regarded independently of its neighbours but typically, would be less than 50% of its ultimate size.
E/M - Early-Mature……..	A specimen, typically 50% - 100% of ultimate dimensions but with substantial capacity for mass and dimensional increase remaining.
M - Mature…….	A specimen of dimensions typical of a full-grown specimen of its species. Future growth would tend to be extremely slow with little if any dimensional increase.
O/M - Over-Mature……..	An old specimen of a species having already attained or exceeded its naturally expected longevity.
V - Veteran…….	An extremely old, veteran specimen of a species, usually of low vigour and typically subject to rapid decline and deterioration or of very limited future longevity.
Tree Dimensions …….	All dimensions are in meters. See notes regarding limitation of accuracy.
Ht…….……	Tree Height
C-Ht……..	Lowest canopy height
FSB……	Level of First Significant Branch
Sp: R……	Tree Canopy Spread measured by radii at north, east, south and west
Dia…….	Stem diameter at approx. 1.50m from ground level.
RPA……...	Root Protection Area, as a radius measured from the tree's stem centre.
Con	Physical Condition
G Good……..	A specimen of generally good form and health
G/F Good/Fair……..	
F Fair……	A specimen with defects or ill health that can be either rectified or managed typically allowing for retention
F/P Fair/Poor……...	
P Poor……...	A specimen whom through defect, disease attack or reduced vigour has a limited longevity or may be un-safe
D Dead……..	A dead tree
Structural Condition	Information on structural form, defects, damage, injury or disease supported by the tree
PMR – Preliminary Management Recommendations	Recommendation for Arboricultural actions or works considered necessary at the time of the inspection and relating to the existing site context and tree condition. Note is also made of works considered as urgent.
Retention Period	
S – Short……	Typically 0 -10 years
M – Medium……..	Typically 10 -20 years
L – Long……	Typically 20 – 40 years
L+……..	Typically in excess of 40 years
Category System……..	The Category System is intended to quantify a tree regarding its Arboricultural value as well as a combination of its structural and physical health. Note should be made of the fact that tree categorization relates to the current site and tree locations therein. As site changes occur, it may become necessary to re-evaluate trees regarding their relationship to new features.
Category U……	Typically relates to trees that are dead, dying or dangerous. Such trees may present a threat of suffer from a defect or disease that is considered irremediable.
Category A……	A typically a good quality specimen, which is considered to make a substantial Arboricultural contribution
Category B…….	Typically including trees regarded as being of moderate quality
Category C…….	Typically including generally poor-quality trees that may be of only limited value. The above categories (A, B and C) will be further subdivided regarding the nature of their values or qualities. A tree may be awarded one or more value categories as below, but such attributes do note infer any additional value and it may be possible for a tree may qualify for one or more of the categories as below.
Sub-Category 1…….	Values such as species interest, species context, landscape design or prominent aspect.
Sub-Category 2…….	Mainly cumulative landscape values such as woods, groups, avenues, lines.
Sub-Category 3…….	Mainly cultural values such as conservation, commemorative or historical links.

Table 1 – Tree Data Table

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural condition	Pmr	Yrs	Cat
1	Ash *(Fraxinus excelsior)*	S/M	F/P	4.50	0.50	3.00	1.50	1.00	2.00	5	302	3.63	Distorted and unbalanced to east suggesting early life partial collapse.	Review regarding retention context.	S	C2
2	Ash *(Fraxinus excelsior)*	S/M	F	5.00	1.00	3.50	4.50	1.00	1.00	2	357	4.28	Unbalanced to north-west and heavily divided from ground level. Proximity to roadway question sustainability over time.	Review regarding retention context.	M	C2
3	Ash *(Fraxinus excelsior)*	S/M	F	3.50	0.75	2.00	1.00	0.50	0.50	1	175	2.10	Young and vigorous but heavily suppressed and distorted receive medium-term.		M	C2
4	Ash *(Fraxinus excelsior)*	S/M	G/F	7.00	2.00	3.50	3.00	2.50	1.50	1	347	4.16	Slightly unbalanced to north-east but is otherwise of good condition. Proximity to roadway raises concerns regarding longer term sustainability.		M	B2
5	Ash *(Fraxinus excelsior)*	S/M	F/P	4.50	0.50	2.00	1.00	0.50	1.50	1	207	2.48	Heavily distorted and of dubious sustainability.		S	C2
6	Ash *(Fraxinus excelsior)*	S/M	F	5.00	2.00	3.00	2.00	0.50	1.00	1	185	2.22	Heavily unbalanced to north east. Proximity to road questions sustainability.		M	C2
7	Ash *(Fraxinus excelsior)*	S/M	F	5.00	2.00	2.50	1.50	1.00	1.50	1	191	2.29	Heavily unbalanced to north east. Proximity to road questions sustainability.		M	C2
8	Ash *(Fraxinus excelsior)*	S/M	F	4.50	1.00	2.00	2.00	0.50	1.00	1	159	1.91	Heavily unbalanced to north east. Proximity to road questions sustainability.		M	C2
9	Ash *(Fraxinus excelsior)*	S/M	F	5.50	2.00	2.50	2.00	1.50	2.00	1	188	2.25	Badly unbalanced to north. Is of good form but is of dubious sustainability in roadside position.		M	C2

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural condition	Pmr	Yrs	Cat
10	Ash *(Fraxinus excelsior)*	S/M	F	5.50	2.00	3.00	2.50	1.50	1.00	1	226	2.71	Slightly unbalanced and north east and divided at 1.50 m. Remains vigorous but is of dubious sustainability considering proximity to roadway.		M	C2
11	Ash *(Fraxinus excelsior)*	S/M	F	6.00	2.00	3.00	2.00	2.00	3.00	1	347	4.16	Heavily divided with compression fork at 1.25 m stop remains vigorous but is of dubious sustainability considering proximity to roadway.		M	C2
12	Rowan *(Sorbus aucuparia)*	S/M	F	7.00	1.50	1.00	1.00	1.00	1.00	1	175	2.10	Young and vigorous, recently planted and still guide. Has sustained minor lower stem damage.		L	B2
13	Norway Maple *(Acer platanoides)*	S/M	F	6.50	1.75	0.50	1.50	1.50	1.50	1	175	2.10	Young and vigorous but has sustained minor damage.		M	B2
14	Ash *(Fraxinus excelsior)*	S/M	F/P	7.00	2.00	2.50	1.00	2.00	2.00	1	226	2.71	Appears to have suffered recent failure and partial collapse. Is currently guide to fence.		S	C2
15	Norway Maple *(Acer platanoides)*	S/M	F	4.50	1.25	2.00	1.50	3.00	2.00	1	191	2.29	Distorted and has suffered notable bark damage.		M	C2
16	Norway Maple *(Acer platanoides)*	S/M	F/P	7.00	1.25	2.50	4.00	1.50	0.00	1	306	3.67	Heavily unbalanced to east suggesting instability and partial failure.		S	C2
17	Norway Maple *(Acer platanoides)*	S/M	F	7.50	4.00	1.50	2.50	1.00	0.00	1	207	2.48	Slightly unbalanced to east and has suffered minor lower stem bark damage.		M	C2
18	Norway Maple *(Acer platanoides)*	S/M	F	7.50	4.00	2.50	2.00	1.00	0.00	1	191	2.29	Slightly unbalanced to east and has suffered minor lower stem bark damage. Has suffered limb loss to lower southern crown.		M	C2
19	Norway Maple *(Acer platanoides)*	S/M	F	7.00	2.25	1.50	1.50	2.00	1.50	1	207	2.48	Young and vigorous but has sustained notable lower crown damage.		M	C2

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural condition	Pmr	Yrs	Cat
20	Ash *(Fraxinus excelsior)*	S/M	P	5.00	1.25	2.50	2.50	2.50	2.50	1	398	4.77	A pollard remnant of an emergent ash from a defunct hedge line. Crown comprises suck regeneration arising from previously cut stump.		S	C2
21	Ash *(Fraxinus excelsior)*	S/M	P	5.00	1.25	2.50	2.50	2.50	2.50	1	398	4.77	A pollard remnant of an emergent ash from a defunct hedge line. Crown comprises suck regeneration arising from previously cut stump.		S	C2
22	Ash *(Fraxinus excelsior)*	S/M	P	5.00	1.25	2.50	2.50	2.50	2.50	1	398	4.77	A pollard remnant of an emergent ash from a defunct hedge line. Crown comprises suck regeneration arising from previously cut stump.		S	C2
23	Ash *(Fraxinus excelsior)*	S/M	F/P	6.50	1.50	3.00	3.00	3.00	3.00	1	341	4.09	Comprises suck regeneration arising from cut remnant of an emergent ash.		S	C2
24	Wych Elm *(Ulmus glabra)*	E/M	D	12.00	2.00	3.50	3.00	3.00	4.50	1	398	4.77	Completely dead, killed by Dutch Elm disease.	Remove.	N/A	U
25	Ash *(Fraxinus excelsior)*	M	P	7.00	0.50	0.00	2.50	3.50	3.00	1	557	6.68	Comprises a sucker arising from stump remnant of a previous tree. Is unsuitable for attention.	Remove.	N/A	U
26	Wych Elm *(Ulmus glabra)*	E/M	D	10.00	3.00	3.00	3.00	3.00	3.00	1	398	4.77	Completely dead, killed by Dutch Elm disease.	Remove.	N/A	U
27	Wych Elm *(Ulmus glabra)*	E/M	D	11.00	2.50	3.00	3.00	3.00	3.00	1	382	4.58	Completely dead, killed by Dutch Elm disease.		N/A	U
28	Wych Elm *(Ulmus glabra)*	E/M	D	7.00	3.50	2.00	3.00	3.00	2.00	1	398	4.77	Completely dead, killed by Dutch Elm disease and previously decapitated because position beneath high tension power cables.	Remove.	N/A	U
29	Ash *(Fraxinus excelsior)*	E/M	G/F	9.00	0.00	3.50	3.50	3.00	4.00	1	462	5.54	Comprises sucker regeneration with obscures basal region being obscured by massive suckering growth.	Clean basal suckers and rereview.	M	C2

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural condition	Pmr	Yrs	Cat
30	Wych Elm *(Ulmus glabra)*	S/M	D	9.00	3.00	2.50	3.00	3.00	3.00	1	366	4.39	General note, hedge on this boundary is identical to previously mentioned hedge.		N/A	U
31	Wych Elm *(Ulmus glabra)*	E/M	D	12.00	2.50	3.00	3.00	3.00	3.00	1	398	4.77	Completely dead, killed by Dutch Elm disease.	Remove.	N/A	U
32	Wych Elm *(Ulmus glabra)*	E/M	D	8.00	2.50	3.00	3.00	3.00	3.00	1	398	4.77	Completely dead, killed by Dutch Elm disease.		N/A	U
33	Ash *(Fraxinus excelsior)*	S/M	F	11.00	2.00	2.50	3.00	3.00	3.00	1	452	5.42	Young and vigorous, supporting ivy cover.	Cut ivy and review.	L	B2
34	Wych Elm *(Ulmus glabra)*	E/M	D	11.00	2.50	3.00	3.00	3.00	3.00	1	382	4.58	Killed by Dutch Elm disease.	Remove.	N/A	U
35	Wych Elm *(Ulmus glabra)*	E/M	D	10.00	2.50	3.00	3.00	3.00	3.00	1	366	4.39	Killed by Dutch Elm disease.	Remove.	N/A	U
36	Wych Elm *(Ulmus glabra)*	E/M	D	9.00	2.50	3.00	3.00	3.00	3.00	1	382	4.58	Killed by Dutch Elm disease.	Remove.	N/A	U
37	Wych Elm Group *(Ulmus glabra)*	S/M	F	10.00	2.50	3.00	3.00	3.00	3.00	1	398	4.77	Approximately 5 adjoining trees the majority of which are completely dead, being killed by Dutch Elm disease.	Remove.	N/A	U
38	Sycamore *(Acer pseudoplatanus)*	S/M	F	6.00	1.00	3.00	3.00	3.00	3.00	1	382	4.58	A young and vigorous specimen supporting extensive ivy cover on principal stem. Appears to be naturally arising from within hedge profile.		L	B2
39	Fruit Tree Group Domestic Apple *(Malus variety)* Domestic Plum *(Prunus Sp.)*	E/M	P	5.00	0.75	5.00	4.00	3.00	2.00	1	239	2.86	Multi-stemmed group dominant specimen of which has recently collapsed.	Remove.	N/A	U

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural condition	Pmr	Yrs	Cat
40	Domestic Apple *(Malus variety)*	S/M	P	3.00	1.50	0.00	1.00	1.50	0.50	1	175	2.10	A poor quality and suppress specimen.		S	C2
41	Domestic Apple *(Malus variety)*	M	G	4.00	0.50	4.00	2.50	2.50	2.50	1	341	4.09	An aged specimen previously pruned.		M	C2
42	Domestic Apple *(Malus variety)*	E/M	F	4.00	1.50	1.00	2.50	3.00	1.50	1	223	2.67	Suppressed and harshly cut in past.		S	C2
43	Domestic Apple *(Malus variety)*	M	F	4.50	1.75	2.00	5.00	4.00	1.00	1	347	4.16	Heavily unbalanced to south east suggesting early life partial collapse.		S	C2
44	Domestic Plum *(Prunus Sp.)*	E/M	F	4.00	0.00	3.00	3.50	1.50	3.50	1	229	2.75	Suppressed and heavily distorted.		M	C2
45	Holly *(Ilex aquifolium)*	M	F	4.50	0.00	1.50	1.00	4.50	1.50	1	191	2.29	Comprises typical element of ornamental shrubbery.		M	C2
46	Domestic Apple *(Malus variety)*	E/M		5.00	0.50	2.00	2.00	2.50	2.50	1	229	2.75	Suppressed and slightly distorted but still vigorous.		M	C2
47	Cherry Laurel *(Prunus laurocerasus)*	M	G/F	5.50	0.00	3.00	3.00	3.00	3.00	1	382	4.58	A large dominating shrub.		M	C2
48	Domestic Apple *(Malus variety)*	M	G/F	5.50	1.00	4.50	3.50	4.00	3.50	1	462	5.54	A large specimen of a fruit tree.		M	B2
49	Elder *(Sambucus nigra)*	M	F	6.00	0.50	1.00	4.00	3.00	0.00	1	261	3.13	Typically regarded as a weed species. Is unsuitable for attention.	Remove.	N/A	U
50	Ornamental Cherry *(Prunus variety)*	E/M	F/P	7.50	1.00	2.00	5.50	4.00	0.00	1	306	3.67	Heavily unbalanced to east suggesting potential instability or prior partial collapse. Is of dubious sustainability.		S	C2
51	Wild Cherry *(Prunus avium)*	E/M	F	10.00	2.50	3.50	4.50	3.50	4.00	1	293	3.51	Suppressed and drawn-up but apparently vigorous. Is affected by extensive spurious and adjoining shrubbery.	Cleanout review regard retention context.	M	B2

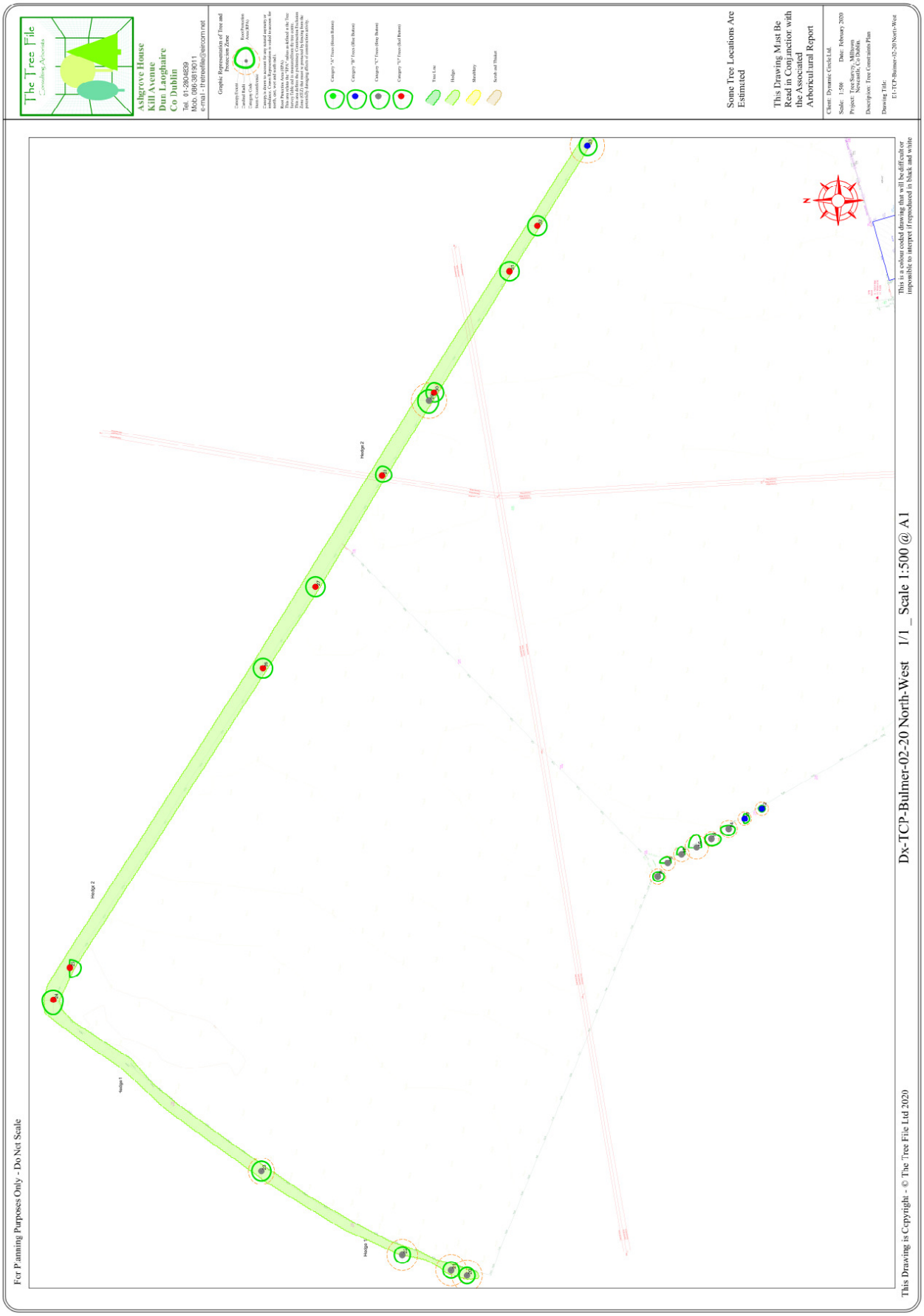
No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural condition	Pmr	Yrs	Cat
52	Wild Cherry *(Prunus avium)*	E/M	F	4.00	4.00	4.50	5.00	3.00	4.50	1	350	4.20	Distorted through suppression of proximity to adjoining Monterey Cypress. Remains vigorous but is of impaired form.	Cleanout review regard retention context.	M	C2
53	Monterey Cypress *(Cupressus macrocarpa)*	M	F	15.00	1.50	5.00	6.00	7.00	6.50	1	993	11.92	Large and dominating specimen of reasonable vigour and vitality. Species predisposition towards mechanical failure in later life must be considered and indeed is noted to have been garden with fracture of lower limb to south east. Suitability of retention will be context dependent.		M	C2
54	Laburnum *(Laburnum anagyroides)*	M	P	4.50	2.00	1.00	1.50	2.00	2.50	1	248	2.98	Primary stem has split rendering remaining tree subject to collapse.	Remove.	N/A	U
55	Sycamore *(Acer pseudoplatanus)*	E/M	F	7.00	1.00	4.50	4.00	4.00	4.00	1	493	5.92	Young and vigorous specimen with immense potential for continued growth over time.		L	B2
56	Domestic Apple *(Malus variety)*	M	F	4.50	1.25	3.00	3.00	3.00	3.00	1	430	5.16	Vigorous but heavily encroached upon by competitive shrubbery.		M	C2
57	Grey Poplar *(Populus canescens)*	S/M	F	10.00	2.00	3.00	3.00	2.00	2.00	1	271	3.25	Young and vigorous with immense potential for continued growth over time.		M	B2
58	Grey Poplar *(Populus canescens)*	S/M	F	8.00	2.50	4.50	2.00	1.50	1.50	1	175	2.10	Young and vigorous but tall and columnar.		M	B2
59	Grey Poplar *(Populus canescens)*	S/M	F	8.00	2.50	3.00	3.00	1.00	4.00	1	175	2.10	Supports pronounced imbalance to north-east.		M	B2
60	Monterey Cypress *(Cupressus macrocarpa)*	M	F	14.00	1.50	6.00	5.50	5.50	5.00	1	939	11.27	Young and still vigorous but is already subject to species typical mechanical failure and collapse with notable elements of mechanical failure to north and south of crown. Is of dubious sustainability.		S	C2

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural condition	Pmr	Yrs	Cat
61	Monterey Cypress *(Cupressus macrocarpa)*	E/M	F/P	9.00	1.00	3.00	6.00	5.00	4.50	1	668	8.02	Heavily distorted and damaged by proximity of adjoining poplar. Would be ill suited for retention, particularly if isolated or exposed.		S	C2
62	Grey Poplar *(Populus canescens)*	M	F	14.00	2.00	10.00	10.00	9.00	9.00	1	1340	15.00	A broad and spreading, multi-stemmed specimen of apparently good vigour and vitality. Mechanical form is impaired and may predispose tree to mechanical failure though such failure has not manifested to date crown support some deadwood that would require cleaning out.	Review regarding retention context.	L	B1-2

Tree Lines and Hedges														
H1	Hedge 1 Hawthorn *(Crataegus monogyna)* Blackthorn *(Prunus spinosa)* Bramble *(Rubus fruticosus)* Ivy *(Hedera helix)*	M	F/P	0.00-3.00	0.00	Spread Discontinuous	m/s	223	2.67	Northern boundary, northern boundary of the site is effectively fenced with vegetation associated with same comprising sporadic individual hawthorns together with Bramble thicket. It would be unrealistic to consider that this boundary supports a true hedge.		M	C2
H2	Hedge 2 Hawthorn *(Crataegus monogyna)* Blackthorn *(Prunus spinosa)* Bramble *(Rubus fruticosus)* Ivy *(Hedera helix)*	M	G	4.00-5.00	0.00	Spread 4.00-6.00m	m/s	223	2.67	A broadly continuous and still vigorous hedge dominated by Hawthorn but seeing the development of elements of Blackthorn. General quality remains good with immense potential for management over time. Hedgerow supports a number of emergent trees including ash and elm however, the Elm population is failing, as a result of Dutch Elm disease.		L	B2

H3	Hedge 3 Hawthorn *(Crataegus monogyna)* Blackthorn *(Prunus spinosa)* Bramble *(Rubus fruticosus)* Ivy *(Hedera helix)* Goat Willow *(Salix caprea)* Wych Elm *(Ulmus glabra)* Holly *(Ilex aquifolium)* Elder *(Sambucus nigra)* Horse Chestnut *(Aesculus hippocastanum)*	M	F	4.00-5.00	0.00	Spread 4.00-6.00m	m/s	223	2.67	By comparison to previous hedge, a low-quality alignment of much more variable form and spread. The original Hawthorn is no longer dominant species with continuity in density being highly variable along the hedge length.		M	C2
H4	Hedge 4 Lonicera Bramble *(Rubus fruticosus)* Elder *(Sambucus nigra)* Ivy *(Hedera helix)*	M	P	1.50-2.50	0.00	Spread 2.00-3.00m	m/s	143	1.72	An unkempt and minimally managed hedge apparently comprising the outer boundary of the adjoining domicile. Hedge exhibits no evidence of recent management on site side or apex. Hedge is substantially outgrown and is becoming heavily suppressed where emergent elder exist.		M	C2
H5	Hedge 5 Hawthorn *(Crataegus monogyna)*	M	F	4.50	0.00	Spread 3.00m	m/s	143	1.72	A short section of hedging from corner to rear façade of house. Remains of reasonable vigour and vitality but is heavily affected by spurious and competitive vegetation including Ivy and Bramble.		M	C2

H6	Hedge 6 Lawson Cypress *(Chamaecyparis lawsoniana)*	E/M	P	8.00	1.00	Spread 5.00-6.00m	1	302	3.63	A short section of cypress hedge presumed installed for screening purposes. Eastern side of hedge is already suffered species typical failure and collapse. Hedge offers limited sustainability through lack of management over time.		S	C2
TG1	Tree Group 1 Leyland Cypress *(Cuppressocyparis leylandii)*	E/M	F/P	16.00	1.50	Spread 10.00-12.00m	1	525	6.30	Presumed have been installed as a hedge, the group is now outgrown already exhibiting evidence of species typical mechanical failure and collapse. The tree group should not be regarded as being sustainable beyond immediate short-term and any retention must appreciate existing and ongoing mechanical failure as illustrative of what is likely to continue over time.		S	C2
TG2	Tree Group 2 Lawson Cypress *(Chamaecyparis lawsoniana)*	E/M	F/P	7.00-8.50	1.00-2.00	Spread 3.00-4.00m	1	271	3.25	An intermittent and variable alignment of trees presumably installed for screening purposes position close to boundary. There is huge variability within the alignment with some specimens suffering chronic suppression and retaining only limited viable canopy. Equally, a small number of specimens remain dominant towards the mid and southern end of the line. Suitability for retention will be context-based and should consider issues of stability should the trees be isolated and exposed.		M	C2
SG	Shrub Groups	Typically including an overgrown and unkempt shrubbery is now beginning to coalesce with many specimens now being considered beyond management or suitability for sustainable retention. Consideration might be given to clearance and replacement planting.										S	C2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Some Tree Locations Are Estimated
This Drawing Must Be Read in Conjunction with the Associated Arboricultural Report
Client: Dynamic Circle Ltd.
Scale: 1:500
Date: February 2020
Project: Tree Survey, Millstown
Townland, Co. Dublin
Description: Tree Constraints Plan
Drawing Title:
D1-TCP-Bulmer-02-20 North-West
Hedge 1
Hedge 2
Hedge 3
Dx-TCP-Bulmer-02-20 North-West 1/1 _ Scale 1:500 @ A1
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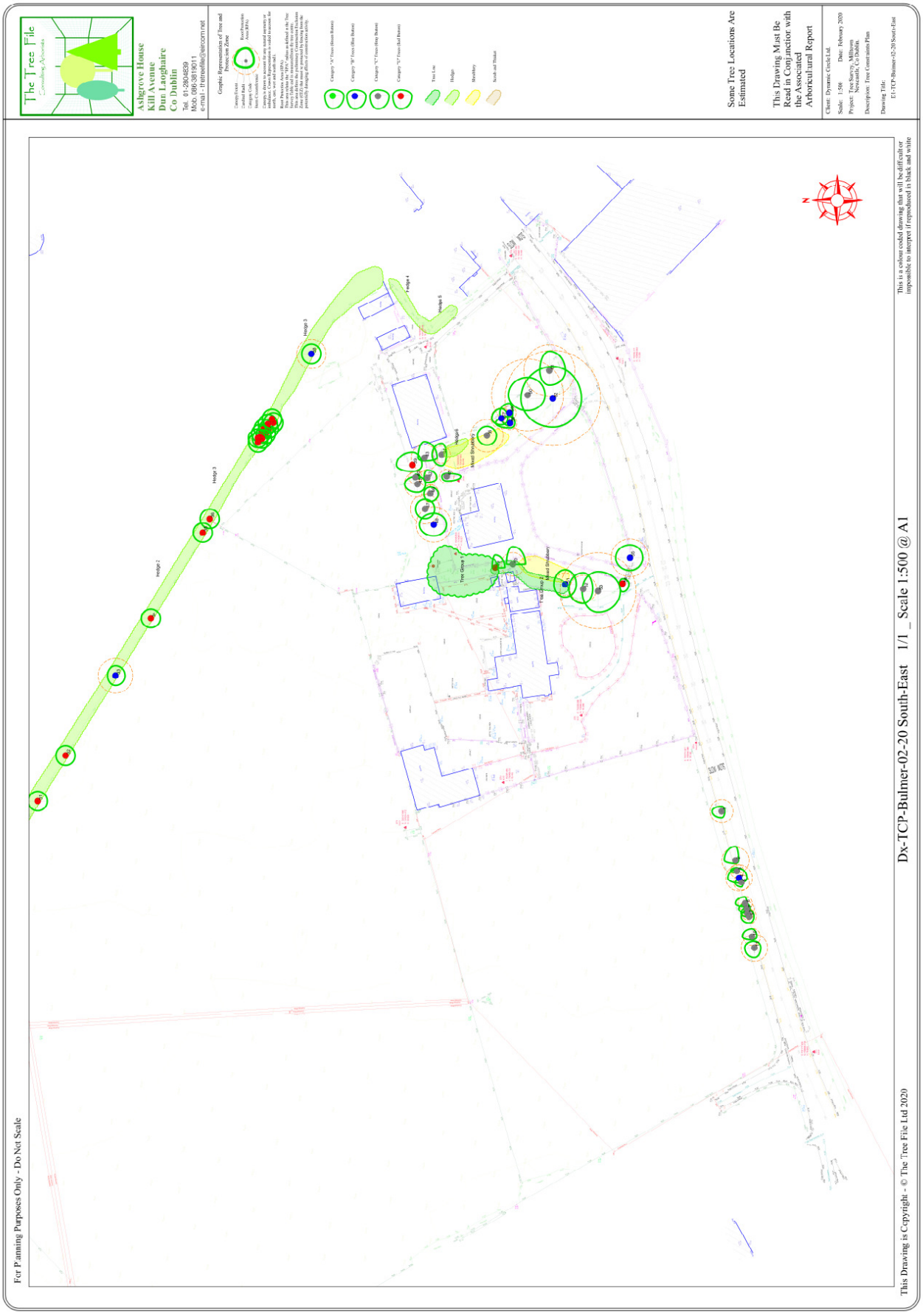
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Some Tree Locations Are Estimated
This Drawing Must Be Read in Conjunction with the Associated Arboricultural Report
Client: Dynamic Circle Ltd.
Scale: 1:500
Date: February 2020
Project: Tree Survey, Milltown
Townland, Co. Meath
Description: Tree Constraints Plan
Drawing Title:
D1-TCP-Bulmer-02-20 South-East
Dx-TCP-Bulmer-02-20 South-East 1/1 _ Scale 1:500 @ A1
This is a colour coded drawing that will be difficult or impossible to interpret if reproduced in black and white
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N
Hedge 2
Hedge 3
Hedge 4
Hedge 5
Hedge 6
Mixed Shrubbery
Tree Group 1
Tree Group 2
Mixed Broadleaf

CHAPTER 12 TRAFFIC AND TRANSPORTATION

Appendix 12.1 Traffic Movement counts

IDASO

Survey Name: 221 19328 EIAR Grangecastle ATC & MCC Data
Site: Site 1
Location: R120/R134 New Nangor Road/R120
Date: Tue 01-Oct-2019

	A => A										A => B									
TIME	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU
07:00	0	0	0	0	0	0	0	0	0	0	2	0	59	0	16	0	2	0	79	80
07:15	0	0	0	0	0	0	0	0	0	0	0	0	69	0	16	2	2	0	89	92.6
07:30	0	0	0	0	0	0	0	0	0	0	0	1	73	0	15	6	3	0	98	104.3
07:45	0	0	0	0	0	0	0	0	0	0	1	0	118	0	13	4	1	0	137	139.5
H/TOT	0	0	0	0	0	0	0	0	0	0	3	1	319	0	60	12	8	0	403	416.4
08:00	0	0	0	0	0	0	0	0	0	0	0	1	112	1	11	3	3	0	131	135.8
08:15	0	0	0	0	0	0	0	0	0	0	1	0	99	1	9	2	0	0	112	112.2
08:30	0	0	0	0	0	0	0	0	0	0	0	0	90	4	9	2	4	0	109	115.2
08:45	0	0	0	0	0	0	0	0	0	0	0	2	117	0	19	1	4	0	143	147.5
H/TOT	0	0	0	0	0	0	0	0	0	0	1	3	418	6	48	8	11	0	495	510.7
09:00	0	0	0	0	0	0	0	0	0	0	0	0	90	2	17	2	3	0	114	118.9
09:15	0	0	0	0	0	0	0	0	0	0	1	0	73	2	9	4	7	0	96	106.3
09:30	0	0	0	0	0	0	0	0	0	0	2	0	35	1	9	2	0	0	49	48.4
09:45	0	0	0	0	0	0	0	0	0	0	0	0	38	0	8	1	2	0	49	52.1
H/TOT	0	0	0	0	0	0	0	0	0	0	3	0	236	5	43	9	12	0	308	325.7
10:00	0	0	0	0	0	0	0	0	0	0	0	0	18	0	9	2	1	0	30	32.3
10:15	0	0	0	0	0	0	0	0	0	0	0	0	22	1	7	7	3	0	40	47.4
10:30	0	0	0	0	0	0	0	0	0	0	0	0	20	0	10	4	5	0	39	47.5
10:45	0	0	0	0	0	0	0	0	0	0	0	0	21	1	9	7	6	0	44	55.3
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	81	2	35	20	15	0	153	182.5
11:00	0	0	0	0	0	0	0	0	0	0	0	0	19	2	7	1	3	0	32	36.4
11:15	0	0	0	0	0	0	0	0	0	0	0	0	20	1	7	2	4	0	34	40.2
11:30	0	0	0	0	0	0	0	0	0	0	0	0	15	1	1	3	1	0	21	23.8
11:45	0	0	0	0	0	0	0	0	0	0	0	0	14	0	7	2	5	0	28	35.5
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	68	4	22	8	13	0	115	135.9
12:00	0	0	0	0	0	0	0	0	0	0	0	0	16	1	11	3	2	0	33	37.1
12:15	0	0	0	0	0	0	0	0	0	0	0	0	20	0	4	1	1	0	26	27.8
12:30	0	0	0	0	0	0	0	0	0	0	0	0	18	3	9	0	0	0	30	30
12:45	0	0	0	0	0	0	0	0	0	0	0	0	16	1	7	2	4	0	30	36.2
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	70	5	31	6	7	0	119	131.1
13:00	0	0	0	0	0	0	0	0	0	0	0	0	18	1	3	2	1	0	25	27.3
13:15	0	0	0	0	0	0	0	0	0	0	0	1	25	0	13	3	3	0	45	49.8
13:30	0	0	0	0	0	0	0	0	0	0	1	0	34	1	7	3	4	0	50	55.9
13:45	0	0	0	0	0	0	0	0	0	0	0	0	35	1	5	1	3	0	45	49.4
H/TOT	0	0	0	0	0	0	0	0	0	0	1	1	112	3	28	9	11	0	165	182.4
14:00	0	0	0	0	0	0	0	0	0	0	1	0	39	2	10	6	3	0	61	67.1
14:15	0	0	0	0	0	0	0	0	0	0	0	0	17	1	9	2	3	1	33	38.9
14:30	0	0	0	0	0	0	0	0	0	0	0	0	17	0	6	2	2	0	27	30.6
14:45	0	0	0	0	0	0	0	0	0	0	0	0	19	1	6	1	7	0	34	43.6
H/TOT	0	0	0	0	0	0	0	0	0	0	1	0	92	4	31	11	15	1	155	180.2
15:00	0	0	0	0	0	0	0	0	0	0	0	0	17	2	8	1	8	0	36	46.9
15:15	0	0	0	0	0	0	0	0	0	0	0	0	14	1	7	1	1	0	24	25.8
15:30	0	0	0	0	0	0	0	0	0	0	0	0	18	0	10	5	1	0	34	37.8
15:45	0	0	0	0	0	0	0	0	0	0	0	0	28	0	2	1	4	0	35	40.7
H/TOT	0	0	0	0	0	0	0	0	0	0	0	0	77	3	27	8	14	0	129	151.2
16:00	0	0	0	0	0	0	0	0	0	0	0	0	16	1	8	4	4	0	33	40.2
16:15	0	0	0	0	0	0	0	0	0	0	0	0	21	1	5	1	1	0	29	30.8
16:30	0	0	0	0	0	0	0	0	0	0	0	0	27	0	4	3	0	0	34	35.5
16:45	0	0	0	0	0	0	0	0	0	0	0	2	11	0	7	1	5	0	26	31.8
H/TOT	0	0	0	0	0	0	0	0	0	0	0	2	75	2	24	9	10	0	122	138.3
17:00	0	0	0	0	0	0	0	0	0	0	0	0	22	0	1	0	3	0	26	29.9
17:15	0	0	0	0	0	0	0	0	0	0	0	0	23	1	3	1	4	0	32	37.7
17:30	0	0	0	0	0	0	0	0	0	0	0	0	18	2	4	0	2	0	26	28.6
17:45	0	0	0	0	0	0	0	0	0	0	1	0	22	1	3	1	5	0	33	39.2
H/TOT	0	0	0	0	0	0	0	0	0	0	1	0	85	4	11	2	14	0	117	135.4
18:00	0	0	0	0	0	0	0	0	0	0	1	0	22	3	3	2	3	0	34	38.1
18:15	0	0	0	0	0	0	0	0	0	0	0	0	20	1	5	4	1	0	31	34.3
18:30	0	0	0	0	0	0	0	0	0	0	0	0	25	2	3	0	3	0	33	36.9
18:45	0	0	0	0	0	0	0	0	0	0	0	0	23	2	2	0	0	0	27	27
H/TOT	0	0	0	0	0	0	0	0	0	0	1	0	90	8	13	6	7	0	125	136.3
12 TOT	0	0	0	0	0	0	0	0	0	0	11	7	1723	46	373	108	137	1	2406	2626.1

IDASO

Survey Name: 221 19328 EIAR Grangecastle ATC & MCC Data
Site: Site 1
Location: R120/R134 New Nangor Road/R120
Date: Tue 01-Oct-2019

A => C										B => A									
P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU
0	0	7	0	2	1	0	0	10	10.5	1	0	15	0	4	4	5	0	29	36.7
1	0	19	0	4	0	0	0	24	23.2	0	0	8	0	3	3	4	0	18	24.7
0	0	21	0	4	0	0	0	25	25	0	0	8	0	4	1	5	0	18	25
0	0	29	0	14	1	0	0	44	44.5	1	0	18	0	3	1	2	0	25	27.3
1	0	76	0	24	2	0	0	103	103.2	2	0	49	0	14	9	16	0	90	113.7
1	0	21	0	3	2	1	0	28	29.5	0	0	16	0	4	1	2	0	23	26.1
0	0	19	0	6	0	0	0	25	25	0	0	11	0	8	1	6	0	26	34.3
1	0	27	1	4	0	0	0	33	32.2	0	0	8	0	6	1	1	0	16	17.8
0	0	27	1	4	0	3	0	35	38.9	0	0	13	1	5	0	3	0	22	25.9
2	0	94	2	17	2	4	0	121	125.6	0	0	48	1	23	3	12	0	87	104.1
0	0	12	0	1	0	1	0	14	15.3	0	0	12	1	3	1	1	0	18	19.8
0	0	22	0	5	1	2	0	30	33.1	0	0	17	1	5	3	3	0	29	34.4
0	0	16	0	5	0	0	0	21	21	0	0	25	1	5	1	5	0	37	44
0	0	27	0	4	1	2	0	34	37.1	0	0	12	0	5	5	5	0	27	36
0	0	77	0	15	2	5	0	99	106.5	0	0	66	3	18	10	14	0	111	134.2
0	0	15	2	2	3	0	0	22	23.5	0	0	11	0	7	2	3	0	23	27.9
0	0	17	0	3	1	0	0	21	21.5	0	0	16	1	7	2	2	0	28	31.6
0	0	15	1	3	3	2	0	24	28.1	0	0	15	0	6	1	2	0	24	27.1
0	0	12	0	3	1	0	0	16	16.5	1	0	16	0	4	1	0	0	22	21.7
0	0	59	3	11	8	2	0	83	89.6	1	0	58	1	24	6	7	0	97	108.3
0	0	7	0	2	2	2	0	13	16.6	0	0	11	1	4	2	2	0	20	23.6
0	0	12	0	8	0	0	0	20	20	0	0	12	0	3	6	1	0	22	26.3
0	0	17	0	4	1	0	0	22	22.5	0	0	22	3	7	3	2	0	37	41.1
0	0	8	0	5	0	1	0	14	15.3	0	0	18	0	7	3	3	0	31	36.4
0	0	44	0	19	3	3	0	69	74.4	0	0	63	4	21	14	8	0	110	127.4
0	0	17	0	2	1	0	0	20	20.5	0	0	13	0	6	0	2	0	21	23.6
0	0	11	0	5	1	0	0	17	17.5	0	0	24	2	8	1	3	0	38	42.4
0	0	13	1	7	2	0	0	23	24	0	1	32	0	3	3	2	0	41	44.5
0	0	16	0	6	1	4	0	27	32.7	0	0	12	3	5	2	1	0	23	25.3
0	0	57	1	20	5	4	0	87	94.7	0	1	81	5	22	6	8	0	123	135.8
0	0	14	0	3	0	1	0	18	19.3	0	1	34	0	2	4	1	0	42	44.7
0	0	9	0	1	2	2	0	14	17.6	0	0	22	0	7	0	1	0	30	31.3
0	0	15	0	8	2	0	0	25	26	0	0	18	1	9	1	1	0	30	31.8
0	0	15	0	9	2	1	0	27	29.3	0	0	14	0	6	2	3	0	25	29.9
0	0	53	0	21	6	4	0	84	92.2	0	1	88	1	24	7	6	0	127	137.7
0	0	8	0	4	0	1	0	13	14.3	0	0	25	0	9	3	4	0	41	47.7
0	0	17	1	4	1	0	0	23	23.5	0	0	24	1	9	3	4	0	41	47.7
0	0	18	1	5	1	2	0	27	30.1	0	0	22	0	7	2	5	0	36	43.5
0	0	21	0	4	0	0	0	25	25	1	0	18	0	4	0	3	0	26	29.1
0	0	64	2	17	2	3	0	88	92.9	1	0	89	1	29	8	16	0	144	168
0	0	15	2	2	2	3	0	24	28.9	0	0	31	1	8	3	2	0	45	49.1
0	0	19	0	4	4	3	0	30	35.9	0	0	28	1	5	1	1	0	36	37.8
0	0	27	0	3	1	0	0	31	31.5	0	0	29	1	6	1	5	0	42	49
0	0	19	1	6	1	1	0	28	29.8	1	1	37	0	10	2	3	0	54	57.5
0	0	80	3	15	8	7	0	113	126.1	1	1	125	3	29	7	11	0	177	193.4
0	0	12	0	8	1	1	0	22	23.8	0	0	47	0	10	2	3	0	62	66.9
0	0	19	0	6	0	2	0	27	29.6	1	1	62	0	9	4	7	0	84	93.7
0	0	26	0	4	1	1	0	32	33.8	1	1	75	0	13	1	0	0	91	90.1
0	0	25	1	5	1	2	0	34	37.1	2	1	63	0	16	2	1	0	85	85.1
0	0	82	1	23	3	6	0	115	124.3	4	3	247	0	48	9	11	0	322	335.8
0	1	17	1	5	3	2	0	29	32.5	1	0	94	0	10	1	3	0	109	112.6
0	1	29	0	5	0	1	0	36	36.7	1	0	97	0	12	0	2	0	112	113.8
0	0	20	1	10	0	1	0	32	33.3	0	0	85	1	12	0	1	0	99	100.3
1	0	25	1	5	1	0	1	34	34.7	1	0	58	1	10	1	0	0	71	70.7
1	2	91	3	25	4	4	1	131	137.2	3	0	334	2	44	2	6	0	391	397.4
0	0	16	1	2	1	0	0	20	20.5	1	1	64	1	8	0	2	0	77	78.2
0	0	20	0	3	0	0	0	23	23	1	0	48	1	8	0	0	0	58	57.2
0	0	18	1	6	0	1	0	26	27.3	0	0	30	0	2	0	0	0	32	32
0	0	23	0	1	0	1	0	25	26.3	1	0	42	0	5	0	0	0	48	47.2
0	0	77	2	12	1	2	0	94	97.1	3	1	184	2	23	0	2	0	215	214.6
4	2	854	17	219	46	44	1	1187	1263.8	15	7	1432	23	319	81	117	0	1994	2170.4

IDASO

Survey Name: 221 19328 EIAR Grangecastle ATC & MCC Data
Site: Site 1
Location: R120/R134 New Nangor Road/R120
Date: Tue 01-Oct-2019

B => B										B => C									
P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU
0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	9	9
0	0	0	0	0	0	0	0	0	0	1	1	13	0	2	1	0	1	19	19.1
0	0	0	0	0	0	0	0	0	0	1	0	22	0	5	0	0	0	28	27.2
0	0	0	0	0	0	0	0	0	0	0	1	24	1	5	0	1	0	32	32.7
0	0	0	0	0	0	0	0	0	0	2	2	68	1	12	1	1	1	88	88
0	0	0	0	0	0	0	0	0	0	0	1	14	1	4	3	0	0	23	23.9
0	0	0	0	0	0	0	0	0	0	1	0	17	0	2	0	1	0	21	21.5
0	0	0	0	0	0	0	0	0	0	2	0	18	1	4	2	0	0	27	26.4
0	0	0	0	0	0	0	0	0	0	0	0	20	0	1	1	0	1	23	24.5
0	0	0	0	0	0	0	0	0	0	3	1	69	2	11	6	1	1	94	96.3
0	0	0	0	0	0	0	0	0	0	0	0	19	2	4	2	1	0	28	30.3
0	0	0	0	0	0	0	0	0	0	0	0	22	1	2	1	0	0	26	26.5
0	0	0	0	0	0	0	0	0	0	0	0	17	1	3	2	1	1	25	28.3
0	0	0	0	0	0	0	0	0	0	0	0	11	0	4	2	1	0	18	20.3
0	0	0	0	0	0	0	0	0	0	0	0	69	4	13	7	3	1	97	105.4
0	0	0	0	0	0	0	0	0	0	0	0	12	0	1	3	0	0	16	17.5
0	0	0	0	0	0	0	0	0	0	0	0	17	0	5	1	1	0	24	25.8
0	0	0	0	0	0	0	0	0	0	0	0	10	0	4	1	1	1	17	19.8
0	0	0	0	0	0	0	0	0	0	0	0	15	0	4	2	1	0	22	24.3
0	0	0	0	0	0	0	0	0	0	0	0	54	0	14	7	3	1	79	87.4
0	0	0	0	0	0	0	0	0	0	0	0	9	0	5	3	1	0	18	20.8
0	0	0	0	0	0	0	0	0	0	0	0	17	0	1	1	0	1	20	21.5
0	0	0	0	0	0	0	0	0	0	0	0	13	0	1	3	0	0	17	18.5
0	0	0	0	0	0	0	0	0	0	0	0	17	1	3	2	0	1	24	26
0	0	0	0	0	0	0	0	0	0	0	0	56	1	10	9	1	2	79	86.8
0	0	0	0	0	0	0	0	0	0	0	0	16	0	2	0	0	0	18	18
0	0	0	0	0	0	0	0	0	0	0	0	10	0	2	1	1	1	15	17.8
0	0	0	0	0	0	0	0	0	0	0	0	17	0	4	1	0	0	22	22.5
0	0	0	0	0	0	0	0	0	0	0	0	18	0	7	1	0	0	26	26.5
0	0	0	0	0	0	0	0	0	0	0	0	61	0	15	3	1	1	81	84.8
0	0	0	0	0	0	0	0	0	0	0	0	15	2	6	7	1	0	31	35.8
0	0	0	0	0	0	0	0	0	0	0	0	22	1	5	1	2	0	31	34.1
0	0	0	0	0	0	0	0	0	0	0	0	24	1	1	3	0	1	30	32.5
0	0	0	0	0	0	0	0	0	0	0	0	18	1	4	5	0	0	28	30.5
0	0	0	0	0	0	0	0	0	0	0	0	79	5	16	16	3	1	120	132.9
0	0	0	0	0	0	0	0	0	0	0	0	23	2	4	0	0	0	29	29
0	0	0	0	0	0	0	0	0	0	0	0	32	1	6	3	2	0	44	48.1
0	0	0	0	0	0	0	0	0	0	0	0	22	0	5	4	2	1	34	39.6
0	0	0	0	0	0	0	0	0	0	0	0	20	1	3	1	0	0	25	25.5
0	0	0	0	0	0	0	0	0	0	0	0	97	4	18	8	4	1	132	142.2
0	0	0	0	0	0	0	0	0	0	0	0	25	1	5	7	1	0	39	43.8
0	0	0	0	0	0	0	0	0	0	0	0	31	3	3	3	0	0	40	41.5
0	0	0	0	0	0	0	0	0	0	0	0	28	0	5	1	0	0	34	34.5
0	0	0	0	0	0	0	0	0	0	0	0	40	2	3	1	3	1	50	55.4
0	0	0	0	0	0	0	0	0	0	0	0	124	6	16	12	4	1	163	175.2
0	0	0	0	0	0	0	0	0	0	0	0	48	2	8	0	1	0	59	60.3
0	0	0	0	0	0	0	0	0	0	1	0	59	1	10	3	1	0	75	77
0	0	0	0	0	0	0	0	0	0	2	0	68	0	12	0	0	0	82	80.4
0	0	0	0	0	0	0	0	0	0	0	0	85	0	9	0	1	1	96	98.3
0	0	0	0	0	0	0	0	0	0	3	0	260	3	39	3	3	1	312	316
0	0	0	0	0	0	0	0	0	0	1	1	73	0	7	0	0	0	82	80.6
0	0	0	0	0	0	0	0	0	0	0	0	74	0	7	0	1	0	82	83.3
0	0	0	0	0	0	0	0	0	0	0	0	66	1	12	0	0	0	79	79
0	0	0	0	0	0	0	0	0	0	0	0	74	2	5	0	1	1	83	85.3
0	0	0	0	0	0	0	0	0	0	1	1	287	3	31	0	2	1	326	328.2
0	0	0	0	0	0	0	0	0	0	0	0	54	0	4	0	0	0	58	58
0	0	0	0	0	0	0	0	0	0	0	1	38	0	12	1	1	0	53	54.2
0	0	0	0	0	0	0	0	0	0	0	0	40	1	4	0	1	0	46	47.3
0	0	0	0	0	0	0	0	0	0	0	0	34	0	7	1	0	1	43	44.5
0	0	0	0	0	0	0	0	0	0	0	1	166	1	27	2	2	1	200	204
0	0	0	0	0	0	0	0	0	0	9	5	1390	30	222	74	28	13	1771	1847.2

IDASO

Survey Name: 221 19328 EIAR Grangecastle ATC & MCC Data
Site: Site 1
Location: R120/R134 New Nangor Road/R120
Date: Tue 01-Oct-2019

C => A										C => B									
P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU	P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU
0	0	8	0	7	5	0	0	20	22.5	0	0	53	0	5	1	2	1	62	66.1
0	0	22	0	6	2	1	0	31	33.3	0	0	118	0	14	2	0	0	134	135
0	0	35	0	6	3	1	1	46	49.8	1	0	138	0	17	5	0	1	162	164.7
0	0	37	0	9	1	0	0	47	47.5	0	0	148	1	16	0	0	0	165	165
0	0	102	0	28	11	2	1	144	153.1	1	0	457	1	52	8	2	2	523	530.8
0	0	54	0	5	0	0	0	59	59	0	0	169	0	25	2	0	1	197	199
0	0	29	0	6	0	0	0	35	35	0	0	134	2	15	3	1	0	155	157.8
1	1	15	0	5	3	1	0	26	27.4	0	1	126	2	8	2	0	0	139	139.4
0	1	10	0	5	3	0	0	19	19.9	0	0	107	0	7	2	0	0	116	117
1	2	108	0	21	6	1	0	139	141.3	0	1	536	4	55	9	1	1	607	613.2
1	0	17	1	3	1	1	0	24	25	0	0	71	1	5	1	3	0	81	85.4
1	0	25	0	4	1	0	0	31	30.7	1	0	80	0	9	2	0	1	93	94.2
0	0	13	0	8	0	2	0	23	25.6	0	0	40	0	7	0	0	0	47	47
0	0	14	1	5	3	1	0	24	26.8	0	0	47	3	5	0	0	0	55	55
2	0	69	2	20	5	4	0	102	108.1	1	0	238	4	26	3	3	1	276	281.6
0	0	19	0	3	0	0	0	22	22	0	0	23	3	4	0	2	2	34	38.6
0	0	17	0	3	3	1	0	24	26.8	0	0	20	0	6	1	1	0	28	29.8
0	0	15	0	4	0	0	0	19	19	0	0	23	0	2	1	1	0	27	28.8
0	0	17	0	4	1	0	0	22	22.5	0	0	22	0	3	1	0	0	26	26.5
0	0	68	0	14	4	1	0	87	90.3	0	0	88	3	15	3	4	2	115	123.7
0	0	10	0	2	3	0	0	15	16.5	0	0	15	0	6	1	1	1	24	26.8
0	0	11	0	1	1	1	0	14	15.8	0	0	11	1	6	2	2	0	22	25.6
0	0	11	0	5	0	2	0	18	20.6	9	0	18	0	2	1	3	0	33	30.2
0	0	11	0	2	2	0	0	15	16	0	1	19	0	1	1	1	0	23	24.2
0	0	43	0	10	6	3	0	62	68.9	9	1	63	1	15	5	7	1	102	106.8
0	0	11	1	3	0	1	0	16	17.3	0	0	9	1	2	1	0	1	14	15.5
1	0	16	0	8	1	0	0	26	25.7	0	0	11	0	2	1	0	0	14	14.5
0	0	17	0	4	3	0	0	24	25.5	0	0	17	0	2	0	2	0	21	23.6
0	0	9	0	2	0	2	0	13	15.6	0	0	18	0	5	0	0	0	23	23
1	0	53	1	17	4	3	0	79	84.1	0	0	55	1	11	2	2	1	72	76.6
0	0	18	1	1	2	1	0	23	25.3	0	0	16	0	4	2	0	1	23	25
0	0	10	0	3	1	2	0	16	19.1	0	0	14	0	6	0	1	0	21	22.3
0	0	11	0	8	0	1	0	20	21.3	0	0	15	0	1	1	0	0	17	17.5
0	0	15	0	4	2	0	0	21	22	0	0	27	2	3	2	0	0	34	35
0	0	54	1	16	5	4	0	80	87.7	0	0	72	2	14	5	1	1	95	99.8
0	1	12	1	5	2	1	0	22	23.7	0	0	14	0	4	0	0	1	19	20
0	0	17	1	2	1	1	0	22	23.8	0	0	13	2	4	0	0	0	19	19
0	0	11	0	2	0	0	0	13	13	0	0	13	1	4	0	0	0	18	18
0	0	17	0	4	2	1	0	24	26.3	0	0	13	1	6	1	0	0	21	21.5
0	1	57	2	13	5	3	0	81	86.8	0	0	53	4	18	1	0	1	77	78.5
0	0	16	0	2	0	1	0	19	20.3	0	0	16	1	1	3	0	1	22	24.5
0	0	19	1	6	1	1	0	28	29.8	0	0	20	3	1	1	1	0	26	27.8
0	0	12	2	7	2	1	0	24	26.3	0	0	15	1	3	1	0	0	20	20.5
0	0	12	0	6	0	0	0	18	18	0	1	18	0	1	0	1	0	21	21.7
0	0	59	3	21	3	3	0	89	94.4	0	1	69	5	6	5	2	1	89	94.5
0	0	24	0	8	0	0	0	32	32	0	0	29	1	2	0	0	0	32	32
1	0	21	0	4	3	1	0	30	32	0	0	21	1	4	0	1	1	28	30.3
0	0	23	0	7	3	0	0	33	34.5	0	2	25	2	4	0	1	0	34	34.1
0	0	15	0	3	0	1	0	19	20.3	0	0	13	1	4	2	1	0	21	23.3
1	0	83	0	22	6	2	0	114	118.8	0	2	88	5	14	2	3	1	115	119.7
1	0	31	1	7	0	1	0	41	41.5	1	0	33	2	3	1	0	0	40	39.7
1	0	26	0	4	1	0	0	32	31.7	0	0	24	0	3	0	0	1	28	29
0	0	23	0	5	0	1	0	29	30.3	0	1	13	1	6	1	0	0	22	21.9
0	0	18	2	5	0	0	0	25	25	0	0	20	2	1	0	0	0	23	23
2	0	98	3	21	1	2	0	127	128.5	1	1	90	5	13	2	0	1	113	113.6
0	0	17	1	1	0	2	0	21	23.6	0	0	13	1	0	0	0	0	14	14
0	0	11	0	5	0	1	0	17	18.3	0	0	13	0	1	0	0	1	15	16
0	0	15	0	2	0	0	0	17	17	0	0	15	0	4	0	1	0	20	21.3
0	0	15	0	3	0	0	0	18	18	0	0	14	0	1	2	0	0	17	18
0	0	58	1	11	0	3	0	73	76.9	0	0	55	1	6	2	1	1	66	69.3
7	3	852	13	214	56	31	1	1177	1238.9	12	6	1864	36	245	47	26	14	2250	2308.1

IDASO

Survey Name: 221 19328 EIAR Grangecastle ATC & MCC Data
Site: Site 1
Location: R120/R134 New Nangor Road/R120
Date: Tue 01-Oct-2019

C => C									
P/C	M/C	CAR	TAXI	LGV	OGV1	OGV2	PSV	TOT	PCU
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	1	1
0	0	1	0	0	0	0	0	1	1
0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	1	1
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	1	1
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	1	0	1	0	0	0	2	2

Appendix 12.2 Bus timetables

A A A

9 47 Like 1 9

68/a

Buses from/to
From Hawkins St. Towards Newcastle / Greenogue Business Park
Operative Date: 20/10/2019
Version: TT 9.1

From Hawkins St. Towards Newcastle / Greenogue Business Park

Sráid Hawkins , Sráid Camden , Bóthar Bulfin , Sráidbhaile Chluain Dolcáin , Bailtíní Choill na Siilní , An Caisleán Nua / Páirc Ghnó Ghrianóige

Buses leave terminus at:

Monday to Friday				Saturday				Sunday			
06:25v	07:30v	08:30	09:30	06:40v	07:50v	08:20	09:30	09:00	10:15	11:30	12:45
10:30	11:30	12:30	13:30	10:30	11:30	12:30	13:30	14:00	15:15	16:30	17:45
14:30v	15:30	16:00a	16:30	14:30v	15:30	16:30	17:30	19:00v	20:15v	21:30v	22:40
17:00a	17:30	18:15a	18:45	18:30	19:30	21:05v	22:20v	23:30			
20:15	21:15v	22:30v	23:30	23:30							

Route Variations
v Via Baldonnell
a To Bulfin Road (Route 68a)

Hawkins St. >> 8mins >> Camden St. >> 12mins >> Bulfin Rd. >> 15mins >> Clondalkin Village >> 10mins >> Cherrywood Villas >> 15mins >> Newcastle / Greenogue Business Park

All times are off peak estimates

From Newcastle / Greenogue Business Park Towards Hawkins St.

An Caisleán Nua / Páirc Ghnó Ghrianóige , Bailtíní Choill na Siilní , Sráidbhaile Chluain Dolcáin , Bóthar Bulfin , Sráid Camden , Sráid Hawkins

Buses leave terminus at:

Monday to Friday				Saturday				Sunday			
06:00	06:30n	07:00	07:45	06:35n	07:10	07:50	09:15v	10:15	11:30	12:45	14:00
08:15a	09:00v	09:15a	10:00	09:45	11:00	12:00	13:00	15:15	16:30	17:45	19:00
11:00	12:00	13:00	14:00	14:00	15:00	16:00v	17:00v	20:15	21:30	22:30	23:45c
15:00	16:00v	17:10v	18:15	18:00	19:00	20:00	21:00	00:25c			
19:15	20:15	21:25	22:25	22:15	23:30	00:15c					
23:35c	00:15c										

Route Variations
v Via Baldonnell
a From Bulfin Road (Route 68a)
n Via Newlands Cross
c To Conyngham Road Garage via Emmet Rd. and Islandbridge

Newcastle / Greenogue Business Park >> 15mins >> Cherrywood Villas >> 10mins >> Clondalkin Village >> 15mins >> Bulfin Rd. >> 12mins >> Camden St. >> 8mins >> Hawkins St.

All times are off peak estimates

Fare Stages

25 75 Hawkins St.		42 58 Monastery Rd. (Castle Park)
26 74 South Great George's St.		43 57 Clondalkin Village
27 73 Aungier St. (Bishop St.)		44 56 Cherrywood Villas
28 72 Kelly's Corner (Camden St.)		45 55 Ongar Rd. (Castlegrange)
29 71 South Circular Rd. (Leonard's Corner)		46 54 Woodlands
30 70 South Circular Rd. (Donore Ave.)		47 53 Nangor Castle
31 69 Dolphin's Barn		48 52 Kilcarbery
32 68 Bulfin Rd.		49 51 Ballbane (Kelly's)
33 67 Naas Rd. (Canal Bridge)		50 50 Leravanagh
34 66 Naas Rd. (Bluebell)		51 49 Milltown Cross / Baldonnel
35 65 Naas Rd. (Robin Hood Rd.)		52 48 Peamount Cottages
36 64 Naas Rd. (Long Mile Rd.)		53 47 Peamount House
37 63 Naas Rd. (Fox and Geese)		54 46 Peamount Cross
38 62 Naas Rd. (John Sisk and Sons)		55 45 Peamount Rd.
39 61 Naas Rd. (Red Cow Inn)		56 44 Sancta Maria
40 60 Naas Rd. (Monastery Corner)		57 43 Newcastle / Greenogue Business Park
41 59 Monastery Rd. (Cluain Mhuire)		

Route Information

Monday to Saturday all buses on Route 68 will operate to and from Greenogue Business Park until 20:00hrs.
Last bus from Hawkins St. to Greenogue will be 18:30hrs and last bus from Greenogue will be 20:00hrs.
On Sunday all buses will operate to and from Newcastle only.

Customer Comment Desk: (01) 8734222
Phone lines open: Monday to Saturday 08:30hrs – 18:00hrs (except public holidays)

18 85 Like 2 52

13

Buses from/to
From Harristown Towards Grange Castle
Operative Date: 24/03/2019
Version: Version TT 9.1

From Harristown Towards Grange Castle

Baile Anraí , An tSráid Mhór Baile Munna , Stáisiún Dhroim Conrach , Sráid Uí Chonaill , Ospidéal San Séamus , Bóthar Thír Chonaill , Bóthar an Náis , Sráidbhaile Chluain Dolcáin , Caislean na Grainsí

Buses leave terminus at:

Route Variations
c To City Centre
v To Cuisine de France

Monday to Friday				Saturday				Sunday			
05:30	06:00v	06:30v	06:45v	06:10	06:30	06:50	07:10	07:00	07:30	08:00	08:30
07:00v	07:10	07:20	07:30v	07:30	07:50	08:10	08:30	09:00	09:30	10:00	10:30
07:40	07:50	08:00	08:10	08:45	09:00	09:15	09:30	11:00	11:20	11:40	12:00
08:20	08:30	08:40	08:50	09:45	10:00	10:15	10:30	12:20	12:40	13:00	13:20
09:00	09:15	09:30	09:45	10:45	11:00	11:15	11:30	13:40	14:00	14:20	14:40
10:00	10:15	10:30	10:45	11:45	12:00	12:15	12:30	15:00	15:20	15:40	16:00
11:00	11:15	11:30	11:45	12:45	13:00	13:15	13:30	16:20	16:40	17:00	17:20
12:00	12:15	12:30	12:45	13:45	14:00	14:15	14:30	17:40	18:00	18:20	18:40
13:00	13:15	13:30	13:45	14:45	15:00	15:15	15:30	19:00	19:20	19:40	20:00
14:00	14:15	14:30	14:45v	15:45	16:00	16:15	16:30	20:20	20:40	21:00	21:20
15:00	15:10	15:20	15:30	16:45	17:00	17:15	17:30	21:40	22:00	22:20	22:40
15:40v	15:50	16:00	16:10	17:45	18:00	18:15	18:30	23:00	23:20c		
16:20	16:30	16:40v	16:50	18:50	19:10	19:30	19:50				
17:00	17:10	17:20v	17:30	20:10	20:30	20:50	21:10				
17:45	18:00	18:15	18:30v	21:30	21:50	22:10	22:30				
18:45	19:00	19:20	19:40	22:50	23:10c	23:30c					
20:00	20:20	20:40	21:00								
21:20	21:40	22:00	22:20								
22:40	23:00	23:20c									

Harristown >> 12mins >> Main St. Ballymun (Ballymun Shopping Centre) >> 9mins >> Drumcondra Rail Station >> 10mins >> O'Connell St. >> 9mins >> St. James's Hospital >> 10mins >> Tyrconnell Rd. (Blacklion) >> 10mins >> Naas Rd. (John Sisk and Sons) >> 12mins >> Clondalkin Village >> 15mins >> Grange Castle

All times are off peak estimates

From Grange Castle Towards Harristown

Caislean na Grainsí , Sráidbhaile Chluain Dolcáin , Bóthar an Náis , Bóthar Thír Chonaill , Ospidéal San Séamus , Sráid Uí Chonaill , Stáisiún Dhroim Conrach , An tSráid Mhór Baile Munna , Baile Anraí

Buses leave terminus at:

Route Variations
c To City Centre
v From Cuisine de France

Monday to Friday				Saturday				Sunday			
06:00	06:15	06:30	06:40	06:10	06:30	06:50	07:10	07:00	07:30	08:00	08:30
06:50	07:00	07:10	07:20	07:30	07:50	08:10	08:30	09:00	09:30	10:00	10:30
07:30	07:40	07:50	08:00v	08:45	09:00	09:15	09:30	11:00	11:20	11:40	12:00
08:10	08:20v	08:30	08:45v	09:45	10:00	10:15	10:30	12:20	12:40	13:00	13:20
09:00	09:15v	09:30	09:45	10:45	11:00	11:15	11:30	13:40	14:00	14:20	14:40
10:00	10:15	10:30	10:45	11:45	12:00	12:15	12:30	15:00	15:20	15:40	16:00
11:00	11:15	11:30	11:45	12:45	13:00	13:15	13:30	16:20	16:40	17:00	17:20
12:00	12:15	12:30	12:45	13:45	14:00	14:15	14:30	17:40	18:00	18:20	18:40
13:00	13:15	13:30	13:45	14:45	15:00	15:15	15:30	19:00	19:20	19:40	20:00
14:00	14:15	14:30	14:45	15:45	16:00	16:15	16:30	20:20	20:40	21:00	21:20
15:00	15:10	15:20	15:30	16:45	17:00	17:15	17:30	21:40	22:00	22:20	22:40
15:40	15:50	16:00	16:10	17:45	18:00	18:15	18:30	23:00c	23:20c		
16:20	16:30	16:40	16:50	18:50	19:10	19:30	19:50				
17:00	17:10	17:20v	17:30	20:10	20:30	20:50	21:10				
17:40	17:50	18:00	18:15v	21:30	21:50	22:10	22:30				
18:30	18:45	19:00	19:20	22:50c	23:10c	23:30c					
19:40v	20:00	20:20	20:40v								
21:00	21:20	21:40	22:00								
22:20	22:40	23:00c	23:20c								

Grange Castle >> 15mins >> Clondalkin Village >> 12mins >> Naas Rd. (John Sisk and Sons) >> 10mins >> Tyrconnell Rd. (Blacklion) >> 10mins >> St. James's Hospital >> 9mins >> O'Connell St. >> 10mins >> Drumcondra Rail Station >> 9mins >> Main St. Ballymun (Ballymun Shopping Centre) >> 12mins >> Harristown

All times are off peak estimates

Fare Stages

86 14 Harristown
85 15 Ballymun Rd.
84 16 Poppintree
83 17 Main St. Ballymun (Ballymun Shopping Centre)
82 18 Ballymun Rd. (Glasnevin Ave.)
81 19 Ballymun Rd. (The Rise)
80 20 Drumcondra Rd. Upr. (Griffith Ave.)
79 21 Drumcondra Rd. Upr. (Clonturk Park)
78 22 Drumcondra Rail Station
77 23 Dorset St. (North Circular Rd.)
76 24 Dorset St. (North Frederick St.)
75 25 O'Connell St.
74 26 Lord Edward St.
73 27 Thomas St. (Francis St.)
72 28 Thomas St. (Watling St.)
71 29 James St. (St. James's Hospital)
70 30 Old Kilmainham (Junction Brookfield Rd.)
69 31 Emmet Rd. (Kilmainham Cross)
68 32 Tyrconnell Rd. (Blacklion)
67 33 Naas Rd. (Canal Bridge)
66 34 Naas Rd. (Bluebell)
65 35 Naas Rd. (Robin Hood Rd.)
64 36 Naas Rd. (Long Mile Rd.)
63 37 Naas Rd. (Fox and Geese)
62 38 Naas Rd. (John Sisk and Sons)
61 39 Naas Rd. (Red Cow Inn)
60 40 Monastery Corner
59 41 Woodford Walk
58 42 Watery Lane (Riversdale)
57 43 Clondalkin Village
56 44 St. Ronan's Church (Junction Oldcastle Drive)
55 45 Grange Castle Business Park

Customer Comment Desk: (01) 8734222
Phone lines open: Monday to Saturday 08:30hrs – 18:00hrs (except public holidays)

8 61 Like 1 19

151

Buses from/to
From Docklands (East Rd.) To Foxborough (Balgaddy Rd.)
Operative Date: 06/09/2015
Version: TT 5.1

Click here to view Route 151 from Hawkins St. towards Foxborough (Balgaddy Rd.)

Click here to view Route 151 from Eden Quay Towards Docklands (East Rd.)

From Docklands (East Rd.) Towards Foxborough (Balgaddy Rd.)

Ceantar na nDugaí (An Bóthar Thoir) , Sráid an Dáma / Cé Urumhan Íochtarach , An Carnán , Bóthar Dhroimeanaigh , An Pháirc Thiar , Baile an tSionnaigh

Buses leave terminus at:

Route Variations
f From Docklands and departs Eden Quay South at 23:30

Monday to Friday				Saturday				Sunday			
06:30	06:50	07:10	07:30	07:10	07:30	07:50	08:10	08:30	09:00	09:30	10:00
07:50	08:05	08:20	08:40	08:30	08:50	09:10	09:30	10:30	11:00	11:30	12:00
09:00	09:20	09:40	10:00	09:50	10:10	10:30	10:50	12:30	13:00	13:30	14:00
10:20	10:40	11:00	11:20	11:10	11:30	11:50	12:10	14:30	15:00	15:30	16:00
11:40	12:00	12:20	12:40	12:30	12:50	13:10	13:30	16:30	17:00	17:30	18:00
13:00	13:20	13:40	14:00	13:50	14:10	14:30	14:50	18:30	19:00	19:30	20:00
14:20	14:40	15:00	15:20	15:10	15:30	15:50	16:10	20:30	21:00	21:30	22:00
15:40	16:00	16:20	16:40	16:30	16:50	17:10	17:30	22:30	23:00	23:20f	
17:00	17:20	17:40	18:00	17:50	18:10	18:30	18:50				
18:20	18:40	19:00	19:30	19:10	19:30	20:00	20:30				
20:00	20:30	21:00	21:30	21:00	21:30	22:00	22:30				
22:00	22:30	23:00	23:20f	23:00	23:20f						

Docklands (East Rd.) >> 10mins >> Dame St. / Ormond Quay >> 15mins >> Dolphin's Barn >> 15mins >> Drimnagh Rd. >> 15mins >> Parkwest >> 15mins >> Foxborough

All times are off peak estimates

From Foxborough (Balgaddy Rd.) Towards Docklands (East Rd.)

Baile an tSionnaigh , An Pháirc Thiar , Bóthar Dhroimeanaigh , An Carnán , Sráid an Dáma / Cé Urumhan Íochtarach , Ceantar na nDugaí (An Bóthar Thoir)

Buses leave terminus at:

Route Variations
t To Eden Quay only

Monday to Friday				Saturday				Sunday			
06:00	06:15	06:30	06:45	06:30	06:50	07:10	07:30	07:30	08:00	08:30	09:00
07:00	07:15	07:30	07:45	07:50	08:10	08:30	08:50	09:30	10:00	10:30	11:00
08:00	08:20	08:40	09:00	09:10	09:30	09:50	10:10	11:30	12:00	12:30	13:00
09:20	09:40	10:00	10:20	10:30	10:50	11:10	11:30	13:25	13:50	14:20	14:50
10:40	11:00	11:20	11:40	11:50	12:10	12:30	12:50	15:20	15:50	16:20	16:50
12:00	12:20	12:40	13:00	13:10	13:30	13:50	14:10	17:20	17:50	18:20	18:50
13:20	13:40	14:00	14:20	14:30	14:50	15:10	15:30	19:10	19:30	20:00	20:30
14:40	15:00	15:20	15:40	15:50	16:10	16:30	16:50	21:00	21:30	22:00	22:30
16:00	16:20	16:40	17:00	17:10	17:30	17:50	18:10	23:00	23:30t		
17:20	17:40	18:00	18:20	18:30	18:50	19:10	19:30				
18:40	19:00	19:30	20:00	20:00	20:30	21:00	21:30				
20:30	21:00	21:30	22:00	22:00	22:30	23:00	23:30t				
22:30	23:00	23:30t									

Foxborough >> 15mins >> Parkwest >> 15mins >> Drimnagh Rd. >> 15mins >> Dolphin's Barn >> 15mins >> Dame St. / Ormond Quay >> 10mins >> Docklands (East Rd.)

All times are off peak estimates

Fare Stages

22 78 Docklands (East Rd.)
23 77 Docklands Rail Station / North Wall Quay
24 76 Eden Quay / Custom House Quay
25 75 Hawkins St. / Eden Quay
26 74 Werburgh St. / Upr. Ormond Quay
27 73 Kevin St. (Patrick St.)
28 72 Cork St. (Ardee St.)
29 71 Cork St. (Donore Ave.)
30 70 Cork St. (Coombe Hospital)
31 69 Dolphin's Barn Cross
32 68 Crumlin Rd. (Loreto Convent)
33 67 Crumlin Rd. (Bangor Drive)
34 66 Crumlin Rd. (Cooley Rd.)
35 65 Drimnagh Rd. (Halfway House)
36 64 Long Mile Rd. (Walkinstown Ave.)
37 63 Long Mile Rd. (Robinhood Park)
38 62 New Nangor Rd. (Jct. Killeen Rd.)
39 61 New Nangor Rd. (Willow Rd.)
40 60 New Nangor Rd. (Oak Rd.)
41 59 New Nangor Rd. (Woodford Walk)
42 58 Nangor Rd. (Michael Collins Park)
43 57 Nangor Rd. (Fonthill Rd.)
44 56 Nangor Rd. (Westbourne)
45 55 Grange Castle Business Park
46 54 Outer Ring Rd.
47 53 Foxborough

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CHAPTER 13 CULTURAL HERITAGE

Appendix 13.1 Record of Monuments and Places

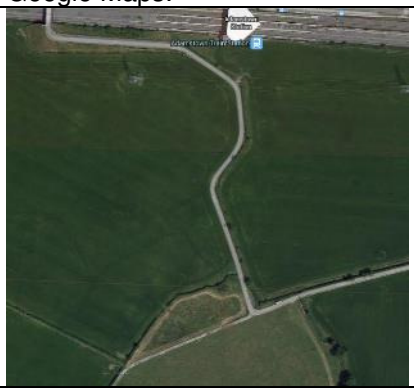
The recorded archaeological sites within c. 2km of the development are listed below, all noted in the Record of Monuments and Places for Co. Dublin.

RMP No.	**DU017-029----**
Townland	ADAMSTOWN (NEWCASTLE BY.)
Site Type	Castle - tower house
NGR	702836, 732705
Description	Located on flat ground between the canal and the railway. A three-storey tower house, which was oblong in plan with a projecting turret and stepped crenellations. Demolished in the 1960s. No visible at ground level (Compiled by: Geraldine Stout, Date of upload: 26 August 2011, Date of last visit: 23 July 1993.
Sources	RMP Healy, P. 1974 Report on Monuments and Sites of Archaeological Interest in County Dublin, p. 22 Ball, F. E. 1906 Parish of Arderrig Part 4, 58-60; Dix, E. R. 1897 The lesser castles of Co. Dublin, in Irish Builder, p. 12.

RMP No.	**DU017-034----**
Townland	GRANGE (NEWCASTLE BY.)
Site Type	Castle - tower house
NGR	703857, 731879
Description	Attached to a farmhouse in flat, low-lying ground. Shown as a castle on the Down Survey (1655-6) map. This is a rectangular tower house with a square tower that's projects to the N in the NE corner. The tower house is three storeys high. The walls are plastered but where stonework is visible it is coursed limestone with roughly dressed quoins. The windows are all later insertions. Entrance is in the N wall through a round-headed doorway. There is a murder hole over the entrance lobby which leads into a vaulted ground floor (int. dims. L 7.08m; Wth.5.2m). Access to stair turret is off the lobby through a round-headed doorway. First floor not accessible. Second floor is accessed through a two-centred arched doorway. There is a garderobe chute in the SE corner which is supported by corbels and entered through a narrow round-headed door to a small circular chamber lit by a single ope. The jambs are hammer-dressed. There is a square stair tower or cap house which rises above parapet level (Healy 1974, 22; Mc Dix 1897, XXXIX, 22). A drawing by Beranger in 1773 shows stepped crenellations at parapet level (Harbison 1998, 168-9). In 1997 monitoring and excavation were undertaken in the vicinity of the castle, in advance of the construction of an access road and the excavation of foul sewers for a Business Park at Grange Castle. A curving ditch was identified orientated north-east/south-west. It was 30m in length, 0.8-0.9m deep, and 1.2-2.4m wide. The upper fills contained charcoal, mortar, flint and animal bones, and were aceramic. A decorated bone comb, stick-pin and knife gave the later ditch phase a terminus ante quem of from the 12th to the 13th century AD. A stone causeway, 0.5-0.6m wide and 0.06-0.1m deep, crossed the ditch. The evidence suggests that extensive early medieval and post-medieval activity survives in this area; the ditches can be interpreted as medieval field boundaries (O'Brien, R. 1998, 26-7). (Compiled by: Geraldine Stout, Date of upload: 26 August 2011, Date of last visit: 03 October 1986)
Sources	RMP Healy, P. 1974 Report on Monuments and Sites of Archaeological Interest in County Dublin, p. 22. Ball, F. E. 1906 Parish of Arderrig Part 4, 65 Dix, E. R. 1897 The lesser castles of Co. Dublin, in Irish Builder, p. 22 Cooper, A. 1780 Down Survey.

RMP No.	**DU017-089**
Townland	COOLSCUDDAN
Site Type	Enclosure
NGR	700632, 732125

Description	This site was first recorded as a positive cropmark in August 1991. Aerial photograph (GB91. EI.21) shows cropmark of a circular enclosure defined by a fosse (Gillian Barrett). Compiled by: Geraldine Stout
Sources	RMP

RMP No.	**DU017-093**
Townland	GOLLIERSTOWN
Site Type	Enclosure
NGR	701891, 732600
Description	A rectilinear enclosure visible as crop marks on an aerial photograph (SMR file; pers. comm. Tom Condit, 11 March 2015).
Sources	RMP Google Maps.
Images	

RMP No.	**DU017-095**
Townland	LOUGHTOWN UPPER
Site Type	Enclosure
NGR	700897, 731252
Description	A sub-circular enclosure visible as a crop mark on an aerial photograph (SMR file; pers. comm. Tom Condit, 11 March 2015).
Sources	RMP Google Maps.
Images	

RMP No.	**DU021-003001**
Townland	KILMACTALWAY
Site Type	Church
NGR	702668, 730092
Description	This medieval parish church is situated at the highest point of a circular walled graveyard surrounded by farmland. There is a bank against the inside of the wall. This is probably an ecclesiastical enclosure(DU021-003003-).The church of Kilmactalway was dedicated to St. Magnenn (Mason 1820, 51, Ronan 1941, 28). In 1366 it was annexed to St. Patrick's Cathedral. In 1615 and 1630 the nave and chancel were returned as in good repair. It was rebuilt (Ball 1906, 66-67). Today the church survives to the eaves, except for the N wall and is built of roughly coursed limestone with hammer dressing on the NE and SE quoins. There is a pronounced base batter on the E wall. The church (int. dims L 16.3m, Wth 5.10m) is entered through a narrow pointed

	doorway in the E end of the S wall. There is a step down to the interior. It is lit by an ogee headed window in the W gable which has a double bellcote and by a two-centred arched window with granite jambs containing bar holes in the S wall. At loft level is a large splayed embrasure for a rectangular window. The most easterly window on the S wall is a rectangular double-light window formed of limestone, probably inserted. The E window is a small round-headed lancet in a deep embrasure with an internal ledge formed of granite and limestone. S of this is a simple square-headed ope. According to D'Alton (1838, 684) there was a baptismal font (DU021-003004-) in the graveyard (DU021-003002-), which is no longer in existence (Ní Mharcaigh 1997, 269-270). Compiled by Geraldine Stout
Sources	RMP

RMP No.	**DU021-003002**
Townland	KILMACTALWAY
Site Type	Graveyard
NGR	702663, 730082
Description	A circular walled graveyard surrounded by farmland. The church of Kilmactalway is located within it (DU021-003001-; see Mason 1820, 51, Ronan 1941, 28). According to D'Alton (1838, 684) there was a baptismal font (DU021-003004-) in the graveyard, which is no longer in existence (Ní Mharcaigh 1997, 269-270). Compiled by Geraldine Stout
Sources	RMP

RMP No.	**DU021-003003-**
Site Type	Ecclesiastical enclosure
Townland	KILMACTALWAY
ITM	702667, 730086
Description	The medieval parish church of Kilmactalway (DU021-003001-) is situated at the highest point of a circular walled graveyard (DU021-003002-) surrounded by farmland. There is a bank revetted against the inside of the wall. This is probably an ecclesiastical enclosure.
Sources	RMP

RMP No.	**DU021-003004-**
Site Type	Font
Townland	KILMACTALWAY
ITM	702669, 730089
Description	According to D'Alton (1838, 684) there was a baptismal font in the graveyard, which is no longer in existence. Ni Mharcaigh 1997, 269-270).
Sources	RMP D'Alton, XX. 1838, XXXX, p. 684 Ni Mharcaigh, X 1997, XXXX, pp. 269-270.

RMP No.	**DU021-004**
Townland	KILBRIDE
Site Type	Castle - unclassified
NGR	703751, 730068
Description	Situated in a narrow valley. There are farm buildings on the site. There is no visible trace above ground (Ball 1906, 66). Compiled by Geraldine Stout
Sources	RMP

RMP No.	**DU021-108**
Townland	BALLYBANE
Site Type	Concentric enclosure
NGR	703060, 730985
Description	Not indicated on any OS map a large concentric enclosure is visible as a crop-mark on an aerial photo. A second enclosure (DU021-109----) is visible to the SW. The area of AH1 contains a recorded concentric enclosure (DU021-108). This site contains subsurface remains of a large double ditched enclosure and the morphology of this monument and its associated ditches suggest it is of possible early medieval

	date. However, 12th to 13th century pottery finds associated with the upper fills of both the internal and external ditch appear to suggest multiple periods of activity. Internal features and deposits within the enclosure are suggestive of settlement evidence. This monument has a diameter of approximately 60m (Stirland 2016, 10).
Sources	RMP Google Maps. Stirland, J. (ACS) 2016 Archaeological testing at Grange Castle South Business Park Ballybane, Clondalkin, Dublin 22 (16E0531).
Images	

RMP No.	**DU021-109**
Townland	BALLYBANE
Site Type	Enclosure
NGR	702937, 730716
Description	Not indicated on any OS map this enclosure is as a crop-mark on an aerial photo. A second larger enclosure (DU021-108----) is visible to the NE. AH5 – the archaeological test trenching confirmed the presence of a single-ditched circular enclosure (DU021-109), 44m in diameter with the ditch measuring 3m wide and 1.6m deep. The general appearance of this features is suggestive of a possible ringfort type enclosure. No internal features were recorded (Stirland 2016, 10).
Sources	RMP Google Maps. Stirland, J. (ACS) 2016 Archaeological testing at Grange Castle South Business Park Ballybane, Clondalkin, Dublin 22 (16E0531).
Images	

RMP No.	**DU021-110**
Townland	KEELOGES
Site Type	Ring-ditch
NGR	700982, 729826
Description	The western of two ring-ditches visible as crop marks on an aerial photograph (SMR file; pers. comm. Ger Dowling, 10 March 2015). See also DU021-111----.
Sources	RMP Google Maps.

Images	

RMP No.	**DU021-111**
Townland	KEELOGES
Site Type	Ring-ditch
NGR	701109, 729783
Description	The eastern of two ring-ditches visible as crop marks on an aerial photograph (SMR file; pers. comm. Ger Dowling, 10 March 2015). See also DU021-110-----.
Sources	RMP Google Maps.
Images	

RMP No.	**DU021-112**
Townland	KLMACTALWAY
Site Type	Enclosure
NGR	702444, 730450
Description	Two concentric enclosures are visible as a crop mark on an aerial photograph (SMR file; pers. comm. Tom Condit, 11 March 2015).
Sources	RMP Google maps.
Images	

Appendix 13.2 Previous excavations

Previously published archaeological excavations in the area from 1969 to 2018 (www.excavations.ie) are summarised below. The following townlands were assessed Adamstown, Ballybane, Blundelstown, Coolscuddan, Gollierstown, Grange (including Grange Castle Business Park), Keeloges, Kilmactalway, Klbride, Loughtown Upper, Milltown and Peamount.

1997:086

NANGOR CASTLE/GRANGE CASTLE, KILMAHUDDRICK
Medieval?
DU 17:34 & 37
97E0116
O045312

Test-trenching was carried out along the line of a proposed road leading northwards from the vicinity of the now-demolished Nangor Castle to Grange Castle, within the area of a proposed industrial park. This was the second phase of testing, the first phase having concentrated on the field to the immediate south of Nangor Castle and its general vicinity.

An intensive geophysical survey had been carried out along the line of the proposed road and several anomalies were identified. This testing specifically examined the areas of anomalies, as agreed on with the relevant authorities within the National Monuments Service. Trenching was carried out by machine, and halted once in situ archaeological deposits were encountered. However, as experienced before, only subsoil-cut features survived-years of ploughing the fairly shallow ploughsoil had completely removed any potential archaeological stratigraphy.

Seven trenches were opened. Of these, only three, all located in Grange Field 3, to the east of Grange Castle, produced any significant archaeology. Two linear features 0.5-0.8m wide, of unknown date and function, ran in a north-south direction. However, their proximity both to the 15th-century castle and to one another could suggest substantial archaeological potential. Some spreads of brown soil had 20th-century pottery inclusions in their upper surface, while other areas, a mix of brown soil and broken slate subsoil, were probably the result of the dragging action of the plough.

This licence was taken over by Richard O'Brien to carry out monitoring and excavation along the line of the road (No. 87 below).

Cia Mc Conway, Archaeological Development Services Ltd, Windsor House, 11 Fairview Strand, Fairview, Dublin 3.

1997:087

GRANGE CASTLE BUSINESS PARK, KILMAHUDDRICK
Medieval
DU 17:34 &:37
97E0116ext.
O045312

Monitoring and excavation were undertaken in advance of the construction of an access road and the excavation of foul sewers for a Business Park at Grange Castle. The excavation work continued until February 1998. Documentary evidence is scarce for Nangor Castle, but it is known that a castle stood on the site in the 16th century. Grange Castle is an upstanding 15th-century tower-house. It is proposed to develop an industrial park in this area.

Previous archaeological assessment by Cia Mc Conway (Excavations 1996, 17, 96E273, and above, No. 86) and geophysical survey by A. Mc Cleary, ADS Ltd, in February 1997 established that the area was archaeologically sensitive.

In advance of construction of a site access road topsoil was stripped from a 24m-wide area by mechanical excavator, under archaeological supervision, for a distance of 480m northwards from the Nangor Road. A further strip, 6m wide and 1300m long, was excavated for the sewers. The full 24m-wide strip was excavated in the field adjacent to Grange Castle.

All archaeological features uncovered had been truncated by deep ploughing, resulting in the removal of all but subsurface features cut into natural boulder clay.

A curving ditch was identified in Field 1; it terminated at Nangor Road, and was orientated north-east/south-west. It was 30m in length, 0.8-0.9m deep, and 1.2-2.4m wide. The eastern terminus continued beyond the limits of the excavation. The upper fills contained charcoal, mortar, flint and animal bones, and were aceramic. A decorated bone comb, stick-pin and knife gave the later ditch phase a terminus ante quem of from the 12th to the 13th century AD.

A stone causeway, 0.5-0.6m wide and 0.06-0.1m deep, crossed the ditch. The existence of this ditch had been shown in Mc Conway's assessment.

Field 7 is located between Grange Castle and the Kilmahuddrick Housing Estate. Two curving ditches were identified in this field. One was found under a post-medieval stone and brick trackway. It was 51m in length and varied in width from 1.1m to 1.4m, and in depth from 0.3m to 0.4m. A stone causeway, 0.6-0.84m wide,

crossed it towards the western side of Field 7. No datable finds came from the primary fills of the ditch, but the secondary fills consisted of charcoal-rich clays with animal bones. It continued beyond the limits of the excavation at its western end.
A second ditch was found 1.6m east of the eastern terminus of the first. No archaeological features or deposits were found in this gap. The second ditch closely resembled the first; it was 22m long, 2m wide and 0.5-0.6m deep. The primary fills were sterile apart from some animal bone. The secondary fills consisted of charcoal-rich clays in which were found animal bones, mortar, two metal knives, and a fragment of worked lignite. An incomplete one-sided decorated bone comb and fragments of another in the upper fills gave a terminus ante quem of the 12th to 13th century AD. This ditch continued beyond the limits of excavation at its eastern end. The evidence from Field 7 suggests that extensive early medieval and post-medieval activity survives in this area; the ditches can be interpreted as medieval field boundaries.
A pit that contained a deposit of iron slag was found in Field 2, north of the site of Nangor Castle; it was associated with post-holes and stake-holes, though no structural pattern could be discerned.
Elsewhere various pits, hearths, furrows and field drains were recorded; some of the hearths may be prehistoric in date.
Richard N. O'Brien, Archaeological Development Services Ltd, Windsor House, 11 Fairview Strand, Fairview, Dublin 3.

2000:0223
GRANGE/KILMAHUDDRICK/NANGOR (GRANGE CASTLE INTERNATIONAL BUSINESS PARK)
Various
SMR n/a
00E0263
O043318
The Grange Castle International Business Park is located to the west of Clondalkin village and incorporates part of the townlands of Grange, Kilmahuddrick, and Nangor. Wyeth Medica Ireland intends to construct a biotechnology campus on this site. The area, of c. 100 acres (40ha), was used for agricultural purposes until recently. The site is bounded to the north by the Grand Canal, to the south by the New Nangor Road, to the east by a new housing estate and land reservation for the proposed Dublin Outer Ring Road (linking the N4 and N7 roads), and to the west by the Grange Castle International Business Park access road.
Two medieval occupation sites are adjacent to the boundary of the Business Park. Grange Castle (SMR 17:34) is a fine late medieval tower-house, while Nangor Castle (SMR 17:37), to the south of the development site, appears to have been demolished during the 1970s. Geophysical survey and excavation were previously carried out by Cia McConway and Richard N. O'Brien (Excavations 1996, 17, 96E0273; Excavations 1997, 26–7, 97E0116). This work revealed that plough-truncated medieval and prehistoric features do survive within the confines of the Business Park.
Archaeological assessment by the writer consisted of the excavation of test-trenches during April and May 2000 in Fields 105, 106, 109, 110 (EIS field reference numbers) and in the northern part of Field 111. This was followed by the test-trenching of anomalies detected through geophysical survey carried out by Geophysical Surveys Bradford (GSB) in Fields 104, 107, 108, 111 (southern part), 112, 113 and 114. This assessment took place during June and July 2000.
A ring-barrow was detected through geophysical survey and follow-up test-trenching in Kilmahuddrick townland (Field 108). The remains of field boundaries were revealed close to this ring-barrow. Approximately 50m to the east of the ring-barrow two cobbled surfaces, a charcoal spread and a series of linear features were revealed (see below No. 225).
Other truncated archaeological features were detected in Field 110 to the south of the Grange Castle tower-house. In the other areas that were tested a number of features were detected, the majority of which can be explained by ploughing or by the presence of spreads of dumped redbrick debris. Much of this redbrick debris appears to have been over-fired and reduced to a vitreous slag. There was no evidence for in situ burning or oxidation of the natural subsoil adjacent to these features. These redbrick features were only detected in Field 112.
To the south of Kilmahuddrick townland, in Nangor townland, several features of archaeological potential were detected. In Field 111 a small, undated, charcoal-rich pit was revealed. This contained a small quantity of cremated bone. In the central part of Field 111 a cluster of small, undated pits and charcoal stains was detected. A trench in the south-eastern corner of the field revealed a large cut into natural, containing 19th/20th-century cultural material. This cut corresponds with the location of an 'Old Gravel Pit' marked on the 1864 1:2500 OS map.
Field 112 is located to the north of Nangor Castle and is adjacent to the Business Park access road. In the south-eastern corner of this field a cluster of cobbled surfaces, pits and gullies, associated with medieval pottery, was revealed. Some 60m to the west of this complex a narrow ditch on a south-east/north-west axis was detected. No cultural material that could date this feature was retrieved (see below No. 226).
Further medieval material was uncovered in Field 113. Here, a trench contained a series of linear ditches directly associated with medieval ceramics (see below No. 226). A short stretch of ditch was also revealed in

the north of Field 113. This length of ditch was undated but contained frequent inclusions of charcoal at the base. The ditch proved difficult to trace, but the location and orientation correspond with an anomaly detected in the geophysical survey carried out by GSB. Trenches excavated in the south-eastern portion of this field revealed a series of concrete yard surfaces and modern buildings associated with recent occupation of Nangor Castle. These remains had been covered over by spoil derived from nearby construction activity in the recent past.
Test-trenching in Field 114, a narrow field immediately north of Nangor Castle, revealed modern ground disturbance to a depth of 1.4m below the ground level. This field appears to have been associated with the Nangor Castle gardens.
None of the areas of archaeological potential have any visible, above-ground, expression. Archaeological features, where detected, were present in a truncated form, cut into subsoil and were only apparent when ploughsoil was removed.
Excavation of the ring-barrow and adjacent features commenced under licence 00E0448, while the medieval remains in Nangor townland were excavated under licence 00E0754. Topsoil-stripping during construction was monitored under licence 00E0718.
Ian W. Doyle, Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower, Glenageary, Co. Dublin.

2000:0224
GRANGE/KILMAHUDDRICK/NANGOR (GRANGE CASTLE INTERNATIONAL BUSINESS PARK)
Monitoring
SMR n/a
00E0718
O043318
Monitoring of topsoil-stripping commenced in early September 2000. In Nangor townland, in the northern part of Field 111, the remains of a small fulacht fiadh were revealed. This consisted of a small pit or trough, a spread of heat-cracked stone and a linear feature to the south-west of the trough.
The pit/trough consisted of a subcircular cut into natural, 0.56m by 1.25m. The cut was steep-sided, leading to a flat base. It was filled with a mix of silt and compact, stony clays.
A spread of heat-shattered sandstone was located some 0.9m to the west of the trough. This spread consisted of a moderately compact, dark grey, sandy clay with frequent inclusions of heat-shattered sandstone fragments, pieces of burnt clay and charcoal. This spread measured 1.92m north–south x 1.18m with a maximum depth of 0.05m.
Approximately 6m to the west of the spread a linear gully feature was revealed. This gully consisted of a cut into natural boulder clay measuring 2.57m north–south x 0.28–0.54m. This had a depth of 0.16m with sharply sloping sides and a flat base. The cut was filled with a moderately compact, mid-brown clay containing frequent pieces of oxidised clay and occasional flecks of charcoal. Infrequent fragments of burnt bone were noted in the fill. Some 4m to the south of the heat-shattered sandstone spread, a small linear gully feature was excavated. This measured c. 1m north-east/south-west x 0.12m with a depth of 0.14m. The fill of this comprised a mid-brown, sandy clay with frequent charcoal flecking. No archaeological objects were recovered.
To the south of the fulacht fiadh, a backfilled field boundary was revealed by topsoil-stripping. The alignment of this boundary possibly corresponds with a similar ditch encountered in Field 113 (see above No. 223). Topsoil-stripping is set to continue in 2001.
Ian W. Doyle, Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower, Glenageary, Co. Dublin.

2000:0225
KILMAHUDDRICK (GRANGE CASTLE INTERNATIONAL BUSINESS PARK)
Ring barrow
SMR n/a
00E0448
304420 231665
The initial detection of this ring-barrow by geophysical survey was confirmed by archaeological assessment under licence 00E0263 (See above No. 223). Excavation commenced in July for a period of eight weeks, during which time the ring-barrow and several adjacent features were excavated.
The ring-barrow was located in Field 108, a large field at the centre of the area designated for the biotechnology campus buildings. The topography is generally level at c. 68m OD. However, the south-eastern corner of the field contains a natural raised area measuring c. 60m east–west x 150m. This area is generally 2m higher than the surrounding topography. The ring-barrow was sited in this slightly elevated position.
The ring-barrow was not visible prior to the geophysical survey or archaeological testing. Following stripping, a dark, circular band of charcoal-rich, black, ditch fill was visible, with a spread of cremated bone in the interior. A series of linear features skirted the eastern side of the ditch. Excavation of the ditch fills revealed a

well-stratified sequence of deposits in a ditch 2.5m wide at the top and 0.25–0.3m wide at the base. The ditch cut had a depth of 1.6m below the level of natural subsoil and measured c. 13m in external diameter. The uppermost fills of the ditch, F4 and F5, contained occasional fragments of burnt bone, charcoal and mollusc shells. Although occasional fragments of burnt bone were recovered from these ditch fills, no coherent or discrete cremation deposits were detected. Fragments of a human skull were recovered from the upper fill. A central fill of mid-brown, silty clay in the ditch sealed a series of stone features. F15 and F16, in the western quadrant, were large limestone blocks resting in the base of the ditch. Charcoal deposits were present on the flat upper surfaces of these stones. Oxidised clay patches against the sides of the ditch, adjacent to these stones, indicate that fires had been lit on these boulders in the ditch.
In the northern quadrant of the ditch, at the base, a stone 'cist-like' structure with a capstone was revealed. This was composed of medium-to-large angular stones leaning inwards at an angle of c. 45o. A large, angular capstone was positioned at the apex of the inward-leaning stones. Several of the stones comprising this small structure were fire-reddened, though there were no indications of in situ burning. When excavated, this structure was empty. Some 2m to the east of this structure, at the base of the ditch, a limestone pillar was revealed. This stood upright to a height of 0.62m and had a width of 0.44m.
Within the circular area enclosed by the barrow ditch, several deposits of cremated bone were visible. A small spread of cremated bone was initially apparent, and this may indicate disturbance. Upon excavation this was found to seal a shallow depression filled with frequent inclusions of powdered cremated bone fragments. To the north-west of this, a pit measuring some 2.1m north–south x 0.6m was revealed. This pit contained occasional fragments of cremated bone and appeared to cut an irregularly shaped cremation pit (F87), which measured 1.3m east–west x 0.5m and had a depth of 0.8–0.9m. The upper fill of this was a hard, compact, grey clay with occasional stones. This fill sealed a layer of cremated bone and charcoal. A sherd of pottery was recovered from this material, the characteristics of which all point to an Early Bronze Age date for its manufacture, specifically a Beaker or Food Vessel background (Anna Brindley, pers. comm.). What appears to be a small black bead was retrieved, during sieving, from this deposit.
Two undated pits were excavated adjacent to the barrow. A series of linear features was also revealed in the area surrounding the ring-barrow. These are interpreted as the remains of field boundaries and were found to enclose the ring-barrow in a subrectangular field system. These remain undated. A geological seam was traced running from the north side of the barrow.
Some 50m to the east of the ring-barrow a trench was reopened in Field 109 to examine features originally detected during assessment 00E0263 (see above No. 223). A northern return of the field system found to enclose the ring-barrow was revealed. This places the ring-barrow in a rectangular enclosure measuring c. 50m east–west x 100m (minimum). A metalled surface was found to seal the field boundary in this trench. While the field boundary system remains undated at the time of writing, it is likely to post-date the ring-barrow. A hearth was also excavated.
Analysis of the soil samples from the ring-barrow has recovered evidence of cereal production. Charred remains of barley, wheat and oats were identified in the ditch fills and cremation deposits. Traces of hazel, haw and sloe were also found. Post-excavation analysis of the human remains, the faunal remains and the charcoal samples is ongoing.
A cluster of ring-barrows is located on the upland area of Saggart Hill and Verschoyles Hill, approximately 6km to the south of the Kilmahuddrick site. Within this group, the Lugg monument complex, which contained a ring-barrow, was excavated by Kilbride-Jones in the late 1930s. The Kilmahuddrick barrow may be a northern element of this distributional cluster, or, alternatively, its presence in a heavily ploughed lowland area may indicate a greater survival rate and higher level of visibility in the upland areas.
Ian W. Doyle, Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower, Glenageary, Co. Dublin.

2000:0226
NANGOR (GRANGE CASTLE INTERNATIONAL BUSINESS PARK)
Medieval field complex
SMR n/a
00E0754
30440 23117
Excavations commenced in this area of the Grange Castle International Business Park in October 2000 and are continuing at the time of writing (January 2001). The site of Nangor Castle (SMR 17:37) is located immediately outside the southern boundary of the Wyeth Medica Ireland biotechnology campus. There are no upstanding remains of Nangor Castle—demolition appears to have happened in the 1970s. Cartographic evidence and test-trenching carried out close to this area (see above No. 223) indicate that a complex of agricultural buildings and concrete surfaces existed in the area. To the west of the Nangor Castle site, mid-19th-century OS maps depict a well-designed garden. The unkempt remains of this garden exist today to the south of the biotechnology campus.
The place name Nangor appears to be of old French origin. In 1307 there is a reference to the tenements of 'Kilbryde and the Naungre', which were held by Walter de Kenley from William, son of John de Galbarry, for a rent of 20 pounds (Mills 1914, 356). Test-trenching carried out by Cia McConway in 1996 at Nangor Castle

revealed at least one substantial ditch and a shallow linear feature to the west of the castle site (Excavations 1996, 17, 96E0273).
The present phase of excavation was designed to resolve any archaeological material in Fields 112 and 113 within the southern boundary of the biotechnology campus. In addition to this, excavation is ongoing to the south of the boundary in a corridor through the Nangor Castle gardens (South Dublin County Council land) to enable a gas pipeline and access road to serve the Wyeth Medica Ireland site.
To date, a complex of intercutting medieval ditches and gullies has been excavated. Some 1500 sherds of locally manufactured medieval pottery (Dublin-type wares, Leinster cooking ware) have been recovered. A complete iron sickle was found in a ditch associated with sherds of medieval pottery. Further details will be provided for Excavations 2001.
Reference
Mills, J. (ed.) 1914 Calendar of the Justiciary Rolls or Proceedings in the Court of the Justiciar of Ireland, Edward I. Part 2. Dublin.
Ian W. Doyle, Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower, Glenageary, Co. Dublin.

2001:427
GRANGE CASTLE INTERNATIONAL BUSINESS PARK, GRANGE AND KISHOGE
Various
SMR n/a
00E0061
204230 232120
Test-trenching was carried out at Grange Castle International Business Park, Clondalkin, Dublin 22, on a site owned by South Dublin County Council, during February 2001. The greater part of this site is currently under development as a business park by Wyeth Medica Ireland.
The assessment was concerned with the area immediately south of the Grand Canal in Grange and Kishoge townlands. It is intended to construct an attenuation lake in this area, which will aid drainage. The lake structure will measure approximately 250m north-west/south-east by 90m. An underground 110kV electricity cable will run through this area and towards the west for a length of approximately 1.5km. The terrain in the areas to be affected is relatively low-lying and the land has been used for agricultural purposes. The centre of the area intended for the attenuation lake was subjected to ground disturbance in the recent past. This disturbance appears to have been associated with the diversion of a stream and ground was stripped to bedrock in places.
Sixteen trenches were opened by mechanical excavator. These were placed in the areas which would be subjected to disturbance by the attenuation lake and the electricity cable way-leave.
Trench 1 was located at the western end of the lake and associated roadway. It revealed a long linear feature cutting natural subsoil. Where sectioned, the cut for this feature, which measured 2.6m east–west by 16.5m with a depth of 0.35m, comprised a sloping-sided flat-bottomed gulley. The upper fill consisted of a moderately compact light brown clay silt with occasional inclusions of mollusc shells and small pebbles. The lower fill comprised a moderately compact grey clay with occasional mollusc shell inclusions. A small undated hearth was revealed in Trench 4, which was also located to the west of the lake.
Trench 13 was opened on the line of the electricity cable way-leave, at a point where a mound and masonry wall were observed in the extreme north-eastern corner of the field. What is likely to be a modern agricultural feature was revealed, comprised of a mound, a stone wall and a metalled surface. This is likely to represent a watering-hole for livestock formed by excavating a depression, placing the upcast to the west into a mound, which was then revetted with a low masonry wall. A metalled surface was then placed at the point of animal access.
Monitoring of topsoil-stripping was recommended and was later carried out (see below, No. 428).
Ian W. Doyle for Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower, Glenageary, Co. Dublin.

2001:428
GRANGE CASTLE INTERNATIONAL BUSINESS PARK, GRANGE/NANGOR/KILMAHUDDRICK
Monitoring
SMR n/a
01E0718
304420 231665
Monitoring continued in the townlands of Grange, Nangor and Kilmahuddrick. Wyeth Medica Ireland commenced construction of a biotechnology campus in this area in September 2000.
The campus area is located west of Clondalkin village and incorporates parts of the townlands of Grange, Kishoge, Kilmahuddrick and Nangor. It is bounded to the north by the Grand Canal, to the south by New Nangor Road, to the east by a new housing estate and reservation for the South Dublin Outer Ring Road and, finally, to the west by the Grange Castle International Business Park access road. The Wyeth Medica Ireland site is approximately 90 acres in extent.

Previously, during 2000, excavation in Kilmahuddrick townland concentrated on a prehistoric ring-barrow, which was resolved in advance of construction (Excavations 2000, No. 225, 00E0448). Monitoring of topsoil-stripping in October 2000 led to the identification and excavation of a small fulacht fiadh in Nangor townland. The monitoring of topsoil-stripping within these townlands continued during January 2001. No additional archaeological material was detected.
Ian W. Doyle for Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower, Glenageary, Co. Dublin.

2001:429
GRANGE CASTLE INTERNATIONAL BUSINESS PARK, GRANGE AND KISHOGE
Post-medieval
SMR n/a
01E0718 ext.
20423 23212
The archaeological assessment carried out in this area during February 2001 (see below, No. 438) recommended that an archaeologist be present to monitor the stripping of topsoil.
The initial recognition of archaeological features was compromised somewhat by the contractor stripping a quantity of topsoil before informing the archaeologist. However, several metalled surfaces, field drains, pits and gullies of post-medieval and modern date were recognised during the stripping when an archaeological presence was maintained.
In Kishoge townland, to the south-west of the area intended for the attenuation lake, the remains of a subrectangular structure, which appears to have burnt down, were detected. This consisted of what appeared to be the remains of slot-trenches cut into natural boulder clay with a fill of oxidised clay and charcoal. The feature measured 5.8m east–west by 4.6m and appeared to have been truncated through intensive ploughing. Access to this area was not available at the time of the assessment owing to dumping and storage of building materials. This area was later excavated by Edmond O'Donovan (see below, No. 438).
Ian W. Doyle for Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower, Glenageary, Co. Dublin.

2001:455
GRANGE CASTLE INTERNATIONAL BUSINESS PARK, NANGOR
Medieval field system
SMR n/a
01E0754
304400 231170
Excavations were carried out in Nangor townland, west of Clondalkin, Dublin 22, during October 2000–January 2001. The excavations revealed a medieval ditch complex. The northern area of the site is presently under development as a biotechnology campus.
Construction of the campus commenced in September 2000. The area excavated in Nangor is south of the construction site and outside the immediate area of impact. No detailed development is presently intended for the greater part of this area. However, additional excavation was undertaken to mitigate the impact of a gas pipeline and associated access road in part of the area formerly occupied by the Nangor Castle gardens. Nangor Castle (RMP 17:37) is located immediately outside the southern boundary of the Wyeth Medica Ireland site. References to a castle at this site date from the 15th–16th centuries. All buildings on the site were demolished during the 1970s, but an area of archaeological potential surrounds the site.
Trench 1, which measured 60m north–south by 33m, was located some 90m to the north-west of the castle site. Geophysical survey and subsequent test-trenching had suggested that the area of Trench 1 held archaeological potential. Excavation in Trench 1 commenced in October 2000 and continued until December 2000. Activity assigned to Phase I in this trench consisted of a linear feature and a pit, both of which cut natural subsoil. These features did not produce pottery or finds. The pit consisted of a rectangular cut into natural subsoil, which contained a series of ash deposits. Areas of oxidised or fire-reddened soil present on the north-east and south-west sides are indicative of in situ burning. This cut was filled with a series of sterile silty layers and dumps of ash.
The Phase I activity was succeeded by a medieval phase of activity which consisted of further linear features, pits and cobbled surfaces. These were assigned to a single general phase which is capable of further subdivision based on stratigraphic grounds. Finds retrieved from the fills of these features include approximately 1000 sherds of Leinster Cooking Ware and Dublin-type wares, and assorted iron finds including nails, an armour-piercing arrowhead, a buckle, a key and an intact iron sickle.
Trench 2, located to the east, detected a similar sequence of linear features, which contained sherds of medieval pottery in their fills. Trench 3, to the south of Trench 1, detected shallow linear features running on an east–west axis. These linear features were succeeded by a pit and a metalled surface, both of which were directly associated with medieval pottery.
Trench 4, located to the west, was excavated to examine a ditch encountered during an earlier assessment. A ditch orientated north-west/south-east with steep sloping sides and a rounded U-shaped base was

revealed. It was 1.05m wide, narrowing to 0.3m at the base, with a maximum depth of 1.1m. Its fill contained occasional fragments of animal bone, from which a radiocarbon date of cal. AD 601–883 was obtained.
Trench 5, located to the south-east of Trench 4, uncovered further medieval linear features. A narrow ditch which ran across the trench on a south-east/north-west axis is likely to represent a continuation of a similar feature encountered in Trench A to the south. A series of post-medieval field boundaries was also detected in Trench 5.
Trench A was excavated to the south of Trench 5 on the line of the gas pipeline and associated roadway. Excavation in this area revealed an undated metalled surface and a series of ditches/gullies. Excavation of these commenced in January 2001. Although there were relatively few finds from these features, their stratigraphic relationship indicates that there were five phases of ditches and gullies in the trench dating from medieval to modern times.
The excavation of Trench B, an extension of Trench A, revealed one feature of interest, a substantial medieval ditch which cut into natural subsoil. This was found in the extreme eastern end of the trench. The ditch ran through Trench B, outside the northern and southern limits of excavation. The cut measured 10m north–south by 2.5m, with a depth of 1.1m as exposed, and had sloping sides and a rounded base. The ditch ran on a north–south axis with a slight curve towards the north-east. In overall plan the ditch appears to have been subcircular, enclosing an area to the east of Trench B. The fills of the ditch comprised black sticky silts with organic content. The lower and upper fills contained medieval pottery. No trace of an enclosing bank was detected in the area opened for examination; however, the depth of overburden, composed of cultivated soils, in this area may be in part composed of a levelled bank.
Trench C to the north-east of Trench B did not detect the ditch. No archaeological material was detected in Trench C, where it was found that modern disturbance had removed the old ground surface.
In total, some 1600 sherds of native medieval pottery were recovered from the Nangor excavations. It is of some interest that only two sherds of imported medieval pottery were recovered. The excavated linear features at Nangor may represent the remains of medieval field boundaries with associated water-management gullies. The presence of such linear features, which can be dated to the medieval period by the presence of Leinster Cooking Ware and Dublin-type wares, argues for land enclosure during the medieval period. That cereal production was the purpose of such enclosures may be suggested by evidence from pollen and macro-plant analysis. The examination of a wide range of medieval samples from the Nangor excavations has shown a predominance of wheat over other plant remains.
Ian W. Doyle for Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower, Glenageary, Co. Dublin.

2002:0448
ADAMSTOWN
No archaeological significance
SMR n/a
01E1147
702819, 732976
Test excavation before the construction of a housing development was carried out in the townland of Adamstown, adjacent to the Newcastle Road, west Dublin. The greenfield site measured c. 200m by 200m. Testing was required because of the proximity of the site to that of Adamstown Castle, SMR 17:29. Seven trenches, 30–50m long, were excavated by mechanical digger. In no trench were finds, features or structures of archaeological significance uncovered.
Georgina Scally, 81 Upper Leeson Street, Dublin 4, for Margaret Gowen & Co. Ltd.

2003:0604
GRANGE
Mill
SMR n/a
03E1210
The site was excavated because it was directly threatened by the realignment of the Griffeen River within the precincts of the Grange Industrial Park. Surface evidence for the mill was in the form of the north wall, surviving as part of the boundary fence separating the Beattie farm from the Grand Canal towpath. Some 19th-century pottery was found on the surface and some fragments of floor tiles from an industrial drying kiln. Testing and subsequent excavation revealed the extent of the building as a single block, 13m west–east by 8.5m. Wall thickness was between 0.8 and 0.9m. The wall structure was of coursed rubble with opes defined by brick dressings. The dressings allowed for the identification of two window opes in the north-east corner of the building. Flanking the main block to the west was a wheel pit, 2.2m in width and 1.6–1.7m in depth. The wheel pit is delimited on the west by a wall 0.85m thick, widening to 1.1m where the axle bearing was mounted. The wheel pit was partially lined with red brick. The upper courses, forming the downslope of the wheel pit, are formed of brick with headers presented, while the lower part of the pit and its base are lined with brick, stretchers presented.

The flanking walls show evidence for wheel wear in the stonework, and this suggests that the wheel had a diameter in the region of 3m. The wheel was breast shot fed from a headrace to the south. The headrace either emanated from a penstock to the south or was linked back to the Griffeen further upstream. There was no evidence for a race in the field south of the mill site. The confluence of the headrace and the wheel pit is again lined with red brick in a rough English bond pattern.
Within the mill structure, the pit for the pit wheel was identified. No machinery was present on the site. Artefacts within the mill structure were largely of 19th-century date, although some sherds of post-medieval imported ware were found in the topsoil but do not appear to be contemporary with the mill. It is possible that the mill has its origin in the later 18th century and served as a gristmill for flour milling. The general water supply would make such a mill difficult to operate. With the inauguration of the Grand Canal, a constant head of water became available and so the mill relocated to the Lock area at Adamstown. It is likely that the machinery was taken from the old mill and tweaked to function within the new mill. The old mill may well have served a later function as a cereal-drying kiln, as suggested by the quantities of kiln tiles found on the northern part of the site.
Red Tobin, Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower, Glenageary, Co. Dublin.

2003:0607
GRANGE CASTLE
Monitoring
DU 17:29, 34 & 37
03E0025
030335 23200
Monitoring of topsoil-stripping for a pharmaceutical plant and associated services located at Grange Castle International Business Park was carried out from 8 January to 2 February 2003. The development consisted of a 20-acre greenfield site, of which c. twelve acres were stripped of topsoil by a mechanical excavator equipped with a toothless bucket. The only subsoil cut features uncovered dated to recent times. These consisted of refuse pits, field drains and areas of burning. The field boundary and watercourse that were revealed had been backfilled in the 19th century. All the finds recovered were either post-medieval or modern in date.
John O'Connor, 2 Walnut Rise, Courtlands, Dublin 9, for Archaeological Development Services Ltd.

2003:1918
GRANGE INTERNATIONAL BUSINESS PARK
No archaeological significance
DU 17:34
03E1846
Monitoring of works took place within the constraint area of Grange Castle, RMP 17:34, at Grange International Business Park, Clondalkin. South Dublin County Council required tat the site be cleared of debris and secured with a fence and ground-beams. The site was being vandalised and used as a dumping ground. A method statement was agreed with the client and with the National Monuments Service. This involved a low-impact solution involving lightweight plant, with the majority of the work being carried out in dry weather to further reduce the surface damage.
The clearance work was carried out without disturbing any archaeological deposits and without the recovery of any artefacts. The fencing required the excavation of a series of holes for the fence posts. These excavations were monitored and no archaeological deposits were disturbed. The ground slab required some excavation but was secured within the depth of the topsoil and remaining debris field. The work has now been completed satisfactorily.
Red Tobin for Margaret Gowen & Co. Ltd, 2 Killiney View, Albert Road Lower, Glenageary, Co. Dublin.

2004:0602
GRANGE INTERNATIONAL BUSINESS PARK, GRANGE
Burnt mounds
SMR n/a
04E0299
Excavations were carried out during works on the Griffeen River realignment, part of ongoing infrastructure works within the precincts of the Grange International Business Park. The works are principally aesthetic in purpose, designed to enhance the appearance of the park and to highlight the river, which otherwise would have flowed behind the Takeda Pharmaceuticals complex. The area stripped will also accommodate the extended road network that will serve the business park when it is fully occupied.
Topsoil-stripping for this realignment commenced in early December 2003 and continued intermittently until May 2004. Topsoil-stripping revealed the locations of three burnt mounds. Of these three features, two were excavated, as the development was likely to have a total impact on them. The third mound was preserved in situ, as it was located outside the development area.

The first mound was excavated between 16 and 18 February 2004 and the second was excavated from 5 April 2004.

Burnt Mound 1, 303279.542 231522.602
During the monitoring of the topsoil removal this site was identified as an irregularly shaped deposit of firing material (heat-shattered stone and blackened soil). The burnt-mound material extended 28m east-west along the northern edge of the stripped corridor and extended to the south by 8m from the northern baulk. The feature lay c. 25m to the west of the Griffeen River on gently undulating pasture sloping to the south. The evidence from initial survey work and subsequent excavation suggests that the main spread of this site remains preserved in situ to the south of this location.
The nature and extent of the mound material was exaggerated by plough action, which had dragged it from its original focal point to extend over 28m in length. After the removal of topsoil, etc., the F2 mound of firing material extended little more than 0.5m from the limit of the excavation. From this southern extremity, the mound rose to the north to a maximum height of 0.65m at the northern limit of the excavation. No cut features were exposed during the excavation.

Burnt Mound 2, 303104.7 231270.2
The realigned Griffeen crosses the course of the old river at two locations. To allow for the excavation of the first of these crossings it was necessary to divert the Griffeen into a third channel. During stripping prior to this channel being dug the second burnt mound was found. During the topsoil removal this site was identified as an irregularly shaped deposit of firing material (heat-shattered stone and blackened soil).
The area of excavation measured 13m east-west by 17.5m. A silted-up streambed abutted the southern part of the mound. The stream appears originally to have flowed from east-north-east to south-west. It had a width of 3-5m, but the length could not be discerned as it extended beyond the limit of excavation. The stream fill contained water-rolled stones, pebbles and a dark-grey silt with a minimum depth of 0.1m. Wood residue, possibly alder, was in evidence here and was probably indicative of remnants of fen woodland. This stream system is likely to have been the reason for siting the burnt mound at this location.
One of the earliest features on the site was a grouping of stake-holes cut into the clayey peat. These formed a semicircular band. All were comparable in shape and size and all contained the same fill. They ranged in depth from 5mm to 2mm with a diameter of 6-12mm. Small amounts of heat-affected pebbles and small stones around the sides of the stake-holes may be evidence for packing material. The function of the complex is not clear. Some stake-holes are vertical, while others have been driven into the ground at an angle. They follow a vague northeast to south-west pattern, but the angled stakes do not appear to offer support to each other or to any possible structure.
The burnt mound was situated on the northern bank of the silted up stream. The bank was steepsided. The main concentration of firing material is in the west. No evidence for a trough was found and the only evidence of activity associated with the burnt mound appears to be the stake-hole complex. The mound measured 11m east-west by 4.5m. It is more likely that the original east-west dimensions were closer to being 6m, with a depth of 0.12-0.25m.
Covering and surrounding the burnt mound was a layer of peat measuring 4.64m from north to south by 14.7m, with a surviving depth of 0.2-0.45m. This was a moist dark-reddish-brown peat of moderate compaction that contained inclusions of sphagnum moss, plants and wood. It was most pronounced to the south of the burnt mound, sloping downwards to the stream. A third burnt mound was recorded during the course of the topsoil-strip. The site was not fully exposed but was identified by a number of concentrations of the characteristic firing material. This site was not impacted on by the development and it was possible to preserve it in situ. It was first sealed using a double layer of geotextile material and then covered by a soil bund forming the boundary between the business park and the pitch-and-putt course.
Red Tobin, Margaret Gowen & Co. Ltd, 27 Merrion Square, Dublin 2.

2005:379
ADAMSTOWN
Urban burial ground
SMR n/a
703029, 732827
05E1295
Human remains were located within the road-take of the Adamstown link road (ALR) at the rear of the old Lucan train station adjacent to the Ascon compound in Adamstown, Dublin. The investigations involved the excavation of human remains uncovered during the course of topsoil-stripping in advance of the construction of the ALR. The excavations entailed the lifting of 36 full or partial skeletons and eight disarticulated skeletons. Two linear features and two deposits were also excavated at the site.
The skeletal remains were primarily orientated in a west–east direction, with heads to the west, but a number were aligned slightly along a south-west/north-east axis and two along a north-west/south-east axis. All were in simple graves, with no traces of any coffins or grave-markers. They appeared to represent 43 adults and

one infant. A single find uncovered with a burial was a fragment of plastic rosary beads found in the pelvic region of Skeleton 10. This find may not suggest a modern date for the burials, as they were disturbed and truncated by the railway wall, which appears to date to the 1950s. It is possible that the rosary beads were interred when the burial was disturbed during the demolition of Lucan station or the construction of the wall that divided the site from the Dublin/Kildare railway line. Removal of the wall and build-up on its southern side revealed that skeletal remains did not extend over the northern side of the existing railway wall.
It is hoped that further post-excavation and osteoarchaeological analysis of the remains will indicate a possible date for the site.
Ellen O'Carroll, The Archaeology Company, 17 Castle Street, Dalkey, Co. Dublin.

2006:581
NEW IAWS HQ, GRANGE CASTLE BUSINESS PARK, CLONDALKIN
No archaeological significance.
SMR n/a
06E1161
30280 23110
The Grange Castle Business Park has witnessed several archaeological investigations since 2000 (O'Donovan 2004; Doyle 2005). These investigations resulted in the discovery and excavation of several prehistoric sites in the area of the Grange Castle Business Park. The Record of Monuments and Places records two castles located within the grounds of Grange Castle Business Park, namely Grange Castle DU(017–134) and Nangor Castle DU(017–037). The new IAWS HQ has an area of 9.3ha and is located at the south-west corner of Grange Castle Business Park, being bordered on the west by the R120 (Lucan road). The site was part of an extensive geophysical survey carried out by Margaret Gowen & Co. Ltd in October 2005, which revealed that the south-west corner of the site had a distinct magnetic disturbance indicative of a spread of material, possibly rubble.
All groundworks associated with the development were monitored during December 2006. The excavation of the site access road resulted in the discovery of a modern pit, a modern linear spread of angular stone, a small spread of red brick mixed with shells and several modern land drains. No features of archaeological significance were encountered during the stripping of topsoil. The programme for the monitored stripping of topsoil at the eastern portion of the site will resume in January 2007.
References
Doyle, I. 2005 Excavation of a prehistoric ring barrow at Kilmahuddrick, Clondalkin, Dublin 22. The Journal of Irish Archaeology 14, 43–75.
O'Donovan, E. 2004 A Neolithic house at Kishoge, Co. Dublin. The Journal of Irish Archaeology 12 and 13, 1–27.
Eoin Sullivan, for Margaret Gowen & Co. Ltd, 27 Merrion Square, Dublin 2.

2006:659
GRANGE CASTLE BUSINESS PARK (GRANGE, MILLTOWN AND CLUTTERLAND)
No archaeological significance
SMR n/a
06E0777
Monitoring of ground-disturbance activities associated with the construction of a link road within Grange Castle Business Park was undertaken in July and August 2006. The link road was constructed in the west of the business park from the Takeda Factory to the Nangor Road; 1250m of single carriageway was constructed parallel to the course of the Griffeen River. The majority of the route of the link road was disturbed by the previous realignment of the Griffeen River (see Red Tobin in Excavations 2003, No. 604, 03E1210). No features or stratigraphy of an archaeological nature were identified.
Emer Dennehy, Margaret Gowen & Co. Ltd, 27 Merrion Square, Dublin 2.

2007:515
GOLLIERSTOWN
No archaeological significance
SMR n/a
07E0671
Testing was carried out in compliance with a planning condition for enabling works to facilitate the construction of the district centre at Adamstown, Lucan, Co. Dublin. The proposed development lands were in use as a compound for the railway development and, as such, the topsoil had been stripped from some of the area. A bridge has also been constructed across the lands at the western side. There are no known monuments in the development lands for the district centre and cartographic research indicates that the development site was always laid out in open fields.
Eleven test-trenches were excavated across the development site with a 1.8m-wide toothless bucket. The stratigraphy consisted of c. 0.2m of topsoil underlying subsoil on to natural stony marly soils.

Nothing of archaeological significance was recorded during the testing.
Ellen O'Carroll, 8 Cumberland Street, Dún Laoghaire, Co. Dublin.

2008:363
GOLLIERSTOWN, ADAMSTOWN
Urban
SMR n/a
08E0197
701516, 732303
An assessment and associated testing were in compliance with a planning condition for the construction of a post-primary school and a community centre. The proposed development is to be located to the south of the SDZ lands and adjoins the railway line. Previous testing was carried out by the author at the adjoining site for the Adamstown District Centre. There are no known monuments in the development lands for the District Centre and cartographic research indicates that the development site was always laid out in open fields.
The proposed development site is located on a brownfield site at the western edges of the Adamstown development. The lands were in use as a compound for the railway development and other developments in the surrounding area and therefore topsoil had been stripped from most of the site. Two large holding tanks at the north-west of the site, a small access road at the south and housing developments to the north-east had already been constructed in the part of the areas proposed for development prior to the author arriving on-site.
Seven test-trenches were excavated across the site with a 1.8m wide toothless bucket. The stratigraphy consisted of c. 0.2–0.4m of topsoil intermixed with debris and overlying subsoil onto natural stony marl soils at the western portion of the site where the proposed community centre is to be located. There was very little topsoil remaining at the eastern end of the development site and the stratigraphy comprised of orange/brown subsoil overlying natural marl subsoil with veins of stone/slate running south-east/north-west across the development lands.
Nothing of archaeological significance was recorded during testing.
Ellen O'Carroll, 8 Cumberland Street, Dun Laoghaire, Co. Dublin.

2013:043
GRANGE/BALLYBANE/NANGOR
Furnace pit (monitoring)
SMR n/a
13E0435
703978. 703391
Monitoring of a proposed central carriageway at Grange Castle Business Park, Co. Dublin was carried out from 1-8 November 2013. Monitoring followed an archaeological appraisal carried out in September 2013 and geophysical survey was previously carried out throughout the entire area of Grange Castle Business Park.
Two features of archaeological interest were identified during monitoring of topsoil stripping in the east of the development area in Nangor townland. These features comprised a small bowl furnace (0.36m x 0.33m x 0.15m) filled with charcoal-rich soil and slag, and a shallow oval pit (0.97m x 0.69m x 0.1m) filled with charcoal, thought to be a charcoal clamp. These features were located approximately 35m apart and may have been associated with each other.
It is anticipated that specialist analyses in the form of charcoal analysis, radiocarbon dating and metallurgical analysis will be carried out on the material retrieved from the features excavated at the site
Courtney Deery Heritage Consultancy, 65 Mountain View Drive, Boghall Road, Bray, Co. Wicklow

2013:196
GRANGE
No archaeology found
SMR n/a
13E0459
Testing was carried out at the site of a proposed biopharmaceutical plant in Grange Castle Industrial Park, Co. Dublin. The entire development site is approximately 11ha in size however the proposed plant will be built on the southern 7.5ha of the site, leaving the northern portion available for future expansion. Only the southern 7.5ha was subject to testing. A total of 15 trenches, measuring 2,585 linear metres, were excavated across the area of proposed development over the course of four days from 9 December 2013. Nothing of archaeological significance was identified during this programme of testing.
Fintan Walsh for IAC Ltd, Unit G1, Network Enterprise Park, Kilcoole, Co. Wicklow

2013:521
GRANGE/BALLYBADE/NANGOR
Iron Age smelting pit and early medieval charcoal clamp
SMR n/a
13E0435
703873, 731566
Archaeological monitoring of a proposed central carriageway at Grange Castle Business Park, Co. Dublin was carried out from 1-8 November 2013 (east of Pfizer Ireland). Monitoring followed an archaeological appraisal carried out in September 2013 and geophysical survey was previously carried out throughout the entire area of Grange Castle Business Park.
Two features of archaeological interest were identified during monitoring of topsoil stripping in the east of the development area in Nangor townland. These features comprised a small bowl furnace (0.36m x 0.33m x 0.15m) filled with charcoal rich soil and slag, and a shallow oval charcoal clamp (0.97m x 0.69m x 0.1m). These features were located approximately 35m apart and it was initially thought that they could have been associated, however the dating evidence has indicated otherwise.
The furnace pit contained 1.26kg of metalworking residues and constituted the base of a typical slag-pit furnace. A sample of oak charcoal from fill C3 of the furnace pit returned a radiocarbon date of 2403+/-30 BP (UBA 25347), which was calibrated to 732-400 BC (2 Sigma) dating this feature to the early Iron Age. This radiocarbon date is one of the earliest to come from an Irish iron smelting context to date (Rondelez, 2014). (ITM 703873E 731566N).
A sample of oak charcoal from fill C7 in the charcoal clamp returned a radiocarbon date of 1256+/-32 BP (UBA 25348). The 2 Sigma calibrated result for this was 671-867 AD dating this deposit to the early medieval period. (ITM 703843E 731580N).
The features discovered at the site have been excavated and “preserved by record” and as such no further mitigation measures are necessary in relation to this development, however future development of the adjacent areas have the potential for further isolated small features to be discovered.
Courtney Deery Heritage Consultancy, Lynwood House, Ballinteer Road, Dublin 16

2015:268
GRANGE CASTLE ACCESS ROAD, GRANGE CASTLE
No archaeology found
SMR n/a
15E0392
An archaeological assessment was undertaken for a site at Grange Castle Access Road, Grange, Dublin 22, on a 2.02 ha site. The site was a green field area within an industrial estate off the Nangor Road. The site of a tower-house (Grange Castle) lies 400m to the south. No archaeological features were recorded in the course of the assessment.
Aidan O’Connell for Archer Heritage Planning Ltd, 8 Beat Centre, Stephenstown, Balbriggan, Co.

2016:049
GOLLIERSTOWN, AUNGIERSTOWN, BALLYBANE
No archaeology found
SMR n/a
15E0551
763222, 730681
MOORE GROUP undertook a programme of archaeological testing at two sites in West Dublin as part of the development of a 220/110 kV Substation in a green field site at Ballybane/Aungierstown and the development of an interface compound at nearby Kishoge, South County Dublin. Earthsound Archaeological Geophysics carried out surveys of the proposed development works at both sites in October 2015 (detection Device no. 15R0116). At the interface site in Kishoge dipolar anomalies detected suggested that the land has been used for the deposition of debris or imported soils, causing the magnetic interference. This interference appeared to be truncated by a number of possible ditches which, it was suggested, relate to underlying features or may be an artefact of the deposition of the debris or imported soils. At Ballybane, the proposed sub-station site, a series of circular and sub-circular trends were detected across the northern survey area. These were interpreted as representing archaeological ditches or geological trends. Testing involving the mechanical excavation of twelve trenches was carried out from 22-24 February 2016 in bright and dry conditions.
Ballybane Site
The proposed substation site was accessed via a new business park access road south of the New Nangor Road (R134). The site consists of an improved tillage field to the north, cut by a ditch to the south. The field was originally subdivided into a smaller sub-triangular plot, the boundary of which has in recent years been cleared away. Due to regular ploughing the site was relatively even underfoot. The test trenches were excavated by a 15-tonne backhoe excavator using a 1.2m-wide ditching bucket. All the test trenches were

deliberately sited to target sub-surface anomalies identified during the geo-physical survey. These anomalies were variously interpreted as possible pits, ditches or relict boundaries. Trench 1 was located in the north-west corner of the site in relativity even ground. The trench measured 24m in length and was dug to an average depth of 0.5m. The topsoil was a rich humic material and the subsoil contained a high inclusion of angular stones. The only notable feature was a drainage channel at the west of the trench and was orientated north to south.
Kishoge Site
The proposed interface compound at Kishoge is located to the south-east of a roundabout at the junction of the R136 and the Ninth Lock Road. The field contains a high voltage tower with power lines overhead; the ground is of rough pasture with evidence of previous infill. This infilling was confirmed by the geophysical results, frequent 'iron spikes' were interpreted as relating to the importation of soils/debris. Three trenches were excavated across this area. Groundworks exposed a disturbed stratigraphy of imported builders' rubble and topsoil that had been dumped on the site. Subsoil, a boulder clay, was exposed at 1m in depth. There were no finds or features of archaeological potential.
Moore Archaeological and Environmental Services Ltd. Corporate House, Ballybrit, Business Park, Ballybrit, Galway.

2016:083
DUB06 DATA CENTRE, GRANGE CASTLE BUSINESS PARK, BALLYBANE
Bronze Age - Early Medieval
SMR n/a
13E0471
The initial excavation comprised extensive test trenches over a large area within Grange Castle Business Park, County Dublin, on behalf of Microsoft Operations (Ireland) Ltd, in advance of a Data Centre complex. Test trenching began in January 2014, confirming the results of a geophysical survey carried out in 2004, identifying a circular enclosure in one portion of the site, known as Area 11, and two burnt mounds in another portion, known as Area 9. The excavation of Area 11 began in May 2014 and additional, associated, enclosures came to light leading to a prolonged excavation continuing on an intermittent basis until January 2016. The excavations in Area 9 took place in July 2014. Monitoring continued elsewhere in lands impacted by the construction works, with the subsequent recovery of more isolated features.
Area 11
The excavation of Area 11 revealed a series of associated enclosures aligned north-south. The earliest enclosure, Site 3, comprised a circular penannular ditch, with a maximum diameter of 48m, and maximum depth of 1m. Finds within the ditch included iron knives, a pair of mismatched quernstones, and a cluster of cow skulls. An upended cow skull, with human femur, provided an AMS date 656-727 and 737-768 CAL AD. The ditch was encircled by the penannular Site 4 ditch, maximum diameter 86m, which also contained cow skulls. Both Site 3 & 4 enclosures shared a south-western entrance way. The Site 4 ditch was preceded by a linear, and more shallow, east-west ditch running across the north end of the site for a distance of 86m. The large D-shaped Site 2 enclosure, 40m x 32m, attached itself to the southern arc of the Site 4 ditch. Much reworked and augmented, the ditch cut through the underlying limestone bedrock to a maximum of 0.9m.
A portion of the old ground surface was recovered within this enclosure as well as the burial of a male and female, within a shallow grave, aligned north-south. Other finds included an articulated sheep or goat within a shallow pit, and a complete horse pelvis and femur.
The smaller Site 1 enclosure comprises two concentric ditches, 14.7m diameter maximum. An occupation surface of redeposited clay set it apart from the larger ritual enclosures, as did the numerous stake-holes, post-holes, and kiln, within the interior. A wattle fence survived in what appears to be a later recut ditch within the enclosure. Much of the clay deposits were characterised by large amounts of charcoal, both in the fills of internal pits, and the ditches. Cremated bone was also recovered, raising the possibility of ritual feasting and / or a funeral pyre being situated here.
A significant feature of the enclosures is the deliberate linking of each ditch to one another. In the case of Sites 3 & 4, a shallow ditch provides the connection. Site 2 was then physically attached to the Site 4 ditch. In the case of Site 1, a ditch emanates from its outer enclosure almost to the lip of the Site 2 ditch.
The burial of two individuals within a shallow grave, the cluster of cow skulls, the deposition of a cow skull with human femur, as well as the insertion of mismatched quernstones, all indicate substantial ritual and ceremonial uses, probably including animal sacrifice. The continuation of pre-Christian rituals is not unprecedented but is stark in view of the nearby presence of Clondalkin monastic settlement.
Several post-1169 medieval ditches ran up to, aligned themselves to the enclosures.
Area 9
Two fulacht fiadh were situated in a waterlogged field. The remains to the west comprised a shallow unlined trough, a well and several pits, including a recut pit indicating a second phase of use, as well as a spread of heat-shattered stones. Finds included fragments of human bone in a deep pit.

Thirty metres to the east, another fulacht fiadh comprised troughs, pits, numerous stake-holes and an elongated gully. The stake-holes, and an associated deep trough, appear to belong to a second phase of use. The findings tend to support the hypothesis of intermittent communal feasting.
Other archaeological sites have since been excavated within the Data Centre complex, although none to the same scale as those described above. They include a Bronze Age structure, and a possible Neolithic structure. A summary will be submitted in due course.
Excavations were also carried out in an adjacent associated site under licence 14E0453 in the townland of Nangor revealing a corn-drying kiln, medieval field boundaries as well as two clusters of cremations pits.
Neil O'Flanagan, Botanic Court, 30-32 Botanic Road, Glasnevin

2016:084
DSF, GRANGE CASTLE BUSINESS PARK
Bronze Age cremation pits & medieval corn-drying kiln
SMR n/a
14E0453
Excavations were carried out on behalf of Sisk & Sons Ltd during the course of 2015-16, yielding a corn-drying kiln, medieval field boundaries, and two clusters of cremation pits.
The kiln was dumbbell shaped, 6.06m in length, 1.4m wide across its flue, and cut to a depth of 0.48m. The fill included clays that appear to have originally formed part of the roofing of the kiln, indicating that the roof collapsed after its use, to be followed by a gradual natural accumulation.
The kiln lay adjacent to a pair of parallel ditches, one of which extended to 38m within the monitored area, with a depth of 0.25m maximum.
Some distance to the south, a cluster of 5 cremation pits came to light, with burnt bone within the pits evident from the surface. The pits were cut to a depth of 0.32m maximum, and a diameter of 0.37m maximum.
Further to the south, another cluster of 4 cremation pits, including a shallow oval-shaped pit, measuring 0.57m in length, and 0.07 in depth, and another circular pit 0.48m in diameter, and 0.14m in depth. Some of the pits appear to have been 'capped', or sealed.
Neil O'Flanagan, Botanic Court, 30-32 Botanic Road, Glasnevin, Dublin 9

2016:094
BALLYBANE AND AUNGIERSTOWN
No archaeology found
250m from 'the zones of notification' for RMP's DU 21:108 & 109
16E0030
Archaeological testing at the site of a proposed substation site at Ballybane and an interface compound at Kishoge, Co. Dublin was undertaken between the 22nd and 24th of February 2016. The test trenches were purposely sited on both sites to provide coverage for the new development and to investigate geophysical anomalies identified in an earlier survey. The trenches exposed a number of modern drainage channels across the site and a natural sterile stratigraphy elsewhere. The anomalies can be accounted for by modern disturbance, drains and geology. There was no evidence for any features of archaeological potential.
Billy Quinn for Moore Archaeological and Environmental Services, 3 Gort na Ri, Athenry, Co. Galway

2016:147
GRANGE CASTLE BUSINESS PARK
Early modern agricultural activity
SMR n/a
15E0394
703773, 732160
Testing and monitoring were carried out at Grange Castle Business Park, Clondalkin, Dublin 22, on behalf of Interxion Ireland in advance of the construction of a new data centre. Testing (followed by monitoring as a extension to the existing licence in January 2016) was required as a condition to grant of planning (SD15A/0034: Condition 11 b) from South Dublin County Council.
The 7 test trenches (totaling 229m) were aligned to investigate a faint geophysical trend (c. 23m in diameter) that was identified during geophysical survey of the site in January 2015. The trenching did not reveal any features of considered archaeological significance but did identify a furrow, some oxidised soil, brick waste and evidence of modern ploughing.
The testing report recommended monitoring of the soil strip – due to the wider archaeological/historical significance of the surrounding landscape and the small percentage of the development's footprint that was assessed through the initial testing.
Monitoring was undertaken over two days in January 2016 and exposed evidence for agriculture (furrows) and land improvement (drains) on the site in the early modern to modern period; isolated spreads of burnt clay, brick and charcoal (which were also frequently contained in the backfill of the agricultural features) indicate contemporary light industrial in the vicinity of the site – the brick inferring such activity may have

been associated with a brickfield/brick firing and/or the demolition of brick buildings. However, no features of considered archaeological significance were recorded. The site was fully reduced to the level of natural subsoil under archaeological supervision.
Denis Shine, Number 1, Brendan Street, Birr, County Offaly

2016:340
BALLYBANE, BALLYMAKAILY, CLUTTERLAND, GRANGE AND MILLTOWN
Post-medieval structure
SMR n/a
16E0520
702670, 731650
The development is intended to improve the standard of the existing carriageway on both the Adamstown Road and Nangor Road, and will provide footpaths, cycle tracks, pedestrian crossing facilities, public lighting and two new signalised junctions. The overall length of the scheme is 2.45km. The excavation of six test trenches located throughout the proposed development area failed to reveal any archaeological features or artefacts.
Test trenching in Milltown townland, immediately west of Adamstown Road, revealed two associated mortar-bonded stone walls. The walls appeared parallel, and were 25m apart, forming the gables of a structure that was orientated north-east/south-west. A concrete floor was continuous throughout the structure at a depth of 0.4m below the existing ground level. A structure is depicted in this location on the First Edition Ordnance Survey map.
Dermot Nelis, 36 Fingal Street, Dublin 8

2016:418
PEAMOUNT-SAGGART TRUNKMAIN PROJECT
No Archaeological Features Uncovered
16E0264
700913, 731250m
As part of the overall Leixlip to Saggart Trunkmain Project it is proposed to construct a c. 7km water pipeline from the existing Peamount to the existing Saggart Reservoir, Co. Dublin, together with extension/upgrading works at the existing reservoirs, all located within the townlands of Loughtown Upper, Milltown, Keeloges, Westmanstown, Blundelstown, Jordanstown, Collegeland, Rathcoole and Saggart. This was subjected to an Archaeological Impact Assessment, which included the results of a limited programme of archaeological testing and monitoring of geotechnical investigations.
A limited programme of testing was undertaken as part of the preparation of the Assessment. This entailed the excavation of two 30m long trenches along the edge of the proposed wayleave corridor nearest monuments DU021-110 and DU021-111, Ring Ditches, Keeloges Td. Nothing of archaeological interest/potential was uncovered. The excavation of a total of 48 Geotechnical Trial Pits and 3 Geotechnical Slit Trenches was monitored. No subsurface features of archaeological interest were noted, although a total of 6 sherds of pottery, five of medieval date, were recovered.
Martin E. Byrne, 7 Cnoc na Greine Square, Kilcullen, Co. Kildare

2016:464
GRANGE CASTLE SOUTH BUSINESS PARK, BALLYBANE
Early medieval/medieval enclosures
DU 21:108 & 109
16E0531
703029, 730829
The areas tested were identified initially from studies of aerial photography and geophysical survey results and a very close correlation between the test trenching results and the results of the geophysical survey was noted.
AH1 represented a recorded concentric enclosure (DU021-108) with an internal ditched enclosure measuring c.50m east to west and 60m north to south and an outer ditched enclosure measuring c.90m in diameter. The test trenching confirmed the presence of extensive and well preserved internal and external ditches measuring 4m wide and 1.80m in depth below the current ground level. Numerous internal features were identified which comprised a group of linear type features and pits all of which are suggestive of domestic activity within the enclosure. The enclosure is likely to represent an early medieval settlement site.
AH2 was located 100m to the south of AH1 and represented a probable circular enclosure measuring 25m in diameter. The test trenching clearly identified the presence of a single – ditched circular enclosure measuring between 20m to 25m in diameter, with the ditch averaging 3m in width. The ditch was present within three test trenches and probably represents a ringfort or similar enclosure.
AH3 was described in the geophysical survey as a negative band of data oriented southwest-northeast and extending into the adjacent field which may represent a former track-way. The test trenching of this feature

recorded two linear parallel ditches both measuring 3m wide by 1.60m deep that appear to form an old abandoned road or track. Both ditches contained old terracotta land drainage pipes suggestive of a relatively modern date for these two features.
AH4 was located in the east of the northern most field and was identified in the geophysical survey as a cluster of isolated responses which may represent a spread of burnt material or cluster of small pits and larger, isolated pit-type features. Archaeological test trenching in this area failed to identify any features of an archaeological nature. The ground was quite disturbed in this part of the site and it would appear to have been subject to test trenching previously.
AH5 represented an enclosure (DU021-109) located in the southern field, measuring c.44m with a probable entranceway in the east. The archaeological test trenching confirmed the presence of a single-ditched circular enclosure, 44m in diameter with the ditch measuring 3m wide and 1.60m deep. The general appearance of this feature is suggestive of a possible ringfort type enclosure. No internal features were recorded.
AH6 represented a circular internal ditched enclosure measuring c. 37m in diameter encompassed by a larger oval-shaped enclosure measuring c.75m x 42m. The test trenching confirmed the presence of the large elongated oval enclosure measuring approximately 75m north-south by 42m east-west with a smaller associated internal enclosure c. 37m in width containing features suggestive of occupation. The external ditch of this enclosure measured on average 2.60m wide and 1.60m deep. The site is likely to represent a multi-phased early medieval settlement site.
AH7 was identified in the geophysical survey as a series of circular and sub-circular trends and five possible pits which may be archaeological or agricultural in origin. The test trenching failed to identify any features of an archaeological nature. A field boundary was recorded containing old terracotta land drainage pipes suggestive of a relatively modern date.
AH8 was identified in the geophysical survey as a series of linear negative magnetic trends which were suggestive of archaeology. The test trenching of this area failed to identify any features of an archaeological nature. A field boundary was recorded containing old terracotta land drainage pipes suggestive of a relatively modern date.
Within Field 1, two sections of a possible linear double ditched type feature were recorded with curving u-shaped termini (AH 9-10). These two parallel ditches may form a linear boundary and one of the ditches was clearly identified by the geophysical survey. An archaeological section excavated through one of these ditches recorded its width as 2.5m and depth as 1.45m in depth. The deposits recorded within this section appear similar to that recorded within area AH1 and contain no modern materials suggestive of modern field boundaries.
The geophysical survey and the results of archaeological test trenching clearly indicate that the site contains significant archaeological remains including four separate enclosure sites, two of which are scheduled for inclusion in the next revision of the Record of Monuments & Places. Although preservation in situ of archaeological remains should always be the preferred option, where such can be accommodated within any proposed development, the present site is located with a partly developed business park and any future development here is likely to extend to the entirety of the two fields resulting in an inevitable impact on all identified archaeological features. Any proposed development of this site should take into account the surviving archaeological remains and where possible the development should be designed to avoid the archaeology.
Jon Stirland Will O'Siorain Robert Breen, Archaeological Consultancy Services Unit, Unit 21 Boyne Business Park, Greenhills, Drogheda, Co Louth

2016:495
GRIFOLS PHASE 2 SITE #B201, GRANGE CASTLE BUSINESS PARK, GRANGE
Testing, monitoring and excavation (Isolated pits)
SMR n/a
13E0459
703500, 731930
Testing (Phase 2) was undertaken within the footprint of a proposed biopharmaceutical plant at Grange Castle Business Park, Nangor Road, Grange, Dublin 22 in 2016. This testing followed from a previous phase (Phase 1) of testing undertaken in the southern half of the development site (2013:196), under an extension to licence 13E0459. A total of 13 test trenches were excavated within the Phase 2 development area.
One archaeological feature (AA 1: a pit filled with charcoal-rich soils) was identified. Subsequent monitoring of the Phase 2 development area in late 2016 identified an additional six archaeological areas (AA 2–7) all of which are individual pits/spreads similar to AA1. These areas were excavated under an extension to 13E0459 in December 2016.
Fintan Walsh, IAC Ltd, Unit G1, Network Enterprise Park, Kilcoole, Co. Wicklow

2016:530
GRANGE CASTLE
Tower-house
DU 17:34
16E0510
703859, 731879
Site investigation works associated with a programme of conservation at Grange Castle, Clondalkin, Dublin 22 (OS Sheet 17) by South Dublin County Council took place in October 2016. IAC Ltd monitored these groundworks.
The original structure of Grange Castle (DU017-034) dates from c. 1580 and has an 18th-century, two-storey addition attached to its western elevation. The overall footprint is 6m x 16m. While the buildings were inhabited until the 1970s, they are now in a state of dilapidation. There is significant build-up of vegetation including tree and shrub growth to the external walls of the castle as well as to the internal floors at ground floor level and at first floor level over a deep arch to the original castle.
Monitoring was carried out in October 2016 and a total of eight pits were excavated. The pits revealed that both the Georgian house and the earlier tower-house possess shallow foundations. Nothing of archaeological significance was identified within the pits surrounding the house and tower-house.
Paul Duffy, IAC Ltd, Unit G1, Network Enterprise Park, Kilcoole, Co. Wicklow

2017:042
BALLYBANE AND MILLTOWN
No archaeology found
SMR n/a
16E0520 ext.
702620, 731140
The development is intended to improve the standard of the existing carriageway on both the Adamstown Road and Nangor Road, and will provide footpaths, cycle tracks, pedestrian crossing facilities, public lighting and two new signalised junctions. The overall length of the scheme is 2.45km. Test trenching in Milltown townland, immediately west of Adamstown Road, in 2016 (Licence No. 16E0520) revealed two associated mortar-bonded stone walls. The walls appeared parallel and were 25m apart, forming the gables of a structure that was orientated north-east/south-west. A concrete floor was continuous throughout the structure at a depth of 0.4m below the existing ground level. A structure is depicted in this location on the First Edition Ordnance Survey map.
Additional test trenching in April 2017 confirmed the structure to be built directly on geologically deposited strata, and no associated or earlier phases of activity were noted. A test trench was also excavated in Ballybane townland in April 2017, and no archaeological features or artefacts were noted.
Dermot Nelis, 36 Fingal Street, Dublin 8

2017:411
BALLYMAKAILY, GRANGE CASTLE BUSINESS PARK
Urban monitoring
SMR n/a
16E0471 ext.
703002, 732209
Testing and monitoring was conducted in advance of a proposed development of a new Data Centre, and associated works, in Ballymakaily Townland, Clondalkin, Dublin 22. The site is in close proximity (800m) to Grange Castle (DU017-034—) as well as a range of other upstanding remains and sub-surface archaeological sites. This archaeological work followed a previous phase of testing undertaken by Finola O'Carroll in 2016 in the southern portion of the site. The licence was extended and transferred in January 2017.
Testing and monitoring were required as a condition of planning (Planning Ref. No. SD16A/0345; South Dublin County Council – Condition 12). Testing of the site was completed by mechanical excavator in February 2017. Seven trenches were positioned to investigate anomalies identified during a previous geophysical survey. Monitoring was also undertaken, under the same licence, in April 2017 in advance of a soil strip associated with the construction works (specifically an attenuation pond). No features of archaeological significance were recorded in either phase of works. However, considering the discovery of archaeological remains in the wider region (including Neolithic Houses, Bronze Age Settlement, Ring-Barrows and an Early Medieval Complex) monitoring was recommended for any and all future works.
Denis Shine, CRDS Ltd, Number 2, Saint Brendan Street, Birr

2017:597
GRANGE
No archaeology found
SMR n/a
17E0257
703293, 731784
Archaeological monitoring and testing were undertaken as a condition of planning prior to the construction of an extension to the existing Takeda Ireland pharmaceutical plant within Grange Castle International Business Park in south Co Dublin. Previous archaeological investigation in the vicinity of the development site exposed a Neolithic house, a Bronze Age ring barrow and numerous fulachta fiadh. Earlier archaeological monitoring and excavation in the vicinity of Grange Castle identified a curving ditch orientated NE/SW with the contents suggesting a date phase of 12th/ 13th century.
The overall site area was approximately 17 hectares and the location of the new production facility as well as lands scheduled for the temporary construction compound and car park were tested in advance of the initial phase of the groundworks. A total of eight test trenches were mechanically excavated. Testing at the site compound and temporary car parking area at the western side of the development site revealed that the area had previously been stripped of topsoil and filled with modern inert material. Monitoring of topsoil removal on the footprint of the production building site exposed the partial remains of a nineteenth century building indicated in the 1st Edition OS map for the area. This survived as a localised spread (2m NS/1.7m EW) of red brick and fragmented limestone. No other features or finds of archaeological or cultural heritage value were exposed during topsoil stripping at the development site.
Margaret McCarthy, Rostellan,Midleton, Co. Cork

2018:458
BALLYBANE/AUNGIERSTOWN AND BALLYBANE/CLONDALKIN
No archaeological significance
DU 21:109
18E0292
703105, 730807
A total of 38 test trenches were excavated, across three areas (Area A, B and C). Trenches 1-7 were located in Area A, the north-east section of the proposed development site, Trenches 8-27 were located in Area B to the west, north-west and sout-hwest of the excavated enclosure site Area 3 (AH5; RMP DU021-109; Licence No. 17E0577) and Trenches 28-35 were located in Area C to the south of Trenches 1-7 within the property boundaries of Erganagh, Kent Cottage, and Weston Lodge.
No significant sub-surface archaeological remains are present within the areas tested. There were no indications that there were any outlying archaeological features relating to either of the two enclosure sites (Area 4–AH5 and Area 4–AH6). The features that were encountered were generally drainage and cultivation features relating to the post-medieval agricultural usage of the lands.
The geophysical anomalies identified in March 2018 that could be directly investigated proved to have no archaeological significance. However, due to constraints on access, it was not possible to excavate all the trenches originally planned in the south-west quadrant of the site, so a number of the geophysical anomalies have not been assessed. There is still a potential that these anomalies could reflect the presence of subsurface archaeological features.
The only feature of potential interest encountered was the wide linear ditch (027) encountered at the south-west end of Trench 29 running parallel to the townland boundary between Ballybane and Aungierstown and Ballybane. This ditch appears to represent the sub-surface remains of the earlier (pre-1900) configuration of this townland boundary. It appears on historic mapping as a double field boundary and possibly an earlier trackway or laneway.
Jean O'Dowd, Rubicon Heritage Services Ltd, Office 8, Dominick Court, No. 41 Dominick Street Lower, Dublin

2018:538
AUNGIERSTOWN, BALLYBANE AND MILLTOWN
Medieval linear features
SMR n/a
18E0484
703050, 730780
Development involved installation of 110kv ducts to facilitate operation of a 220kv substation under construction in the Grange Castle Business Park South site. The scheme measured approximately 550m in length north-west/south-east x 15m in width north/south (maximum), and was located immediately north of an existing north-west/south-east orientated road (Grange Castle South Access Road).
Fieldwork previously carried out on site by Rubicon Heritage revealed two roughly parallel ditches, on average 5m apart, running north-east/south-west within the development area. A small sub-circular deposit

of greyish-brown stony silty clay was also revealed within the area of land take. A rough piece of granite measuring 0.25m x 0.2m x 0.1m was recovered from the surface of this deposit; it contained a single evenly-pecked face suggestive of a grinding surface. A shallow arc on the opposite surface is suggestive of part of a broken central perforation. Pending specialist examination, it was suggested that this is a fragment of a rotary quernstone of uncertain type.

A Method Statement was submitted to facilitate excavation of these known archaeological features, and for test trenching of the remainder of the area of land take.

Excavation of these features has now been completed. A report on the pottery prepared by Clare McCutcheon confirmed that of the 60 sherds recovered from the site, 41 are medieval in date. In addition to the household pottery, three sherds of post-medieval unglazed red earthenware roof tile were recovered, one of which is a fragment of pantile. The fabrics and vessel forms are consistent with other sites in the wider Dublin city area. The medieval glazed ware in particular was very worn with all surfaces reduced by post-depositional wear.

No additional archaeological features or artefacts were revealed as a result of carrying out the monitoring.

Dermot Nelis, 36 Fingal Street, Dublin 8

Appendix 13.3 National Inventory of Architectural Heritage

The recorded archaeological sites within c. 1km of the development are listed below, all noted in the National Inventory of Architectural Heritage (NIAH) for Co. Dublin (www.archaeology.ie).

Peamount, Newcastle, South Dublin County

Reg. No.	**11208003**
Date	1790 - 1810
Previous Name	N/A
Townland	LOUGHTOWN UPPER
County	South Dublin County
Coordinates	301347, 230820
Categories of Special Interest	ARCHITECTURAL ARTISTIC SOCIAL
Rating	Regional
Original Use	country house
In Use As	office

Description

Detached five-bay three-storey former country house, c.1800, now in use as hospital administrative offices. Pedimented central breakfront bay with steps leading to panelled timber door. Pedimented doorcase having pilasters, with Venetian and Diocletian windows over, the latter now containing a clock. Roughcast rendered walls with cut stone dressings. uPVC casement windows. Blank gables with full-height chimney breasts. Rere elevation has advanced bay with arched and Diocletian windows. M-profile slate roof with chimney stacks to gables. Six-bay three-storey laundry extension to north. Multiple modern annexes to west. Commemorative plaque in hallway.

Appraisal

A handsome, substantial former Palladian country house which, though no longer in domestic use, retains its original imposing form and some internal features. Acts as a focal point within the hospital grounds.

Milltown, South Dublin County

Reg. No.	**11208005**
Date	1850 - 1900
Previous Name	N/A
Townland	MILLTOWN (NE. BY.)
County	South Dublin County
Coordinates	302185, 230870
Categories of Special Interest	ARTISTIC SOCIAL TECHNICAL
Rating	Regional
Original Use	gates/railings/walls
In Use As	gates/railings/walls

Description

Pair of cylindrical rendered gate piers, c.1870, of squared limestone with conical cement capping. Five-bar wrought-iron gate with arched bar. Former entrance to farm house beyond, now demolished.

Appraisal

A fine intact example of a type of vernacular gateway peculiar to this area of County Dublin. Preserves the old road line and is now set back from the re-aligned section.

Milltown, South Dublin County

Reg. No.	**11208006**
Date	1840 - 1860
Previous Name	N/A
Townland	MILLTOWN (NE. BY.)
County	South Dublin County
Coordinates	302518, 230958
Categories of Special Interest	ARCHITECTURAL
Rating	Regional

Original Use	outbuilding
In Use As	outbuilding

Description

Detached two-storey farm outbuilding, c.1850, with two-bay gable ends. Rendered walls. Blind wall to street with chamfered corners. Timber sash and casement windows. Corrugated aluminium pitched roof. Adjoining rubble stone walls of demolished outbuildings to south-east and ruinous cottages to north-east.

Appraisal

The chamfered corners of this outbuilding indicate the volume of horse-drawn traffic originally passing into the farm complex. Such buildings following the road line sheltered the farm yard and were a characteristic feature of Irish agriculture. This farm was associated with the now-demolished Milltown House.

Milltown, South Dublin County

Reg. No.	**11208008**
Date	1840 - 1870
Previous Name	N/A
Townland	GRANGE (BA. W BY.)
County	South Dublin County
Coordinates	302752, 231546
Categories of Special Interest	ARCHITECTURAL
Rating	Regional
Original Use	farm house
In Use As	farm house

Description

Detached four-bay two-storey farm house, c.1850. Roughcast rendered walls. uPVC door and casement windows. Replacement pitched slate roof with terracotta ridge tiles and gable coping. Two central brick chimney stacks. Later drip moulding over northern front window. Lean-to extension to the rere, and shed to side.

Appraisal

A tidy detached farm house which retains its original form and an unusually formal front garden, still serving the farm to the rere.

The Manor, Peamount Hospital, Newcastle, South Dublin County

Reg. No.	**11208009**
Date	1800 - 1830
Previous Name	N/A
Townland	LOUGHTOWN UPPER
County	South Dublin County
Coordinates	301355, 230863
Categories of Special Interest	ARCHITECTURAL HISTORICAL SOCIAL
Rating	Regional
Original Use	farm house

Description

Detached three-bay two-storey former farm house, c.1815, now disused. Rendered walls. Glazed timber door with leaded overlight. Recent door opening alongside, now blocked. Timber sash windows. Pitched slate roof with stone ridge tiles, gable coping, and two brick chimney stacks to gable ends. Single-storey extension to rere with pitched slate roof. Single-storey farm outbuilding and two-storey stable building in yard opposite, with rendered walls and pitched slate roofs.

Appraisal

A handsome former farm house with a rich history associated with Peamount House and Hospital. The farm formerly provided food for the hospital, before being used as a library and then workers' accommodation.

Milltown, South Dublin County

Reg. No.	**11208015**
Date	1750 - 1770
Previous Name	N/A
Townland	MILLTOWN (NE. BY.)
County	South Dublin County
Coordinates	302520, 231041

Categories of Special Interest	ARCHITECTURAL
Rating	Regional
Original Use	farm house
In Use As	farm house

Description

Detached four-bay two-storey farm house, c.1760, with attached outbuildings. Rendered rubble stone walls. Glazed timber door in gabled porch. Timber sash windows. Some openings blocked. Possible traces of carriage arch to central bay. Pitched slate roof with two rendered chimney stacks. House possibly originally single-storey. Adjoining outbuildings to north with hayloft, and enlarged openings inserted recently. Partial tubular iron sunburst gate. Original fir tree stand to south.

Appraisal

A fine example of an eighteenth-century farm cottage and barn, demonstrating a classic sequence of vernacular evolution. Retains many period features.

Polly Hop's, Milltown, South Dublin County

Reg. No.	**11208016**
Date	1780 - 1810
Previous Name	N/A
Townland	MILLTOWN (NE. BY.)
County	South Dublin County
Coordinates	302591, 231012
Categories of Special Interest	ARCHITECTURAL SOCIAL
Rating	Regional
Original Use	house
In Use As	public house

Description

Formerly detached four-bay two-storey former house, c.1790, in use as public house. Roughcast rendered walls with parallel render quoins. Timber casement windows. Timber door with iron fittings. Pitched slate roof with single rendered chimney stack. Series of nineteenth- and twentieth-century extensions to south and west.

Appraisal

This site has long been in use as a public house as shown by the extensions surrounding the original modest rural house. Its presence gives a focus to this important and formerly more developed junction.

St Finian's R.C. Church, Peamount Hospital, Newcastle, South Dublin County

Reg. No.	**11208017**
Date	1910 - 1920
Previous Name	N/A
Townland	PEAMOUNT
County	South Dublin County
Coordinates	301221, 230786
Categories of Special Interest	ARCHITECTURAL SOCIAL TECHNICAL
Rating	Regional
Original Use	church/chapel
In Use As	church/chapel

Description

Detached gable-fronted church, c.1915, with two single-storey aisles and full-width porch, added c.1930. Corrugated-iron cladding on a timber frame to walls and roof. Timber casement windows. Plain timber doors. One gable half-timbered, the other having a tripartite window with central statue niche. Simple timber truss roof with iron tie bars to interior.

Appraisal

A distinctive, unusual church, displaying an increasingly rare vernacular use of corrugated iron as a building material. Still in regular use, the church adds charm and character to the hospital grounds.

Peamount Hospital, Newcastle, South Dublin County

Reg. No.	**11208018**
Date	1935 - 1950
Previous Name	N/A
Townland	MILLTOWN (NE. BY.)
County	South Dublin County
Coordinates	301561, 230908

Categories of Special Interest	ARCHITECTURAL SOCIAL TECHNICAL
Rating	Regional
Original Use	church/chapel
In Use As	church/chapel

Description

Detached two-bay single-storey mortuary chapel, c.1945. Roughcast rendered walls with smooth rendered eaves. Narrow openings with original timber sash windows. Timber tongue and groove door. Flat roof with wide eaves.

Appraisal

A simple, virtually intact mortuary chapel, also retaining its original internal features. Discreetly sited in a corner of the hospital grounds.

Peamount Hospital, Newcastle, South Dublin County

Reg. No.	**11208019**
Date	1910 - 1940
Previous Name	N/A
Townland	LOUGHTOWN UPPER
County	South Dublin County
Coordinates	301469, 230833
Categories of Special Interest	TECHNICAL
Rating	Regional
Original Use	tank/silo
In Use As	tank/silo

Description

Cylindrical riveted iron plate oil tank, c.1925. c.3 metres in diameter and 6 metres in length, supported and surrounded by concrete frame. Portal to top accessed by ladder.

Appraisal

A vigorously articulated oil tank, still in use within the hospital grounds. An unusual intact early twentieth-century feature.

Peamount Hospital, Newcastle, South Dublin County

Reg. No.	**11208020**
Date	1910 - 1915
Previous Name	N/A
Townland	LOUGHTOWN UPPER
County	South Dublin County
Coordinates	301326, 230801
Categories of Special Interest	ARCHITECTURAL SOCIAL TECHNICAL
Rating	Regional
Original Use	hospital/infirmary
In Use As	restaurant
Additional Use	shop/retail outlet

Description

Single-storey double-gable-fronted pavilion, c.1912, with attached ancillary buildings. Now in use as a dining hall. Timber frame with timber clapboard walls. Full-width glazed timber veranda to front. Timber casement windows. M-profile felt roof. Southern wall now roughcast rendered with uPVC casement windows.

Appraisal

This dining hall and shop preserve the form and many materials of the original temporary timber pavilions. Built as a disease control measure by the TB sanatorium, they are a valuable reminder of this phase of the history of the estate.

St Luke's C. of I. Church, Peamount Hospital, Newcastle, South Dublin County

Reg. No.	**11208021**
Date	1910 - 1920
Previous Name	N/A
Townland	LOUGHTOWN UPPER
County	South Dublin County

Coordinates	301241, 230871
Categories of Special Interest	ARCHITECTURAL ARTISTIC SOCIAL TECHNICAL
Rating	Regional
Original Use	church/chapel
In Use As	library/archive

Description

Detached four-bay gable-fronted former church, c.1915, in use as hospital records store. Timber framed and clad in corrugated-iron sheets throughout. Timber casement windows with decorative surrounds. Pitched roof with a single vent on each pitch.

Appraisal

A charming, distinctive building which, though no longer in religious use, retains the form and features of its former function. A good example of the use of corrugated iron in a vernacular manner.

Appendix 13.4 Archaeological figures

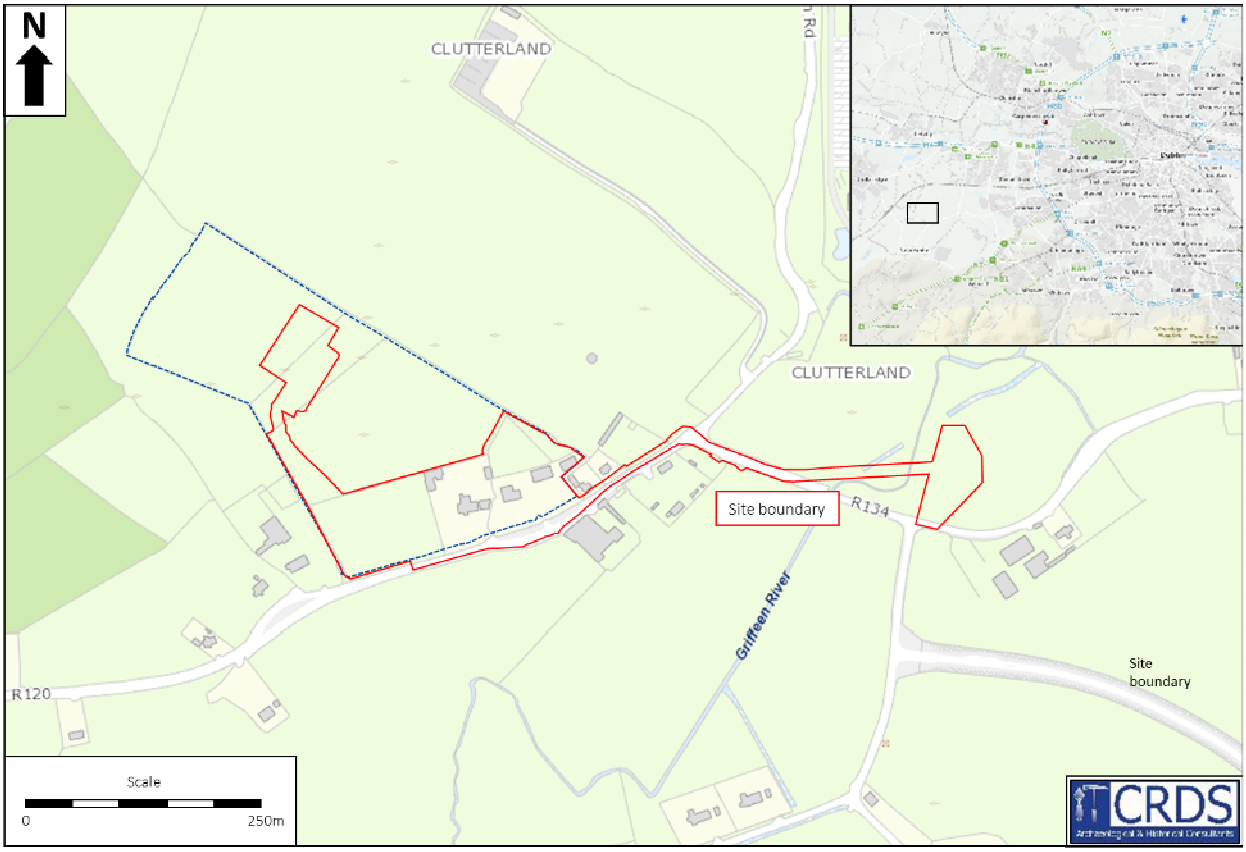


Figure 1. Location of proposed development

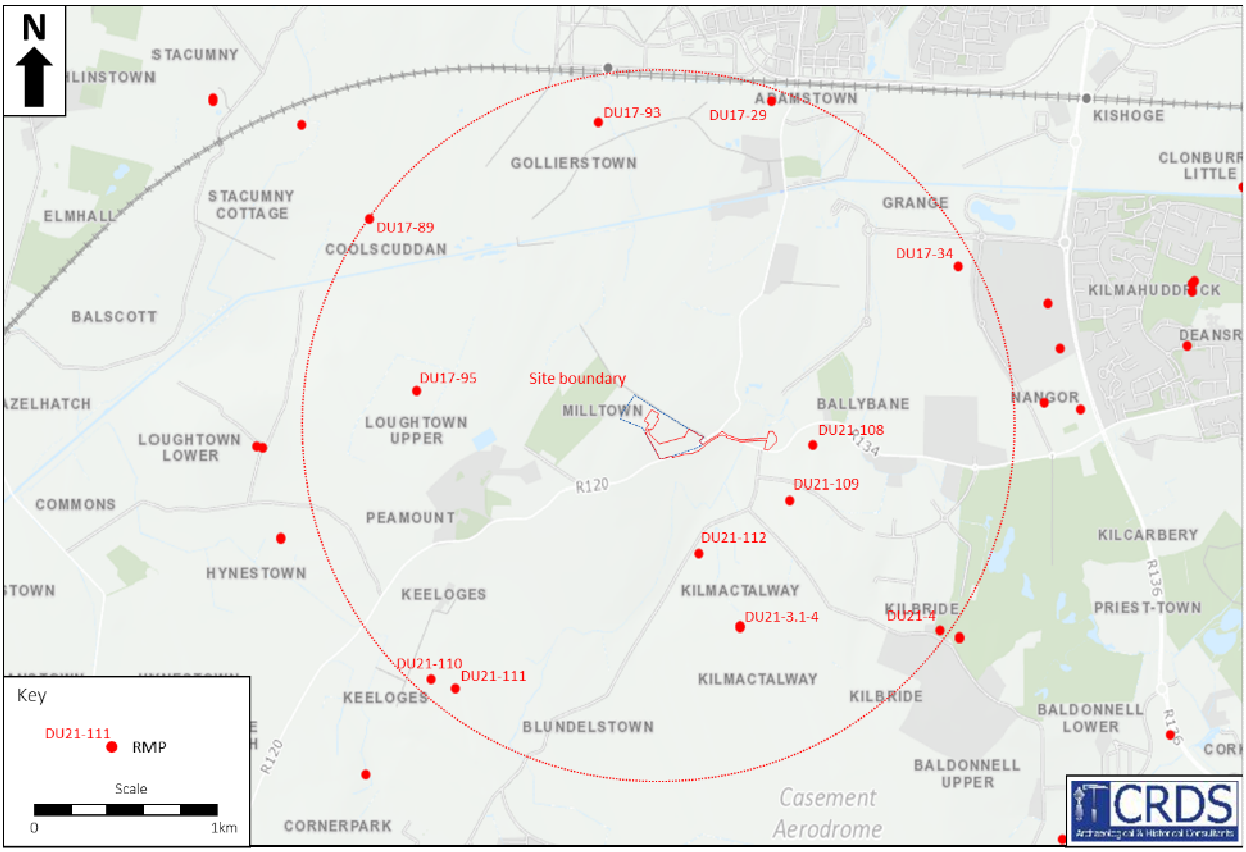


Figure 2. Recorded archaeological sites within the vicinity of the proposed development (source www.archaeology.ie)

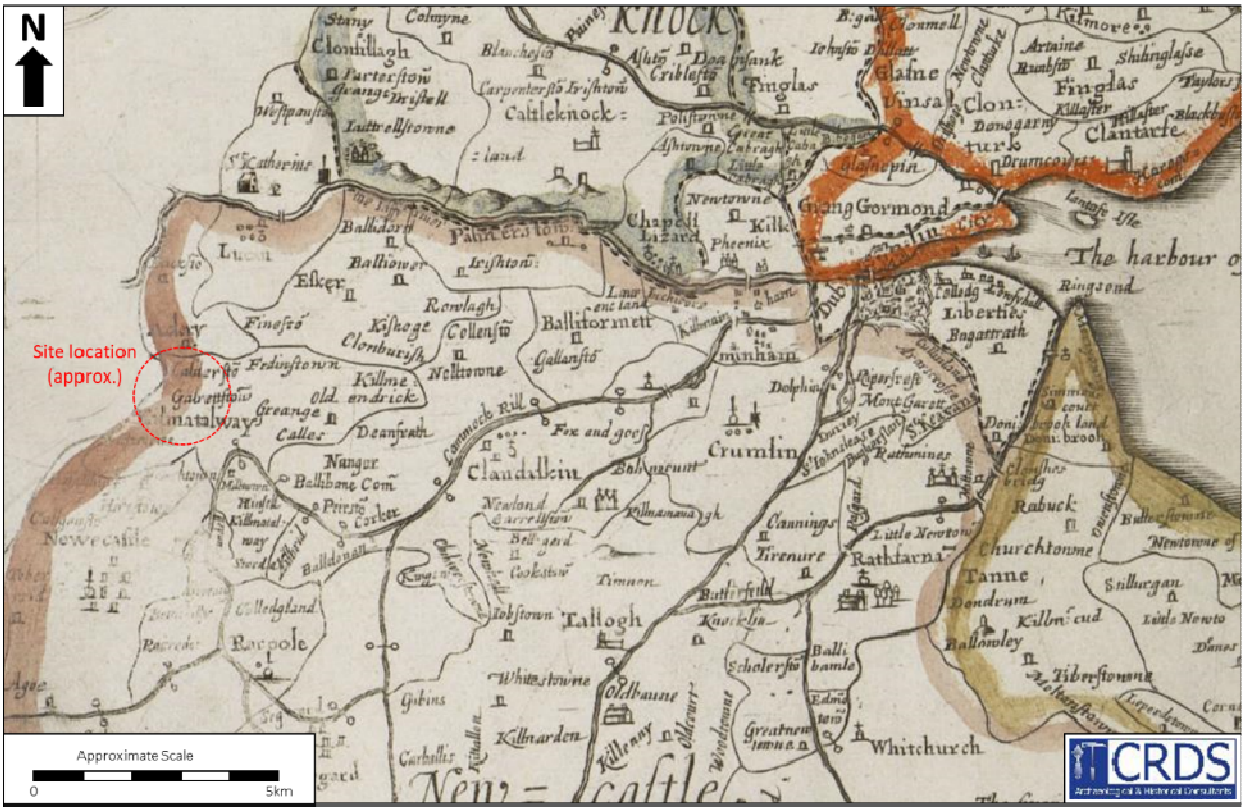


Figure 3. Extract from Down Survey Barony map of Newcastle and Uppercross, c. 1656 (source http://downsurvey.tcd.ie/down-survey-maps.php)

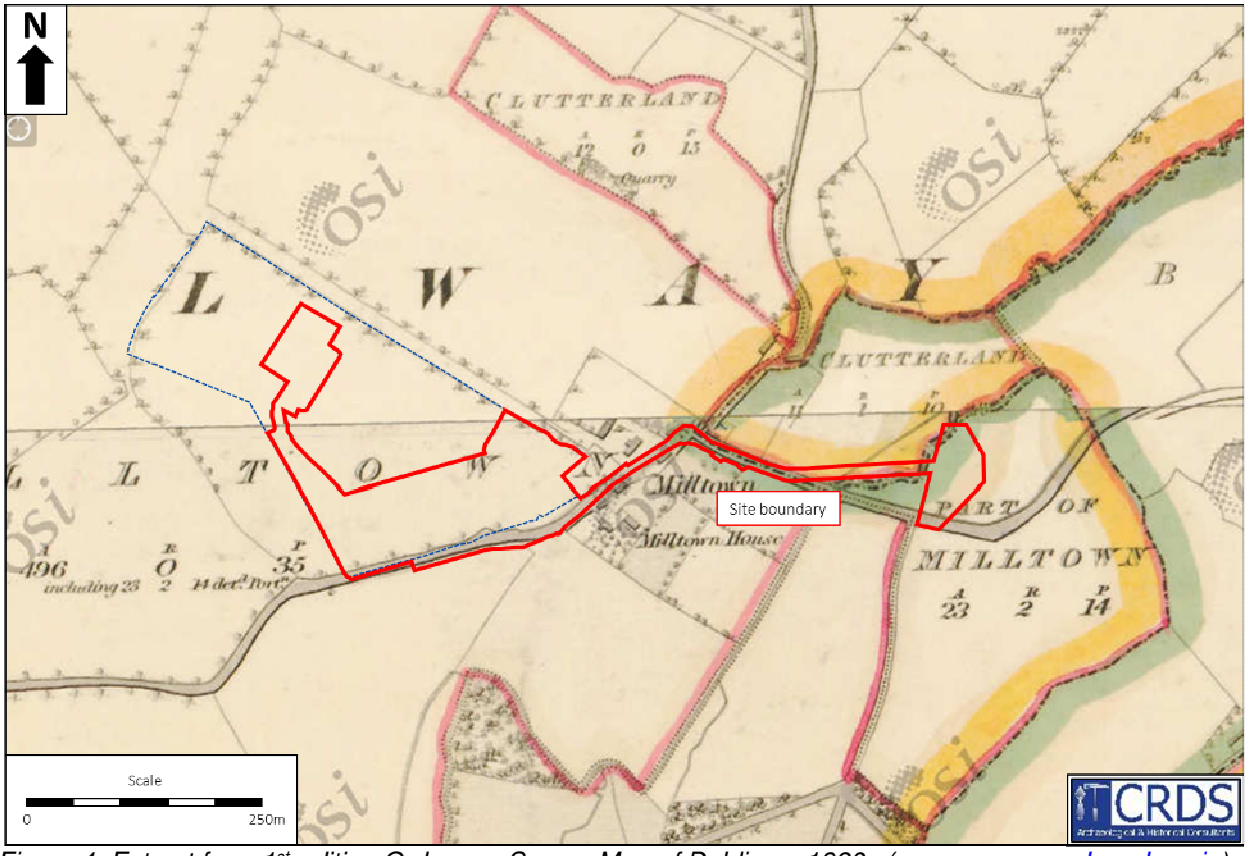


Figure 4. Extract from 1st edition Ordnance Survey Map of Dublin, c. 1830s (source www.archaeology.ie)

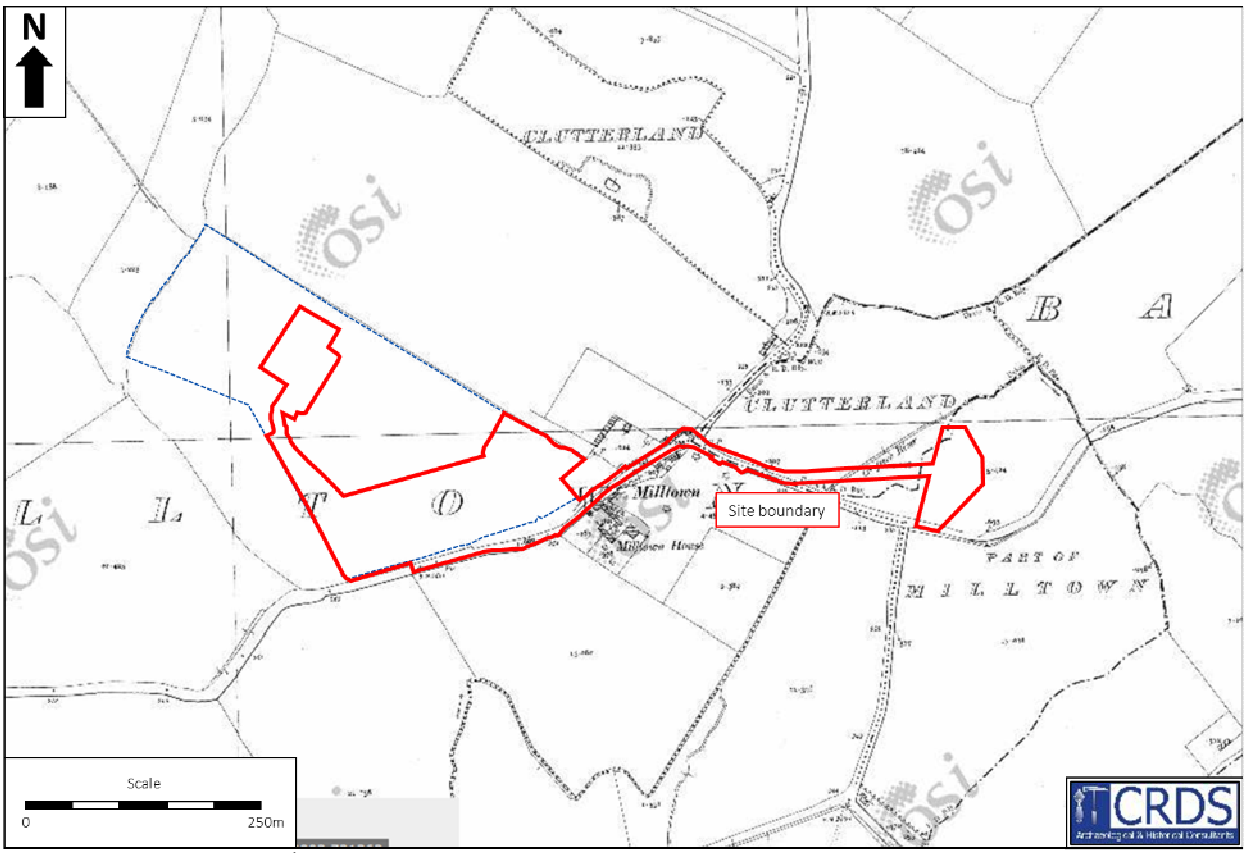


Figure 5. Extract from 2nd edition Ordnance Survey Map of Dublin, c. 1910s (source www.archaeology.ie)

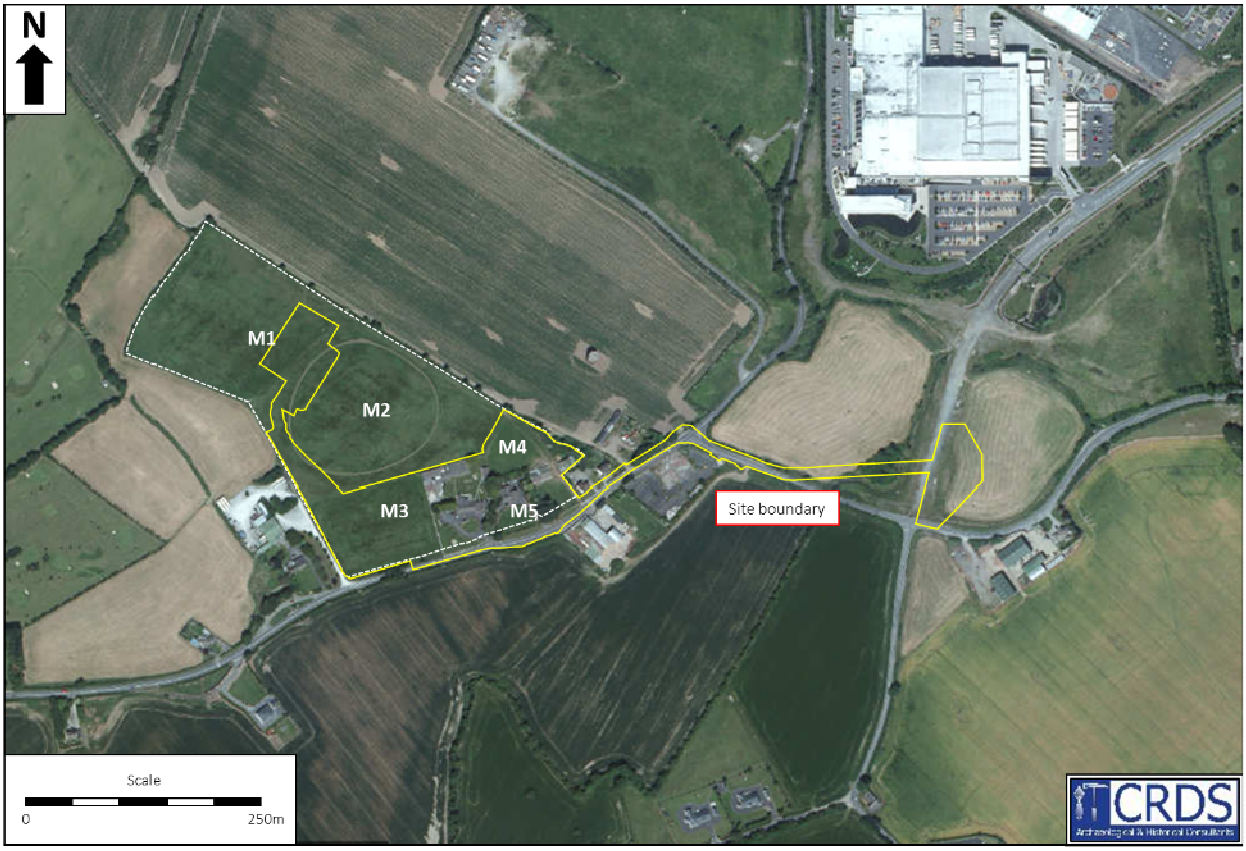


*Figure 6. Aerial photograph of the proposed development (source **www.archaeology.ie**)*

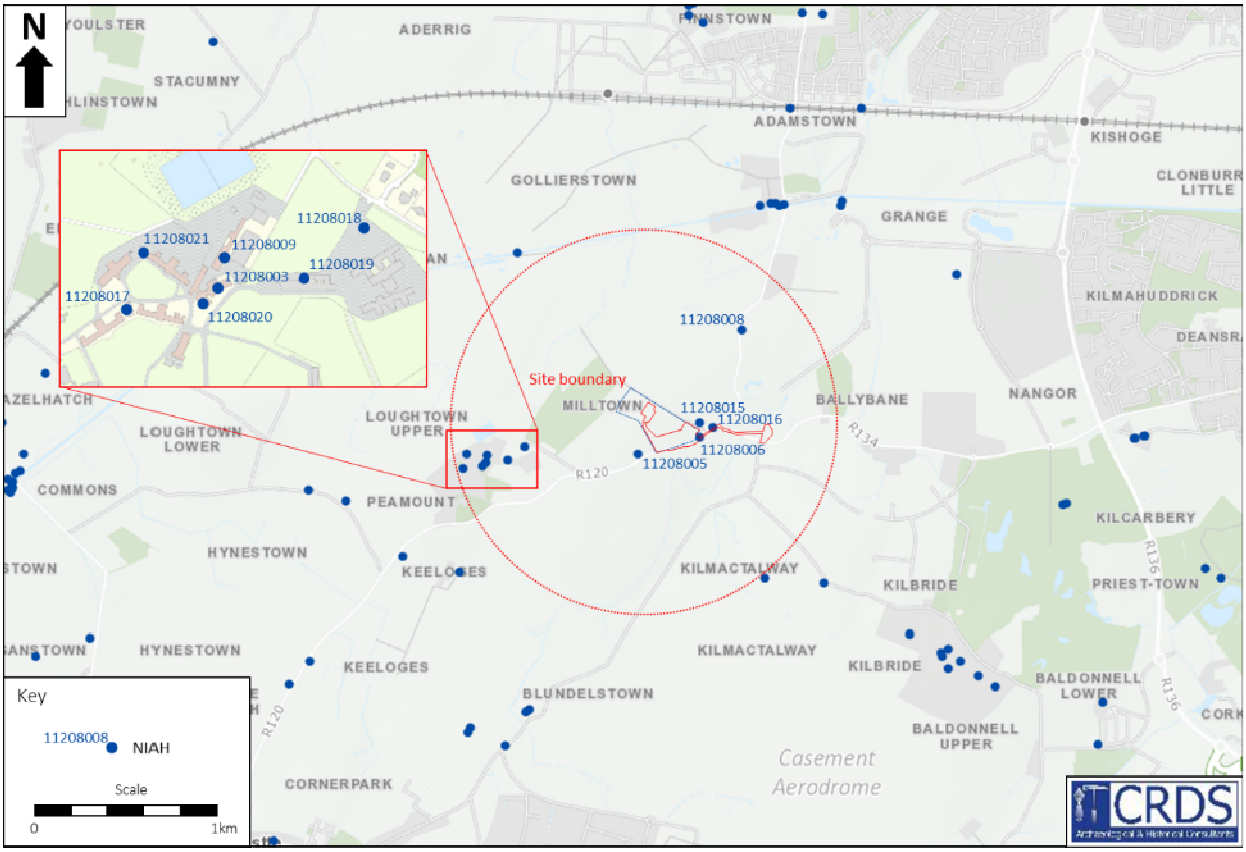


Figure 7. Recorded architectural heritage sites within the vicinity of the proposed development (source www.archaeology.ie)

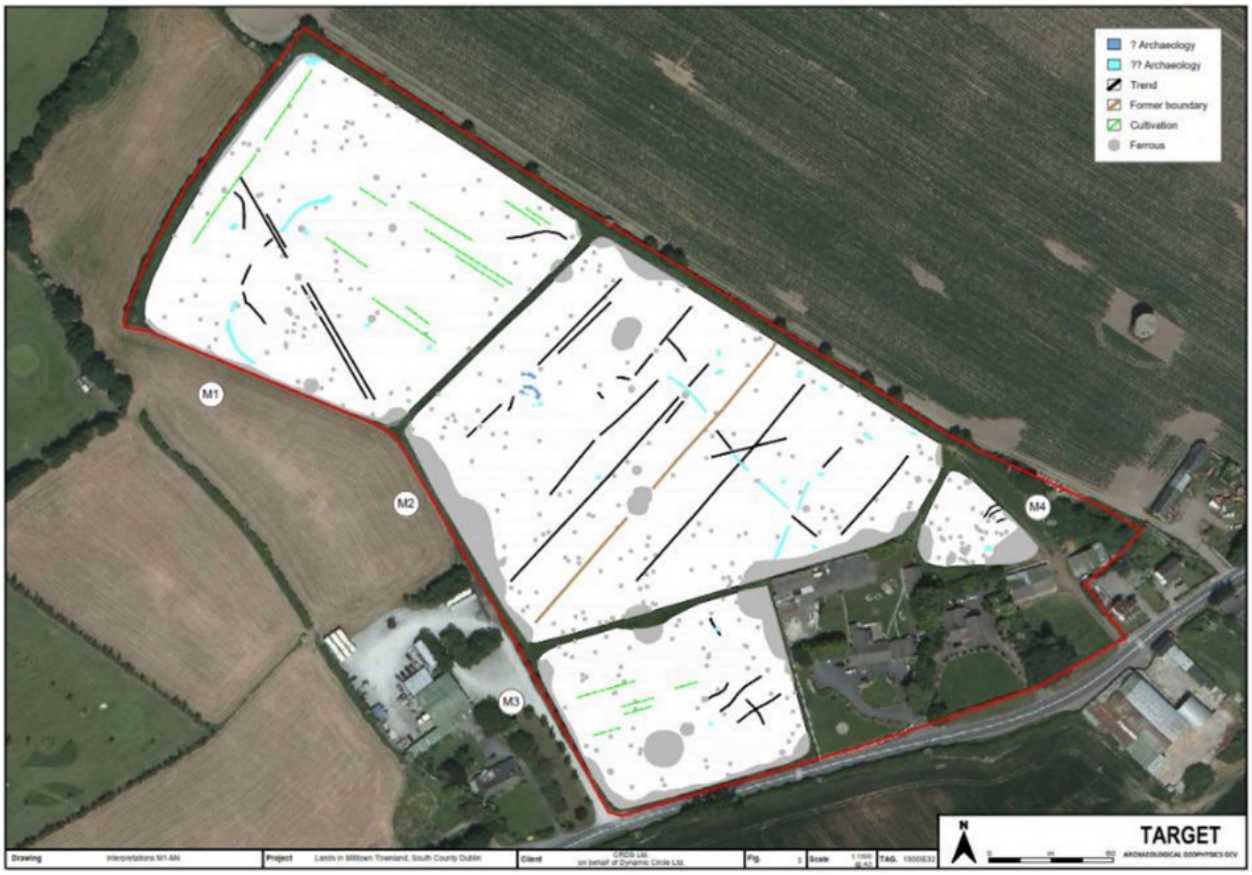


Figure 8. Summary of results of geophysical survey (source Target Ltd; License no 19R0190)

Appendix 13.6 Geophysical survey report

Geophysical Survey Report

Lands in Milltown (Newcastle By.) Townland, South County Dublin

Detection License
19R0190

Author
John Nicholls MSc

Client
AMS-CRDS

On behalf of
Dynamic Circle Ltd.

Date
September 2019

Project
TAG1900IE32

TARGET
ARCHAEOLOGICAL GEOPHYSICS GCV

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TARGET REPORT 1900IE32
LANDS IN MILLTOWN (NEWCASTLE BY.) TOWNLAND, SOUTH COUNTY DUBLIN

PROJECT BACKGROUND

Geophysical survey was undertaken in connection with a proposed development located in Milltown (Newcastle By.) Townland, South County Dublin, c.1km SW of Grange Castle Business Park, 0.6km NE of Peamount Hospital, immediately E of the Newcastle Golf Centre and the Hinde Exports site. The site of the proposed development, which encompasses a total c.8.3ha of land, comprises of 4 adjacent pasture fields bound to the N, S, and W by agricultural land, with two private dwellings, gardens and stables also located within the site boundary facing the R120 to the E-SE. A total 6.4 hectares of land available within the proposed development was subjected to geophysical survey.

This geophysical was conducted as part of a pre-planning archaeological assessment being undertaken by AMS-CRDS on behalf of Dynamic Circle Ltd., and was commissioned with the following aims:

- to identify any geophysical anomalies of possible archaeological origin within the proposed development boundary
- accurately locate these anomalies and present the findings in graphical format
- describe the anomalies and discuss their likely provenance in a written report

ITM Coordinates 702183 731077 (central coordinate)

Townland Milltown (Newcastle By.)

County South County Dublin

Landuse Pasture

Landscape, soils geology Mostly flat agricultural land occupied by loamy drift of the Straffan (700D) association, with bedrock comprising of dark limestone and shale (calp) of the Lucan formation (Irish National Soils Map, 1:250,000k, V1b, 2014; Geological Survey Ireland Spatial Resources, Public Data Viewer Series).

Archaeology No recorded monuments (RMPs) are located within the proposed development boundary. Several RMPs are, however, located within a 1.5km radius as detailed in the table below, with further enclosure remains recorded immediately to the NE from previous geophysical survey (2018, Nicholls J & Murphy D, detection license 18R0222):

SMR NO.	CLASS	TOWNLAND	ITM EAST	ITM NORTH
DU017-089----	Enclosure	Coolscuddan	700640	732116
DU017-093----	Enclosure	Gollierstown	701891	732600
DU017-095----	Enclosure	Loughtown Upper	700900	731258
DU021-003001-	Church	Kilmactalway	702669	730091
DU021-003002-	Graveyard	Kilmactalway	702665	730084
DU021-003003-	Ecclesiastical enclosure	Kilmactalway	702667	730086
DU021-003004-	Font	Kilmactalway	702669	730089
DU021-108----	Concentric enclosure	Ballybane	703060	730985
DU021-109----	Enclosure	Ballybane	702937	730716
DU021-112----	Enclosure	Kilmactalway	702444	730450
DU017-089----	Enclosure	Coolscuddan	700640	732116
DU017-093----	Enclosure	Gollierstown	701891	732600
DU017-095----	Enclosure	Loughtown Upper	700900	731258
DU021-003001-	Church	Kilmactalway	702669	730091

Fieldwork	27th & 29th August 2019
Report issue	9th September 2019
Author	John Nicholls MSc
Detection License No.	19R0190
Client	AMS-CRDS on behalf of Dynamic Circle Ltd.
Geophysical technique	High resolution magnetic gradiometry

1.1 Methodology

1.1.1 High resolution magnetic gradiometer survey was undertaken throughout the available lands within the proposed development boundary, completing a total 6.4 hectares investigating parts of 4 adjacent pasture fields (M1-M4).

1.1.2 The survey employed an advanced multichannel fluxgate gradiometer system combined with cm precision GPS, recording magnetic gradiometer and GPS data simultaneously at rates of 75Hz and 1Hz respectively, conducting parallel instrument traverses 2.7m in width throughout M1-M4, with the instrumentation installed in tow configuration for use with an ATV.

1.2 Instrumentation

1.2.1 Details of the geophysical instrumentation employed for this survey are provided below:

Technique	Sensor spacing	Sample rate	Instrumentation	Sensitivity / precision	No. of measurements recorded
Magnetic (fluxgate) gradiometry	0.30m	75Hz	10 x Foerster Ferex CON650 Archaeology fluxgate gradiometers, 15 channel data logger	<75pT / √Hz at 1Hz (650mm baseline)	883,208
GPS	3.00m	1Hz	Trimble R10 GPS (VRS)	<0.1m (vertical & horizontal)	12,922

1.2.2 The field instrumentation and software used during this geophysical survey were configured to apply a spatial resolution of c.80-100 magnetometer gradiometer measurements per $m,^2$ which exceeds the 'Level 3 – Characterisation' EAC Guidelines recommendation for geophysical survey in archaeology, (Schmidt et al, 2016).

1.3 Data processing

1.3.1 Post fieldwork magnetic gradiometer data processing was performed as follows:

Process	Description
1	Positioning of magnetic gradiometer data based on real-time GPS measurements
2	Zero median transect processing for multi-sensor magnetometer data collected along parallel transects
3	Gridding (nearest neighbor interpolation)
4	Export of georeferenced greyscale images at optimum range

1.3.2 To ensure integrity of the processed geophysical data, and maintain close correlation with the original raw on-site measurements, no additional smoothing, low or high pass filters were applied proceeding steps 1-4.

1.4 Data display

1.4.1 Figure 1 presents a site location diagram (scale 1:7500), highlighting the area of proposed development immediately NW of the R120 with RMPs in 1.5km proximity indicated.

1.4.2 Figure 2 presents the results from survey in M1-M4 in greyscale format at a scale of 1:1500.

1.4.3 Figure 3 presents the interpretations of the results from survey in M1-M4 at a scale of 1:1500.

2 GENERAL CONSIDERATIONS & COMPLICATING FACTORS

2.1 Access & ground conditions

2.1.1 The proposed development extends across mostly level agricultural land. Fieldwork in M1-M4 was undertaken either side of cutting and baling of silage. Bales remaining in M1-M2 during the latter stages of fieldwork precluded survey, and consequently several gaps in the data exist, most notably in M1.

2.1.2 Survey across the south-eastern portion of the proposed development was not undertaken due to large-scale ferrous disturbance from private dwellings and stables, which would ultimately obscure any subtle contrasts associated with buried archaeological remains, if present.

2.2 Modern interference

2.2.1 The results from survey in M1-M4 highlight numerous small-scale ferrous responses throughout. Ferrous responses are a common occurrence in magnetic survey data, and in most cases represent modern metal debris contained within the topsoil.

2.2.2 Broad ferrous responses are also apparent in the results, mostly notably at the perimeters of survey and in proximity to the private dwellings and stables which occupy the south-eastern portion of the site. Large-scale sub-circular ferrous responses traversing M2-M3 represent the locations of a number of electricity pylons oriented approximately N-S.

3 MAGNETIC GRADIOMETRY SURVEY RESULTS

3.1 M1

3.1.1 Remnants of a former boundary traversing M1 NW-SE are evident W of survey centre, with responses from past cultivation visible as parallel linear responses aligned mostly NW-SE.

3.1.2 Fragmented and poorly defined curvilinear anomalies (1-2), c.90m at their greatest extent, which extend through the western portion of M1, may be of archaeological interest, perhaps forming part of a levelled enclosure. However, the potential that anomalies 1-2 may derive from more recent equestrian activity within the site boundary should not be excluded, Google aerial imagery indicating a large circular exercise ring to the SE in M2.

3.1.3 Magnetically weak small-scale positives and weak trends of possible significance are also evident in M1, notably W of survey centre (3-4), to the E and SE. The significance of these anomalies is uncertain. They are poorly defined, at the limits of instrument detection, and a recent landuse, modern ferrous or natural soil/geological explanation should also be considered.

3.1.4 No further responses of significance are indicated by the results from survey in M1.

3.2 M2

3.2.1 Remnants of a former boundary traversing M2 NE-SW have been recorded, with multiple weakly magnetic linear trends of similar alignment reflecting past cultivation/landuse throughout this central portion of the proposed development.

3.2.2 Two probable pit/posthole concentrations (5-6), are highlighted by the results from M2 NW of survey centre. These are magnetically strong, within 4-5m proximity of one another, and semi-curvilinear in arrangement. The possibility that 5-6 together form part of a levelled enclosure or structure should not be ignored.

3.2.3 Weakly magnetic interconnecting linear responses 7-9 traversing the eastern/south-eastern portion of M2 NW-SE and NE-SW are expected to represent remains of an early field system.

3.2.4 Discrete positive responses 10-12, located W and NE of survey centre in M2, may be of interest, potentially representing pit/linear remains. Interpretation of responses 11-12 is cautious in view of the previous existence of a large circular exercise ring in this location as shown by Google aerial imagery.

3.2.5 No further responses of note have been recorded from survey in M2.

3.3 M3

3.3.1 The results from M3 display no responses of archaeological interest in this southern portion of the proposed development. Weakly magnetic trends and poorly defined small-scale positives are evident in this location and expected to be of limited significance. A natural soil/geological, recent landuse or modern ferrous origin is expected for these anomalies.

3.4 M4

3.4.1 A possible archaeological interpretation for an irregular shaped response (13) to the SE in M4 should not be excluded. Weak linear trends of expected natural soil/geological origin are also evident E of survey centre in M4.

3.4.2 No further responses of interest are indicated by the results from survey in M4.

4 CONCLUSION

4.1 No responses of definite archaeological character have been recorded within the site boundary. A generally quiet magnetic background within the +/-1.5nT range is indicated by the results from survey in M1-M4, each survey location displaying an abundance of small-scale modern ferrous debris, with remains of former field boundaries and past cultivation also present, notably in M1 and M3.

4.2 Responses of potential interest recorded within the proposed development include a weakly magnetic curving linear response, potentially part of a levelled enclosure ditch to the W in M1, and several outlying small-positives; a curving arrangement of probable pit/posthole remains to the NW in M2, with weak linear anomalies and trends suggesting part of an early field system to the E-SE; and a strongly magnetic discrete positive to the SE in M4. Interpretation of these responses is tentative in view of more recent landuse within the site boundary.

BIBLIOGRAPHY

Nicholls J. & Murphy D, 2018, Grange Castle Business Park West, Brownstown (Newcastle By.), Clutterland (Newcastle By.), Loughtown Upper, Milltown (Newcastle By.) & Peamount Townlands, South County Dublin. Target report 1800IE40, detection license 18R0222.

Schmidt A, (2002), Archaeology Data Service. Geophysical Data in Archaeology. A guide to good practice.

Schmidt A, Linford P, Linford N, David A, Gaffney C, Sarris A, and Fassbinder J, (2016), EAC Guidelines for the Use of Geophysics in Archaeology.

ONLINE RESOURCES

Archaeological Survey of Ireland SMR Database
http://webgis.archaeology.ie/historicenvironment/

Geological Survey of Ireland Spatial Resources, Public Data Viewer Series
https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228

Irish National Soils Map, 1:250,000k, V1b (2014). Teagasc, Cranfield University. Jointly funded by the EPA STRIVE Research Programme 2007-2013 & Teagasc. http://gis.teagasc.ie/soils/map.php

LIST OF FIGURES

APPENDICES

Technical Information T1

MAGNETOMETRY

Introduction

Magnetometry represents one of a suite of geophysical techniques employed in archaeological prospection to inform invasive investigations such as trial trenching and excavation.

Frequently used to determine the often non-visible boundaries of archaeological remains, magnetometer surveys enable archaeologists to identify the location, form and extent of a diverse array of archaeological features no longer visible at the surface.

1. Advanced multi-channel magnetometer survey mapping the buried foundation of a 14th century castle (towed configuration with ATV).

Buried archaeological remains successfully identified using magnetometry include sites such as enclosure systems and deserted villages, hillforts and military encampments, henges and tumuli, villa/castle foundations, and ecclesiastical settlements.

Background to application

The basis for use of magnetometry in archaeological prospection derives from the abundance of natural iron oxides in most soils, and our ability to measure subtle variations in the magnetic properties of these iron oxides caused by human activity. Discrete variations in soil magnetism associated with buried archaeological remains derive typically from in situ burning and organic enrichment of the soil, through activities such as cooking and heating; pottery manufacture and metal working; as well as use of fired building materials such as ceramic tiles and brick. These burnt, fired and organic rich deposits create subtle magnetic contrasts visible as discrete magnetic anomalies superimposed on the earth's geomagnetic field.

2. Results from magnetometer survey presented in greyscale format highlighting pit remains bordering an enclosure site and Roman villa.

3. Burnt & fired debris revealed following excavation of pit remains bordering an enclosure site and Roman villa.

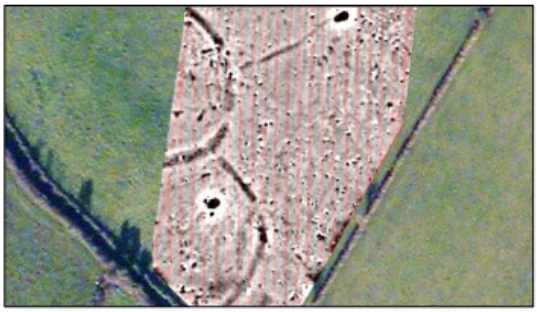
Magnetometer surveys conducted in both commercial and research archaeological investigations enable determination of the location, form and extent of buried archaeological remains. Data acquired from these surveys can be quickly generated into georeferenced images and interpretation layers to inform subsequent trial trenching and excavation.

Technical Information T2

Technology

TARGET provides precise mapping and characterization of buried archaeological remains by employing an array of highly stable and sensitive fluxgate gradiometers, combined with an advanced data logging system and cm precision GPS. This state-of-the-art geophysical instrumentation, which is capable of collecting extremely dense data sets, permits detailed high resolution survey of archaeological sites from as small as 1ha in size, to larger scale investigation of sites up to 150ha or more.

4. Advanced multi-channel gradiometer system for magnetometer survey (manual configuration).



5. GPS tracks (red) highlighting lines of data collection & results from magnetometer fieldwork at a suspected burial ground.

TARGET undertakes high resolution magnetometer surveys as standard, recording data at c.5cm intervals with probe separations of 0.28m or 0.5m, for precise measurement and characterization of buried archaeological remains.

Data Display

Greyscale plots are the most common format for displaying magnetometer data. This display format assigns a cell to each datum according to its location on the grid. The display of each data point is conducted at very fine increments, allowing the full range of values to be displayed within a given data set. This display method also enables the identification of discrete responses barely visible above natural 'background' magnetic variation on site.

6. Greyscale from survey at the site of a deserted medieval village.

XY trace plots provide a near-perspective representation of measurements along individual lines of data recorded from each of the magnetometer sensors. The XY trace format is used as a conventional method for identifying responses which derive from modern ferrous debris. The XY trace display is particularly when identifying magnetically strong anomalies indicative of buried hearths, kilns and furnaces.

7. XY trace from survey at the site of a deserted medieval village.


Site location
SMR
Aerial imagery 2018 Microsoft Corporation © 2018 Digital Globe © CNES (2018) Distribution Airbus DS © HERE
DU021-108 Concentric enclosure
DU021-109 Enclosure
DU021-112 Enclosure
Enclosure DU017-095
Enclosure DU017-089
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ARCHAEOLOGICAL GEOPHYSICS GCV
Drawing
Site location
Project Lands in Milltown (Newcastle By.) Townland, South County Dublin
Client
AMS-CRDS on behalf of Dynamic Circle Ltd.
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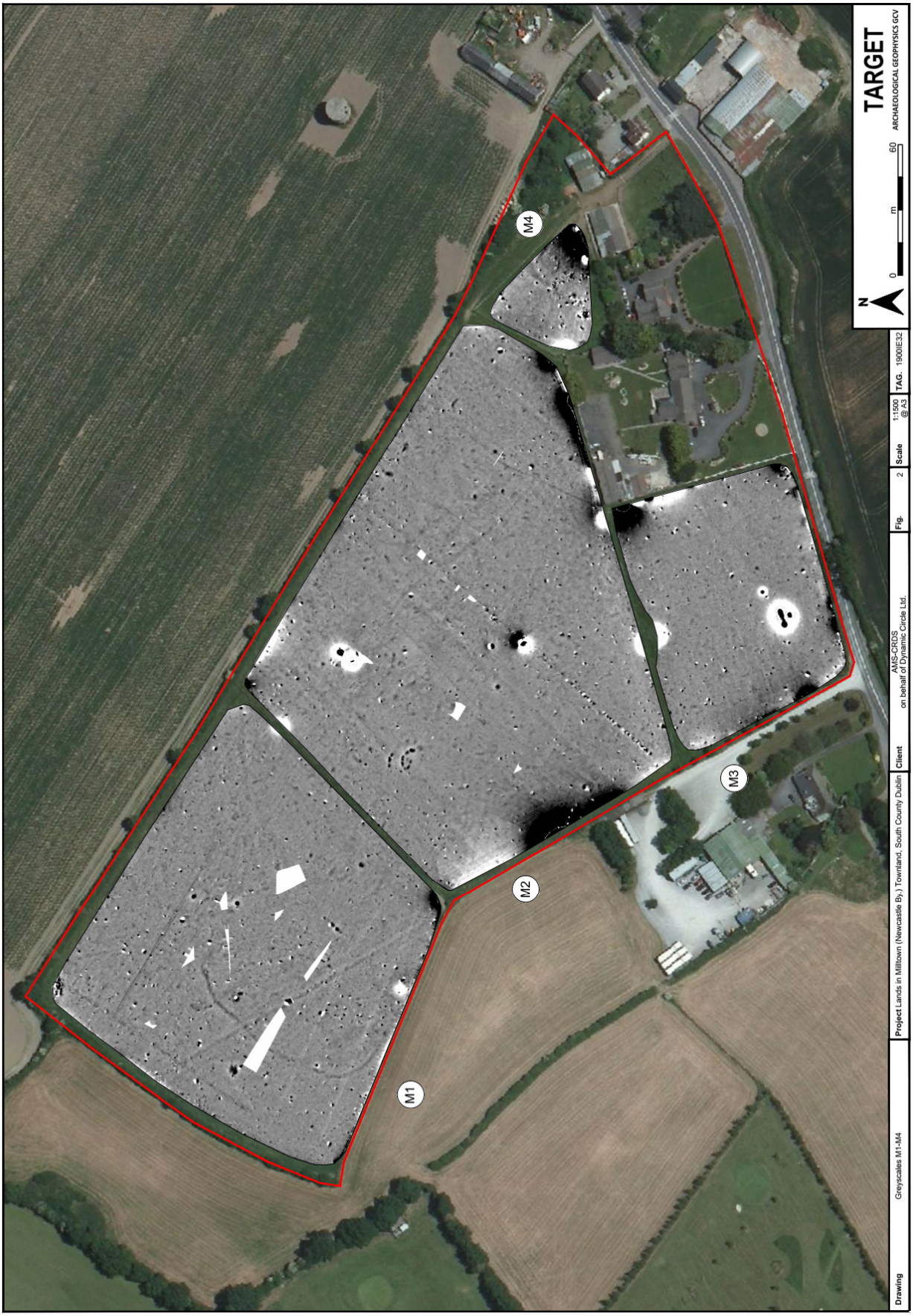
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on behalf of Dynamic Circle Ltd.
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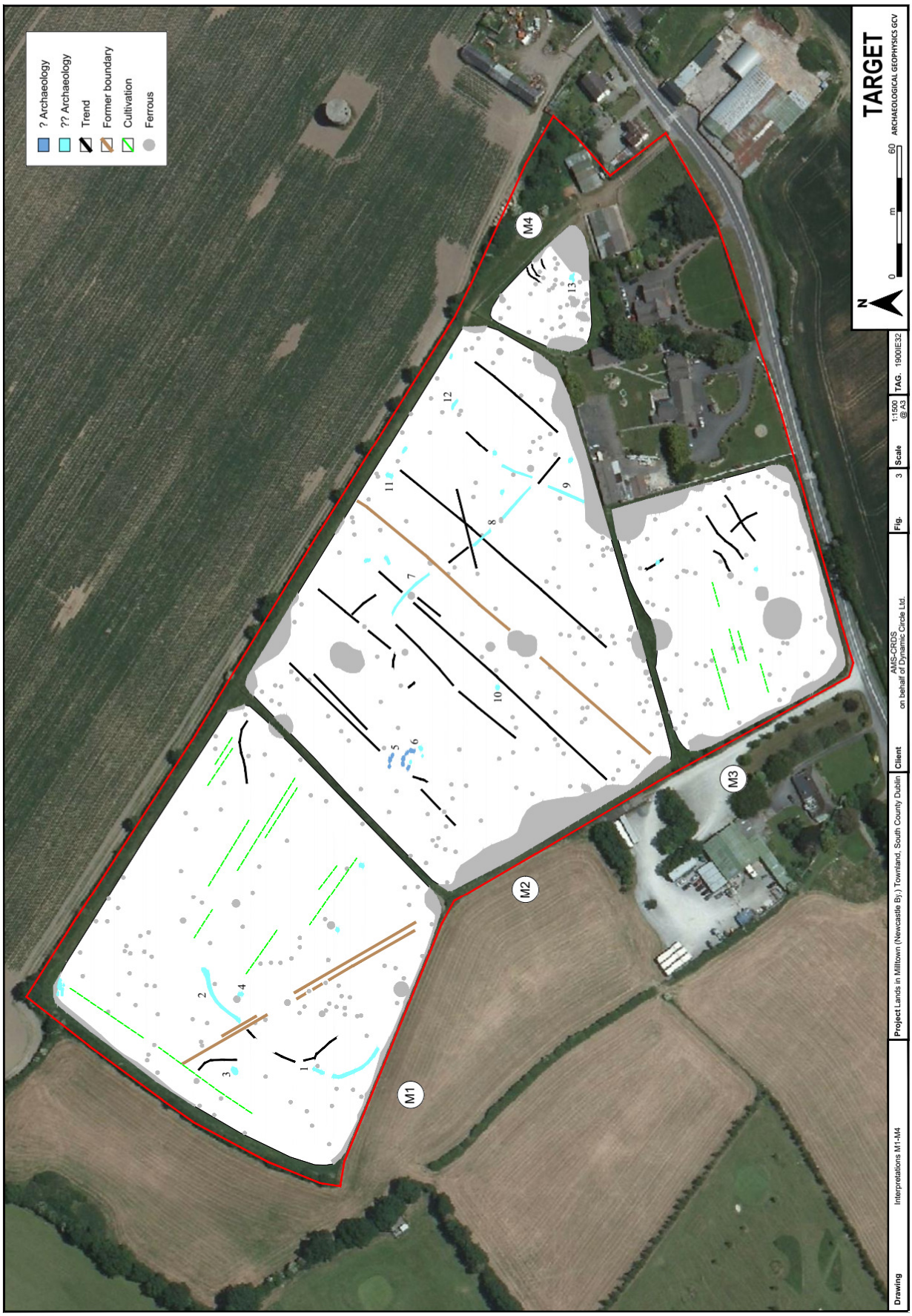
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Drawing Interpretations M1-M4
Project Lands in Milltown (Newcastle By.) Townland, South County Dublin
Client AMS-CRDS on behalf of Dynamic Circle Ltd.
Fig. 3
Scale 1:1500 @ A3
TAG. 1900IE32

CHAPTER 14 – WASTE MANAGEMENT

Appendix14.1 Outline Construction and Demolition Waste Management Plan

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APPENDIX 14.1 CONSTRUCTION & DEMOLITION WASTE MANAGEMENT PLAN

Technical Report Prepared For

Data and Power Hub Services Ltd

Report Prepared By

Jonathan Gauntlett, Environmental Consultant

Our Reference

JG/21/12086WMR01

Date of Issue

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Signature		
Name	Jonathan Gauntlett	Chonaill Bradley
Title	Environmental Consultant	Senior Environmental Consultant
Date	26 February 2021	26 February 2021

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1.0 INTRODUCTION

AWN Consulting Ltd (AWN) has prepared this Construction and Demolition (C&D) Waste Management Plan (WMP) to accompany a Strategic Infrastructure Development application to An Bord Pleanála (ABP). The proposed development primarily comprises the provision of two no. 110kV transmission lines and a 110kV Gas Insulated Switchgear (GIS) substation compound and Transformers / MV switch room compound along with associated and ancillary works.

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 purpose of this report is to provide information necessary to ensure that the management of C&D waste at the site is undertaken in accordance with current legal and industry standards including the *Waste Management Acts 1996-2011* and associated Regulations[1], *Protection of the Environment Act 2003* as amended[2], *Litter Pollution Act 1997* as amended[3] and the *Eastern-Midlands Region Waste Management Plan 2015-2021*[4]. In particular, this report aims to ensure maximum recycling, re-use and recovery of waste with diversion from landfill, where possible. It 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).

In the preparation of this report consideration has been given to the requirements of National and Regional waste policy, legislation, and other guidelines (referred to in Section 2.0). However, in determining the structure and content of the document, the following two publications have been referenced in particular:

- Department of the Environment, Heritage and Local Government (DoEHLG), Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects (2006)[5].
- FÁS and the Construction Industry Federation (CIF), Construction and Demolition Waste Management – a handbook for Contractors and Site Managers, (2002)[6].

The above 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.

2.0 CONSTRUCTION & DEMOLITION WASTE MANAGEMENT IN IRELAND

2.1 NATIONAL LEVEL

The Irish Government issued a policy statement in September 1998 titled as *'Changing Our Ways*[7] which identified objectives for the prevention, minimisation, reuse, recycling, recovery and disposal of waste in Ireland. The target for C&D waste in this Strategy 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 (by 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 titled *Recycling of Construction and Demolition Waste*[8] concerning the development and implementation of a voluntary construction industry programme to meet the governments objectives for the recovery of construction and demolition waste.

In September 2020 the government released 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'*[9] 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.

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 (Single Use Plastics Directive). 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.

The National Construction and Demolition Waste Council (NCDWC) was launched in June 2002, as one of the recommendations of the Forum for the Construction Industry, in the Task Force B4 final report. The NCDWC subsequently produced *Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects* in July 2006 in conjunction with the Department of the Environment, Heritage and Local Government (DoEHLG).

The guidelines outline the issues that need to be addressed at the pre-planning stage of a development all the way through to its completion. These guidelines have been followed in the preparation of this document and include the following elements:

- Predicted construction and demolition wastes;
- Procedures to prevent and minimise wastes;
- Options for reuse/recycling/recovery/disposal of construction and demolition wastes;
- Provision of training for Waste Manager and site crew;
- Details of proposed record keeping system;
- Details of waste audit procedures and plan; and
- Details of proposed 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 C&D Waste Management Plan for developments. This development requires a C&D WMP under the following criterion:

- New developments other than (1) above, including institutional, educational, health and other public facilities, with an aggregate floor area in excess of 1,250 m2;

Other guidelines followed in the preparation of this report include *'Construction and Demolition Waste Management – a handbook for Contractors and Site Managers'* published by FÁS and the Construction Industry Federation in 2002.

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.

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*[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:

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.

In terms of physical waste infrastructure, three municipal solid waste landfills remain operational in the Eastern Midlands Region (EMR) and are all operated by the private sector. There are a number of other licensed and permitted facilities in operation in the EMR 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.

2.3 LEGISLATIVE REQUIREMENTS

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

- Waste Management Act 1996 (No. 10 of 1996) as amended, as well as sub-ordinate legislation[1].
- Environmental Protection Act 1992 (No. 7 of 1992) as amended.
- Litter Pollution Act 1997 (No. 12 of 1997) as amended.
- Planning and Development Act 2000 (No. 30 of 2000) as amended.

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 Acts 1996 – 2011 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 reuse, recycling, recovery and/or disposal (including its method of reuse, recycling, recovery and/or 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 waste reuse, recycling, recovery and/or disposal site. 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 appointed project owner and construction contractor(s) are legally compliant with respect to waste transportation, reuse, recycling, recovery and disposal. This includes the requirement that a contractor handle, transport and reuse/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* as amended, or a waste or Industrial Emissions (IE) 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.

3.0 DESCRIPTION OF THE PROJECT

3.1 LOCATION, SIZE AND SCALE OF THE DEVELOPMENT

A detailed description of the development is provided in Chapter 2 (Characteristics of the Proposed Development) of the EIA Report. The proposed development primarily comprises the provision of two no. 110kV transmission lines and a 110kV Gas Insulated Switchgear (GIS) substation compound and Transformers / MV switch room compound along with associated and ancillary works. The ancillary works include soft landscaping, underground foul and storm water drainage network including SuDS measures.

The development works include the demolition of the existing two storey dwelling of Bulmer and associated outbuildings; and demolition of the existing single storey house of Little Acre and its associated garage and other buildings; as well as the demolition of the single storey stable building on the overall site. The total gross floor area of demolition is c. 1,382sqm.

3.2 OVERVIEW OF THE NON-HAZARDOUS WASTES TO BE PRODUCED

There will be waste materials generated from the demolition of some of the existing buildings, hardstanding areas on site, as well as from the excavation of the building foundations. 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.

Site preparation, excavations and levelling works will be required to facilitate construction of foundations, access roads and the installation of services. The construction of foundations for the GIS substation, the installation of ducting for the 110kV transmission line, and construction of concrete bases for the new cable bays will require the excavation of made ground, tarmac, topsoil, subsoil and possibly bedrock (if encountered).

Topsoil, subsoils, tarmacadam / hardcore fill will be excavated to facilitate construction of the proposed transmission lines. It is currently envisaged that majority of this excavated material will require removal offsite for reuse, recovery and/or disposal.

In addition to the transmission lines, of topsoil and subsoils will be excavated for the substation, attenuation, and landscaping component of the proposed development. Suitable soils and stones will be reused on-site as backfill in the grassed areas, where possible. It is currently envisaged that all of the excavated material will be reused for a landscaping on site, and will require an additional import of soil to complete the landscaping aspects.

During the construction phase of the proposed substation and cable bays, waste produced will include surplus steel and other metal materials and broken/off-cuts of timber, plasterboard, concrete etc. Waste from packaging (cardboard, plastic, timber) and oversupply of materials are also likely to be generated.

Waste will also be generated by construction workers. These wastes would generally be 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 at the site compound 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. The welfare facilities and site office for the Proposed Development will be located within the site compound.

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.

3.3 POTENTIAL HAZARDOUS WASTES ARISING

3.3.1 Contaminated Soil

Geotechnical and environmental site investigations were carried out by Ground Investigation Ireland (GII) in October to November 2020 during the preparation of the for the Information Communication Technology (ICT) facilities under SDCC Reg. Ref. SD20A/0324. Eleven (11) no. trial pits were excavated to a maximum depth of c.1.60 m. Three (3) no. groundwater monitoring wells were installed as part of these investigations. Eight (8) No. representative soil samples were also recovered from a number of the pits for laboratory analysis. The ground investigation report shows there was no evidence of subsurface contamination encountered during the site investigation works. Environmental analysis was carried out on eight soil samples and all were below the inert threshold concentration for waste as per Waste Acceptance Criteria (WAC) specified in the *European Communities (EC) Council Decision 2003/33/EC)*[11] which establishes the criteria for the acceptance of waste at landfills. Further details on the soil quality at the site is provided in Chapter 7 of the EIAR (Land, Soils, Geology and Hydrogeology).

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.

All excavations should still 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 need to 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'*[12] using the *HazWasteOnline* application (or similar approved classification method). The material will then need to be classified as clean, inert, non-hazardous or hazardous in accordance with the *Decision 2003/33/EC*.

Excavation works will be carefully monitored by a suitably qualified person to ensure any potentially contaminated soil is identified and segregated in accordance with the above procedure.

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 Species

Ecological site surveys have been undertaken by Scott Cawley (SC) at this site and in the surrounding area as part of the site ecological assessment. This included walkover surveys of the entire site and the perimeter of the site. There were no Schedule 3 non-native invasive species were recorded during baseline surveys.

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, waste electrical and electronic equipment (WEEE) containing hazardous components, printer/toner cartridges and batteries (Lead, Ni-Cd or Mercury) may be generated from the temporary site offices during construction works. These wastes 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 may typically be generated by the construction activities at the proposed site are presented in Table 1. The List of Waste code (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	List of Waste 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 ESTIMATED WASTE ARISINGS

4.1 DEMOLITION WASTE GENERATION

Demolition works at the site will involve the demolition of existing structures on site. Demolition figures published by the EPA in the *'National Waste Reports'*[13] and data from previous projects have been used to estimate the approximate break-down for indicative reuse (offsite), recycling and disposal targets of demolition waste. This breakdown is shown in Table 4.1.

Table 4.1 *Estimated off-site reuse, recycle and disposal rates for demolition waste*

Waste Type	Tonnes	Reuse/Recovery		Recycle		Disposal	
		%	Tonnes	%	Tonnes	%	Tonnes
Glass	77.2	0	0.0	85	65.6	15	11.6
Concrete, Bricks, Tiles, Ceramics	437.3	30	131.2	65	284.2	5	21.9
Plasterboard	34.3	30	10.3	60	20.6	10	3.4
Asphalts	8.6	0	0.0	25	2.1	75	6.4
Metals	128.6	5	6.4	80	102.9	15	19.3
Slate	68.6	0	0.0	85	58.3	15	10.3
Timber	102.9	10	10.3	60	61.7	30	30.9

Waste Type	Tonnes	Reuse/Recovery		Recycle		Disposal	
		%	Tonnes	%	Tonnes	%	Tonnes
Total	**857.4**		**158.2**		**595.5**		**103.7**

The appointed demolition contractor will be required to prepare a detailed demolition management plan prior to work commencing which should refine the above estimated waste figures.

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, the GMIT*[14] 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

An assessment has been undertaken to estimate the quantity of construction waste likely to be generated from the proposed development.

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/Recovery		Recycle		Disposal	
		%	Tonnes	%	Tonnes	%	Tonnes
Mixed C&D Waste	28	10	3	80	22	10	3
Timber	24	40	9	55	13	5	1
Plasterboard	8	30	3	60	5	10	1
Metals	7	5	0	90	6	5	0
Concrete	5	30	2	65	3	5	0

Waste Type	Tonnes	Reuse/Recovery		Recycle		Disposal	
		%	Tonnes	%	Tonnes	%	Tonnes
Other (includes cabling, ducting, conduits, packaging and plastics)	13	20	3	60	8	20	3
Hazardous Waste	0.5	0	0	0	0	100	0.5
Total	**85**		**19**		**58**		**8.5**

In addition, as noted in Section 3.2, the quantity of excavated material that will be generated. It is currently proposed that the excavated material from the trench works will require export from site, while the substation component will be reused on site.

It should be noted that until final materials and detailed construction methodologies have been confirmed, it is difficult to predict the construction waste that will be generated from the proposed works as the exact materials and quantities may be subject to some degree of change and variation during the construction process.

All waste arising during the construction phase will be transported off-site by an approved waste contractor holding a current waste collection permit. All waste arising requiring reuse, recycling, recovery or disposal off-site will be brought to facilities holding the appropriate COR, licence or permit, as required.

4.3 PROPOSED WASTE MANAGEMENT OPTIONS

4.3.1 Waste Management Options for Excavated Materials

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. Any excavations carried out will be required to facilitate construction works. However, it is currently proposed that all the excavated material will be reused on site and therefore will not require removal from site and therefore the preferred option of waste prevention is proposed for the excavated material.

In the event that any excavated material is removed off-site for reuse as a by-product (and not as a waste), 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 decisions are made to the EPA via their online notification form. However, it is not currently anticipated that any excavated material will be removed offsite for reuse as a by-product. Similarly, 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.

If any excavated material requires removal from site and is deemed to be a waste, then removal and reuse/recycling/ recovery/disposal of the material will be carried out in accordance with the *Waste Management Acts 1996 – 2011* as amended, the *Waste Management (Collection Permit) Regulations 2007* as amended and the *Waste Management (Facility Permit & Registration) Regulations 2007* as amended. The volume of waste removed will dictate whether a COR, permit or licence is required by the receiving

waste facility. Once all available beneficial reuse options have been exhausted, the options of recycling and recovery at waste permitted and licensed sites will be considered.

In the unlikely 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 via Transfrontier Shipment of Wastes (TFS).

4.3.2 Waste Management Options for other Construction Wastes

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. All waste receptacles leaving site will be covered or enclosed. The appointed waste contractor will collect and transfer the wastes as receptacles are filled.

All waste arisings will be handled by an approved waste contractor holding a current waste collection permit. All waste arisings requiring reuse, recycling, recovery or disposal off-site will be transferred to a facility holding the appropriate COR, permit or licence, as required.

Written records will be maintained by the contractor detailing the waste arising throughout the construction phase, the classification of each waste type, the contact details and waste collection permit number of all waste contractors who collect waste from the site and the end destination details for all waste removed and disposed offsite.

Dedicated storage containers will be provided for hazardous wastes which may arise such as batteries, paints, oils, chemicals etc., as required. The containers used for storing hazardous liquids will be appropriately bunded or will be stored on suitably sized spill pallets.

The management of the main construction waste streams are detailed as follows:

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 should 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 placed into a dedicated skip and recycled off-site. Clean timber is typically recycled as chipboard.

Metal

Metals will be segregated and stored in skips. Metal is highly recyclable and there are numerous companies that will accept these materials.

Plasterboard

Plasterboard from the construction phase will be stored in a separate skip, pending collection for recycling. The site manager and project engineers 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

Waste electrical and electronic equipment (WEEE) will be stored in dedicated covered cages/receptacles/pallets pending collection for recycling off site.

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 offsite.

Non-Recyclable Waste

Construction 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 6.0) 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.

Hazardous Wastes

On-site storage of any hazardous wastes produced (i.e. contaminated soil in the unlikely event that it is 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.

It should be noted that until the main contractor is appointed, it is not possible to provide information on the specific destinations of each waste stream. Prior to commencement construction of the proposed development and removal of any waste off-site, details of the proposed destination of each waste stream will be provided to the local authority.

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 waste contractor, either by weighing mechanism on the truck or at the receiving facility. These waste records will be maintained on site by the contractor.

All movement of waste and the use of waste contractors will be undertaken in accordance with the Waste Management Acts 1996 – 2011 as amended, Waste Management (Collection Permit) Regulations 2007 as amended and Waste Management (Facility Permit & Registration) Regulations 2007 as amended. This includes the requirement for all waste contractors to have a waste collection permit issued by the NWCPO. The nominated project Waste Manager 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 COR, waste permit or EPA Waste/IE Licence for that site will be provided to the nominated project Waste Manager. If the waste is being shipped abroad, a copy of the TFS document will be obtained from Dublin City Council (as the relevant authority on behalf of all local authorities in Ireland) and kept on-site along with details of the final destination (permits, licences etc.). A receipt from the final destination of the material will be kept as part of the on-site waste management records.

If any surplus soil or stone is being removed from the site for reuse on another construction site as a by-product, this will need to be done in accordance with Article 27 of the *EC (Waste Directive) Regulations, 2011*. Similarly, if any soil or stone are imported onto the site from another construction site as a by-product, this will also be done in accordance with Article 27. It is not currently envisaged the Article 27 will be used for this development.

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 construction 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 offsite recycling/recovery/disposal costs associated with the requirement for a waste contractor to take the material away to landfill.

Clean and inert excavated material which cannot be reused on site may be used as capping material for landfill sites, or for the reinstatement of quarries, etc. as previously discussed. This material is often taken free of charge for such purposes, reducing final waste disposal costs. However, it is not currently anticipated that there will be surplus excavated material.

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 typically charge less to take segregated wastes, such as recyclable waste, from a site than mixed waste streams.

5.3 DISPOSAL

Landfill charges in the Eastern-Midlands region 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 fee for provision and collection of skips.

Collection of segregated construction waste usually costs less than municipal waste. Specific C&D waste contractors take the waste off-site to a registered, permitted or licensed facility and, where possible, remove salvageable items from the waste stream before disposing of the remainder to landfill.

6.0 TRAINING PROVISIONS

A member of the construction team will be appointed as the Waste Manager to ensure commitment, operational efficiency and accountability during the construction phase of the project.

6.1 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 him/her 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 Project Manager on everyday waste management at the site. Authority will be given to the Waste Manager to delegate responsibility to subcontractors, 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.

6.2 SITE CREW TRAINING

Training of the site crew is the responsibility of the Waste Manager and, as such, a waste training program should 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. A sub-section on hazardous wastes will be incorporated into the training program and the particular dangers of each hazardous waste will be explained.

7.0 RECORD KEEPING

Records should 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 arising's on site.

A waste tracking log should 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 transfer dockets will be transferred to the site waste manager on a weekly basis and can be placed in the Waste Tracking Log file. This information will be forwarded onto the SDCC 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.

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.

8.0 OUTLINE WASTE AUDIT PROCEDURE

8.1 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 development.

8.2 REVIEW OF RECORDS AND IDENTIFICATION OF CORRECTIVE ACTIONS

A review of all the records for the waste generated and transported off-site should be undertaken mid-way through the 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.

9.0 CONSULTATION WITH RELEVANT BODIES

9.1 LOCAL AUTHORITY

Once the main contractor has been appointed and prior to removal of any waste materials offsite, details of the proposed destination of each waste stream will be provided to the local authority for their approval.

The local authority will also be consulted, as required, throughout the construction phase 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.

9.2 RECYCLING/SALVAGE COMPANIES

Companies that specialise in C&D waste management will be contacted to determine their suitability for engagement. Where a waste contractor is engaged, each company will be audited in order to ensure that relevant and up-to-date waste collection permits and facility COR/permits/licences are held. In addition, information regarding individual construction materials will be obtained, including 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.

10.0 REFERENCES

1 Waste Management Act 1996 (No. 10 of 1996) as amended 2001 (No. 36 of 2001), 2003 (No. 27 of 2003) and 2011 (No. 20 of 2011). Subordinate and associated legislation includes:

- European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011) as amended 2011 (S.I. No. 323 of 2011)
- Waste Management (Collection Permit) Regulations 2007 (S.I No. 820 of 2007) as amended 2008 (S.I. No. 87 of 2008) and 2016 (S.I. No. 24 of 2016)
- Waste Management (Facility Permit and Registration) Regulations 2007 (S.I. No. 821 of 2007) as amended 2008 (S.I. No. 86 of 2008), 2014 (S.I. No. 310 and S.I. No. 546 of 2014) and 2015 (S.I. No. 198 of 2015)
- Waste Management (Licensing) Regulations 2000 (S.I. No. 185 of 2000) as amended 2004 (S.I. No. 395 of 2004) and 2010 (S.I. No. 350 of 2010)
- Waste Management (Planning) Regulations 1997 (S.I. No. 137 of 1997) as amended 1998 (S.I. No. 164 of 1998), 2001 (S.I. No. 356 of 2002) and 2011 (S.I. No. 126 and No. 192 of 2011)
- 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 (Food Waste) Regulations 2009 (S.I. No. 508 of 2009) as amended 2015 (S.I. No. 190 of 2015)
- European Union (Household Food Waste and Bio-waste) Regulations 2015 (S.I. No. 191 of 2015)
- European Union (Packaging) Regulations 2014 (S.I. No. 282 of 2014) as amended 2015 (S.I. No. 542 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 2014 (S.I. No. 349 of 2014) and 2015 (S.I. No. 347 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 by European Communities (Shipments of Hazardous Waste exclusively within Ireland) Regulations 2011 (S.I. No. 324 of 2011)
- The European Communities (Trans frontier Shipment of Hazardous Waste) Regulations 1988 (S.I. No. 248 of 1988) o European Union (Properties of Waste Which Render It Hazardous) Regulations 2015 (S.I. No. 233 of 2015)

2 Environmental Protection Act 1992 (Act No. 7 of 1992) as amended by the Protection of the Environment Act 2003 (Act No. 27 and S.I. No. 413 of 2003) and amended by the Planning and Development Act 2000 (Act No. 30 of 2000) as amended.

3 Litter Pollution Act 1997 (Act No. 12 of 1997) as amended by the Litter Pollution Regulations 1999 (S.I. No. 359 of 1999) and Protection of the Environment Act 2003, as amended.

4 Eastern-Midlands Waste Region, Eastern-Midlands Region Waste Management Plan 2015 – 2021 (2015).

5 Department of the Environment, Heritage and Local Government (DoEHLG), Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects, (2006).

6 FÁS and the Construction Industry Federation (CIF), Construction and Demolition Waste Management – a handbook for Contractors and Site Managers, (2002).

7 Department of Environment and Local Government (DoELG) Waste Management – Changing Our Ways, A Policy Statement (1998).

8 Forum for the Construction Industry, Recycling of Construction and Demolition Waste (1999).

9 Department of Communications, Climate Action and Environment (DCCAE), Waste Action Plan for the Circular Economy - Ireland's National Waste Policy 2020-2025 (Sept 2020).

10 South Dublin County Council (SDCC), Development Plan 2016-2022 (2016)

11 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.

12 EPA, Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous (2015)

13 Environmental Protection Agency (EPA), National Waste Database Reports 1998 – 2012.

14 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).