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

Aungierstown Substation and transmission lines
Grange Castle South Business Park

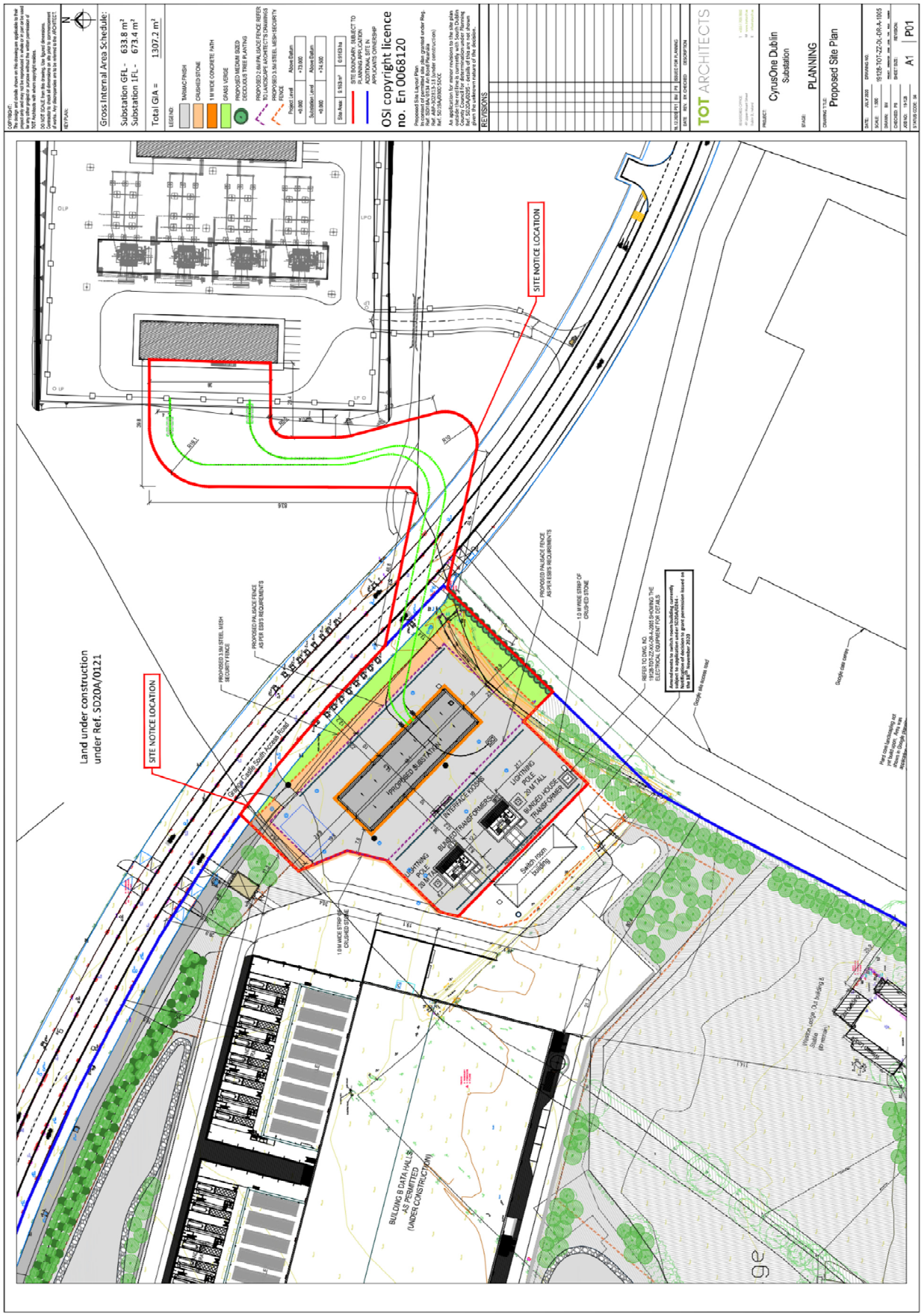
January 2021

MARSTON
PLANNING CONSULTANCY

CONTENTS

CHAPTER 2 DESCRIPTION OF THE PROPOSED DEVELOPMENT

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



Appendix 2.2 Schedule of mitigation measures

Project Phase	Mitigation Measures
	Biodiversity
Construction - *Pollution prevention*	A draft CMP is included as part of the Proposed Development planning application documents. The CMP will be refined by the works contractor prior to commencement of construction and will be implemented by all contractors on site. This document will ensure that storm water and wastewater runoff are managed and will not cause an off-site environmental impact. This document will be developed to include the following: • Silt control on roads; • Discharge water from dewatering systems; • Diversion of clean water; • Treatment and disposal of wastewater from general clean-up of tools and equipment; • Spills control; • Refueling of machinery off-site or at a designated bunded refueling area; and • Silt trapping and oil interception (to be considered where surface water runoff may enter watercourses). The Outline Construction Management Plan (Structuretone, 2020) specifies a range of general pollution prevention measures that will be implemented. The mitigation measures outlined in the Hydrology chapter (Chapter 8) of this EIAR will prevent pollution of the receiving surface water network. These include measures which prevent contaminated surface water run-off entering the stream, measures to prevent spillage of fuels and chemicals, measures to deal with accidental releases and measures to prevent impacts arising from the management of soil removal and compaction.
Construction - *Bats*	Construction phase lighting will be designed to be sensitive to the presence of bats commuting and foraging bats along the eastern boundary of the substation and should 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 2008).*
Construction phase - *Birds*	If vegetation removal must take place in the nesting season, then checks for breeding birds will be undertaken immediately prior to site clearance. Where active nests are found, works must cease until such a time that the nests are deemed inactive.
Construction phase – *Common frog*	If works to clear any of the habitat features suitable to support common frog are to begin during the season where frogspawn or tadpoles may be present (February – mid-summer), a pre-construction survey will be undertaken to determine whether breeding common frogs are present. Any frog spawn, tadpoles, juvenile or adult frogs present will be captured and removed from the affected habitat by hand net and translocated to the nearest area of available suitable habitat, beyond the Zone of influence of the Proposed Development. Any capture and translocation works will be undertaken immediately in advance of site clearance/construction works commencing.
Operational – *Pollution prevention*	In summary, all surface waters from hardstanding areas within the Proposed Development site will pass through an oil interceptor to remove detritus from the water. These waters will be retained onsite in the attenuation tank prior to controlled release into the surface water system.
Operational – *Operational lighting*	Operational phase lighting will be designed to be sensitive to the presence of bats commuting and foraging bats along the northern treeline and southern boundary to the Castlebaggot substation and should 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);* • *Bats and Lighting in the UK – Bats and the Built Environment Series (Bat Conservation Trust UK, January 2008).*

	Land, Soil and Geology
Construction - *CEMP*	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 the installation of the ducting for the cable routes. 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 envisioned that 12,300m^3 of soil/stones will be excavated to facilitate the Proposed Development. Suitable soils and stones will be reused on site as backfill in the grassed areas, where possible. However, it is currently envisaged that majority of the excavated material will require removal offsite for reuse, recovery and/or disposal. Refer to Chapter 14 Waste Management for further detail. 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 Permitted Development will be sourced from reputable suppliers. No fill is required for the Proposed Development that cannot be sourced from the overall Proposed Development site. 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*	As detailed in Chapter 2 ESB Networks implements an Environmental Safety and Health Management System at each of its facilities. Prior to operation of the Proposed Development, a comprehensive set of operational procedures will be established (based on those used at other similar facilities) which will include site-specific mitigation measures and emergency response measures.
Operational – *Fuel storage*	The primary potential impact relates to a failure or accidental spill of diesel fuel which is stored and used on-site for back-up power generation. 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 Proposed Development site will be covered in hardstand (c. 40% - 2530sqm). 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 - general	The design of the Proposed Development has taken account of the potential impacts of the development and the risks to the water environment specific to the areas where construction is taking place. There are two watercourses (Milltown & Baldonnel Streams) to the north and west, which are tributaries of the River Liffey, therefore caution is required to mitigate the potential effects on the local water environment. The Baldonnel Stream is largely culverted through the Grange Castle Business Park and directly north of the proposed substation development and there will be no impact to the quality or flow of this watercourse. Furthermore, where the path of the trenches intersect the culverted local stream the excavations will be performed by hand beneath the culvert with the appropriate supports and measures in place as per the project Construction Management Plan (CMP). There is no direct hydraulic link to the Griffeen of Liffey Rivers or the Grand Canal pNHA to the north. The following measures seek to avoid or minimise potential effects in the main through the implementation of best practice construction methods and adherence to all relevant legislation.
Construction - *CEMP*	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 entre 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. 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 2017 & 2018 (see Chapter 7) 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*	ESB Networks implements an Environmental Safety and Health Management System at each of its facilities. Prior to operation of the Proposed Development, a set of operational procedures will be established (based on those used at other similar facilities) which will include site-specific mitigation measures and emergency response measures.
Operational – *Fuel and chemical handling*	The containment measures planned will minimise the risk of release of solid/ liquid material spillages to the water environment. Containment measures will include storage of fuels on site in bunded containers or compartments. The design of all bunds will conform to standard bunding specifications - BS EN 1992-3:2006, *Design of Concrete Structures – Part 3: Liquid retaining and containment measures.*
Operational – *Storm water & foul sewer drainage*	Storm water from the Proposed Development has been designed in accordance with the GDSDS and ensures that Best Management Practice has been incorporated into the design. Storm water from all other hardstanding areas, except for the roof and surrounds of the MV switch (client control) building & transformer yard (that will drain to the attenuation system of the Permitted Development), will be drained into a new attenuation tank. Further information of the surface and foul water drainage for the Proposed Development is included in the Engineering Planning Report *(Aungierstown 110 kV Sub-Station Engineering Planning Report December 2020*) which is provided as a separate document to this application. The allowable discharge rate (QBAR) according to project Engineers. The allowable discharge rate (QBAR) applicable to the Proposed Development is 0.5 l/s.

	It is proposed to ultimately discharge surface water from the Proposed Development, post attenuation and outflow restrictions, via a 300mm Ø gravity sewer network and connect into the existing manhole, EX SWMH, with a Cover Level of c. 74.02 m and an Invert Level of circa 72.07 m located adjacent to the ESB sub-station, to the north of the subject site. It is proposed to discharge foul water from the Proposed Development, via a 225mm gravity foul sewer network and connect into the aforementioned existing 225mm Ø foul sewer spur to the north of the site. There is an existing manhole, EX FMH, located at the property boundary near the site access to the north, with a Cover Level of circa 74.13m & an Invert Level of circa 72.83m - refer Drawing No. P200401– 200 Rev. D by Pinnacle Consulting Engineers.
Operational – *Water supply*	It is intended to serve the proposed Substation off the existing (8") 200 mm Ø water main spur located adjacent to Grange Castle South Access Road, circa 85m to the west from the site access into the application site. Hydrants will be installed in accordance with Part B of the building regulations, and these are detailed on our engineering drawings - refer Drawing No. P200401-200 Rev. A. Water demand for the development has been based on design loadings as indicated by Irish Water, i.e. 150 ltr/person/day, giving an estimated average water demand of 3,000litres/day (0.004 litres/second). The peak water demand is calculated as being circa 0.02litres/second. Water meters in line with South Dublin County Council & 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. The vibration from construction activities to off-site residences will 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 9.3 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 that have an increased potential in giving rise to issues off site (Note: no rock breaking is anticipated as part of the Proposed Development).
Operational - *Building services noise / emergency site operation*	Once operational, there are no noise or vibration mitigation 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.
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 – *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). • 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. • 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. • 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 permitted development (SDCC Reg. Ref.SD18A/0134 / An Bord Pleanala Ref. ABP-302813-18) 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 impact
Operational – *visual impact*	The Proposed Development is situated on suitably zoned lands in a landscape where a number of large developments have been recently constructed or have recently acquired planning permission. The Permitted Data Centre Development (described in detail in chapter 2 of this EIAR) will precede the construction of the Proposed Development and the built development and the significant landscape scheme permitted as part of the Permitted Development will provide substantial mitigation of the Proposed Development. The mitigation of potential negative landscape and visual impacts of the Proposed Development was considered in the application made for the Permitted Development under SDCC Planning Reg. Ref. SD18A/0134. No additional landscape mitigation measures are therefore proposed as part of the Proposed Development beyond minor changes to the minimal planting to the north and east of the proposed substation that will increase the visibility of the substation in localised views from the north and east. As a result of the mitigations measures, the following landscape design mitigation measures will continue to be implemented as part of the Permitted Development: • earth modelling and large tree planting, reinforced with woodland whip planting in belts is proposed to provide a high level of visual screening of the most sensitive views of the development; • set back of built development form the perimeter of the lands to accommodate significant landscape buffer zones; and • incorporation of the stormwater attenuation systems as above ground wetlands and ponds to improve the amenity, visual and biodiversity value of the landscape.
	Traffic and transportation
Construction – *traffic and transportation*	A detailed Construction Traffic Management Plan (CTMP) has been prepared by the Main Contractor to minimise the potential impact of the construction phase of the Permitted Development that is currently under construction. The Detailed Construction Traffic Management Plan (CTMP) will be updated by the Main Contractor and will consider the potential impact of any additional construction phase traffic associated with the proposed GIS Substation and transmission lines. The Updated Detailed CTMP will consider:

	• 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. Construction traffic will minimise movements during peak hours; and • Construction traffic routes shall be use strategically by construction vehicles to minimise traffic impact to surrounding properties. The construction 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. During the construction phase, the Contractor will be required to appoint a Construction Traffic Manager who will ensure that car sharing is encouraged and that the use of single occupancy vehicles to access the site is minimised. Further, construction personnel will be made aware of the public transport options in the locale at staff induction stage. Public transport timetables and information will be posted on notice boards, at appropriate locations, within the Site Compound.
Operational – *traffic and transportation*	The traffic impact assessment for the operational phase are significantly below the thresholds stated in the TII Guidelines for Traffic and Transport Assessments, 2014 for junction analysis. Therefore, no mitigation measures in the form of junction modifications are proposed on the public road to facilitate the Proposed Development.
	Cultural heritage
Construction / Operation	The mitigation strategies outlined in this section detail the techniques to be adopted in order to ameliorate the impacts that the Proposed Development may have on features of archaeological, architectural and/or cultural heritage within the study area during both the construction and operation phases of the scheme. The following proposed mitigation measures are subject to approval by South Dublin County Council and the National Monuments Service, Department of Housing, Local Government and Heritage: 1. A programme of archaeological monitoring of groundworks associated with the cable connection route to the north of the Grange Castle South Business Park Access Road will be carried out. This should be carried out by a suitably qualified archaeologist under license and in accordance with the provisions of the National Monuments Acts 1930-2004. 2. If archaeological material is encountered, then it will be investigated and fully recorded. However, if significant archaeological material is encountered then the National Monuments Service (DoHLGH) will be notified. Resolution of any such significant material will be determined in consultation with the National Monuments Service (DoHLGH). 3. No further archaeological works are required in relation to development works within the sub-station compound site on the south side of the Grange Castle South Access Road. 4. A written report will be prepared detailing the results of all archaeological work undertaken.
	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.

	The project engineers have estimated that 1,050m^3 of excavated material will be generated by the trench of the transmission lines and 11,250m^3 by the proposed substation. Suitable soils and stones will be reused on site as backfill in the grassed areas, where possible. However, it is currently envisaged that majority of this material will require removal offsite. It will be reused offsite where practical and where it cannot be reused, it will be recycled/recovered. 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 previously referred to Section 14.24 and 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 and 49kVa cable installation 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 Permitted and Proposed Development site, and there will therefore be no offsite impact. The excavation of trenches within the vicinity of existing electrical services will be carried out by hand and 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. SD18A/0134 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 power available from the existing area network for the Proposed Development. The nature of the Proposed Development ensures that it will facilitate continuity of supply of electricity to the Permitted Development. The proposed substation will only use a minimal amount of electricity provided by the temporary ESB substation. 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.

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 network1 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 2019; 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.*

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).

[1] 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.[2]
- 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)[3] 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).[4]

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)[5] of the following:
  - Species protected under the Wildlife Acts; and/or
  - Species listed on the relevant Red Data list.
- Site containing 'viable areas'[6] of the habitat types listed in Annex I of the Habitats Directive

County Importance:

- Area of Special Amenity.[7]
- 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)[8] 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.

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

[3] 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.

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

[5] 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.

[6] 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).

[7] 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.

[8] 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.

- Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the 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)[9] 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.

[9] 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
Yorkshire Fog	*Holcus lanatus*
Perennial Rye	*Lolium perenne*
Ribwort plantain	*Plantago lanceolata*
Ragwort	*Jacobaea vulgaris*
White clover	*Trifolium repens*
Creeping Thistle	*Cirsium arvense*
Broad-leaved Dock	*Rumex obtusifolius*
Poppy	*Papaver sp.*

Improved amenity grassland (GA2)

Common Name	Scientific Name
Perennial Rye	*Lolium perenne*
Ribwort plantain	*Plantago lanceolata*
Poppy	*Papaver sp.*
White clover	*Trifolium repens*

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[10]	Red-Listing Status[11]
Plants			
Ribbonwort	*Pallavicinia lyellii*	FPO	Endangered
Many-seasoned Thread-moss	*Bryum intermedium*	FPO	Endangered
Amphibians			
Common Frog	*Rana temporaria*	HD V, WA	Least Concern
Smooth Newt	*Lissotriton vulgaris*	WA	Least Concern
Mammals			
Red Deer	*Cervus elaphus*	WA	Least Concern
Badger	*Meles meles*	HD II IV, WA	Least Concern
Otter	*Lutra lutra*	HD II IV, WA	Near Threatened
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	Near Threatened
Pipistrelle	*Pipistrellus pipistrellus sensu lato*	HD IV, WA	Least Concern
Soprano Pipistrelle	*Pipistrellus pygmaeus*	HD IV, WA	Least Concern
Pygmy Shrew	*Sorex minutus*	WA	Least Concern
Hedgehog	*Erinaceus europaeus*	WA	Least Concern
Pine marten	*Martes martes*	HD V, WA	Least Concern
Red squirrel	*Sciurus vulgaris*	WA	Least Concern
Birds			
Barn Owl	*Tyto alba*	WA	Red Listed
Black-Headed Gull	*Larus ridibundus*	WA	Red Listed
Corn Crake	*Crex crex*	BD I, WA	Red Listed
Curlew	*Numenius arquata*	BD II (II), WA	Red Listed
Golden Plover	*Pluvialis apricaria*	BD I II (II), III (III), WA	Red Listed
Grey Partridge	*Perdix perdix*	BD II III, WA	Red Listed
Herring Gull	*Larus argentatus*	WA	Red Listed
Lapwing	*Vanellus vanellus*	BD II (II), WA	Red Listed
Pintail	*Anas acuta*	BD II (I) III (II), WA	Red Listed
Red Grouse	*Lagopus lagopus*	BD II (I) III (I), WA	Red Listed
Redshank	*Tringa totanus*	WA	Red Listed
Yellowhammer	*Emberiza citrinella*	WA	Red Listed
Greylag Goose	*Anser anser*	BD III (II), WA, Regulation S.I. 477 (Ireland)	Amber Listed
Hen Harrier	*Circus cyaneus*	BD I, WA	Amber Listed
House Martin	*Delichon urbicum*	WA	Amber Listed
House Sparrow	*Passer domesticus*	WA	Amber Listed
Kestrel	*Falco tinnunculus*	WA	Amber Listed
Kingfisher	*Alcedo atthis*	BD I, WA	Amber Listed
Little egret	*Egretta garzetta*	BD I, WA	Green Listed
Merlin	*Falco columbarius*	BD I, WA	Amber Listed
Peregrine Falcon	*Falco peregrinus*	BD I, WA	Green Listed
Whooper Swan	*Cygnus cygnus*	BD I, WA	Amber Listed
Invertebrates			
Marsh fritillary butterfly	*Euphydryas aurinia*	HD II	Vulnerable
Small Blue	*Cupido minimus*		Endangered
Wall butterfly	*Lasiommata megera*		Endangered
Andrena (Melandrena) nigroaenea	*Andrena (Melandrena) nigroaenea*		Vulnerable
Andrena (Micrandrena) semilaevis	*Andrena (Micrandrena) semilaevis*		Vulnerable

[10] HDII/IV/V = Habitats Directive Annexes II/IV/V; FPO = Flora Protection Order; WA = Wildlife Acts; BD I = Birds Directive Annex I.
[11] 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.

Great Yellow Bumble Bee	*Bombus (Subterraneobombus) distinguendus*		Endangered
Red-tailed Carder Bee	*Bombus (Thoracombus) ruderarius*		Vulnerable
Sphecodes hyalinatus	*Sphecodes hyalinatus*		Vulnerable

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 Trial Pit Logs – IGSL Ltd. 2017/2018 (IGSL, 2018)

TRIAL PIT RECORD

REPORT NUMBER 20544

CONTRACT	Cyrus One, Grange Castle	**TRIAL PIT NO.**	**TP01**
		SHEET	Sheet 1 of 1
LOGGED BY	L. Daniels	**CO-ORDINATES**	702,797.38 E 730,799.24 N
		DATE STARTED	06/11/2017
		DATE COMPLETED	06/11/2017
CLIENT	Cyrus One	**GROUND LEVEL (m)**	70.77
ENGINEER	Downes Associates	**EXCAVATION METHOD**	JCB 3CX eco

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL									
Firm light grey brown slightly gravelly SILT/CLAY with a low cobble content.		0.30	70.47		AA71157	B	0.50		
Possible Highly Weathered Rockhead recovered as Firm very gravelly CLAY with a high cobble content and a low boulder content (up to 400mm). Gravel is angular to subangular fine to coarse of argillaceous limestone.		0.70	70.07		AA71158	B	1.00		
1.0									
2.0				1 (Seepage)	AA71159	B	2.00		
Possible Weathered Rockhead recovered as Angular tabular COBBLES and BOULDERS of medium strong dark grey argillaceous limestone with some (moist) firm grey brown very gravelly CLAY. Gravel is angular to subangular platy of limestone.		2.30	68.47						
End of Trial Pit at 2.60m		2.60	68.17	2 (Moderate)					

Groundwater Conditions
Seepage at 2.20m. Groundwater at 2.60m. Slight putrid odour from groundwater.

Stability
Moderate to poor from 1.30m with slight sidewall collapse

General Remarks

IGSL TP LOG 20544.GPJ IGSL.GDT 22/12/17

TRIAL PIT RECORD

REPORT NUMBER 20544

CONTRACT	Cyrus One, Grange Castle	**TRIAL PIT NO.**	**TP02**
		SHEET	Sheet 1 of 1
LOGGED BY	JL	**CO-ORDINATES**	702,784.58 E 730,767.58 N
		DATE STARTED	06/11/2017
		DATE COMPLETED	06/11/2017
CLIENT	Cyrus One	**GROUND LEVEL (m)**	70.94
ENGINEER	Downes Associates	**EXCAVATION METHOD**	JCB 3CX eco

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft brown slightly sandy silty CLAY with occasional rootlets. Sand is fine to medium.									
	Firm light grey brown occasionally mottled orange sandy gravelly CLAY with a medium to high cobble content. Sand is fine to medium. Gravel is angular to subrounded fine to coarse of limestone. Cobbles are angular to subangular of limestone.		0.30	70.64		AA70609	B	0.40-0.50		
1.0	1.0m Many angular cobbles of limestone									
	Angular blocky COBBLES and BOULDERS of limestone with some firm brown mottled grey brown and orange sandy gravelly CLAY. Sand is fine to medium. Gravel is angular to subangular platy of limestone.		1.10	69.84		AA70610	B	1.15-1.20		
2.0					1 (Moderate)					
	Stiff dark grey gravelly CLAY with a high cobble content and boulder content. Gravel is angular to subangular fine to coarse of medium strong limestone and rarely shaley mudstone. Cobbles and boulders are angular to subangular blocky of limestone (up to 600mm).		2.45	68.49		AA70611	B	2.45-2.50		
	Pit terminated on Possible Rockhead / Boulders of limestone End of Trial Pit at 2.70m		2.70	68.24						

Groundwater Conditions
Groundwater entering base at 2.10m

Stability
Poor stability from 1.30m with sidewall collapse

General Remarks
Toothless bucket used from ground level to 1.25m bgl. Toothed bucket deployed from 1.25m to assist dig. Slow progress on possible highly weathered rockhead from 1.30m.

IGSL TP LOG 20544.GPJ IGSL.GDT 22/12/17

TRIAL PIT RECORD

REPORT NUMBER 20544

CONTRACT	Cyrus One, Grange Castle	TRIAL PIT NO.	TP03
		SHEET	Sheet 1 of 1
LOGGED BY	L. Daniels	CO-ORDINATES	702,767.70 E 730,717.77 N
		DATE STARTED	06/11/2017
		DATE COMPLETED	06/11/2017
CLIENT	Cyrus One	GROUND LEVEL (m)	71.27
ENGINEER	Downes Associates	EXCAVATION METHOD	JCB 3CX eco

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL									
	Firm light grey brown slightly gravelly SILT/CLAY with a low cobble and boulder content (up to 300mm)		0.30	70.97		AA71160	B	0.50		
1.0	Possible Highly Weathered Rockhead recovered as grey very gravelly CLAY with a high cobble content and a low boulder content (up to 400mm). Gravel is fine to coarse angular to subangular of argillaceous limestone and mudstone.		1.00	70.27		AA71161	B	1.20		
2.0	Possible Weathered Rockhead recovered as dark grey slightly sandy clayey angular to subangular fine to coarse GRAVEL with a high cobble content and a low boulder content (up to 400mm).		2.00	69.27		AA71162	B	2.00		
	OBSTRUCTION End of Trial Pit at 2.50m		2.50	68.77	(Moderate)					

Groundwater Conditions
Groundwater at 2.50m

Stability
Moderate to poor with sidewall collapse from 1.40m

General Remarks

IGSL TP LOG 20544.GPJ IGSL.GDT 22/12/17

TRIAL PIT RECORD

REPORT NUMBER 20544

CONTRACT	Cyrus One, Grange Castle	TRIAL PIT NO.	TP04
		SHEET	Sheet 1 of 1
LOGGED BY	L. Daniels	CO-ORDINATES	702,757.32 E 730,666.75 N
		DATE STARTED	06/11/2017
		DATE COMPLETED	06/11/2017
CLIENT	Cyrus One	GROUND LEVEL (m)	71.99
ENGINEER	Downes Associates	EXCAVATION METHOD	JCB 3CX eco

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL									
Firm brown slightly sandy gravelly SILT/CLAY		0.40	71.59						
Firm grey mottled brown slightly sandy very gravelly SILT/CLAY with a medium cobble content and a medium boulder content (up to 300mm). Gravel is angular to subangular fine to coarse.		0.70	71.29						
1.0					AA71163	B	1.00		
Possible Highly Weathered Rockhead recovered as dark grey slightly sandy clayey fine to coarse angular to subangular GRAVEL with a high cobble content and medium boulder content (up to 600mm)		1.80	70.19	1 (Seepage)					
2.0					AA71164	B	2.00		
				2 (Moderate)					
OBSTRUCTION End of Trial Pit at 2.50m		2.50	69.49						

Groundwater Conditions
Seepage at 1.80m. Groundwater at 2.40m.

Stability
Wall collapse from 0.90m

General Remarks

IGSL TP LOG 20544.GPJ IGSL.GDT 22/12/17

TRIAL PIT RECORD

REPORT NUMBER 20544

CONTRACT	Cyrus One, Grange Castle	TRIAL PIT NO.	TP05
		SHEET	Sheet 1 of 1
LOGGED BY	L. Daniels	CO-ORDINATES	702,790.79 E 730,660.19 N
		DATE STARTED	06/11/2017
		DATE COMPLETED	06/11/2017
CLIENT	Cyrus One	GROUND LEVEL (m)	72.25
ENGINEER	Downes Associates	EXCAVATION METHOD	JCB 3CX eco

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL									
	Firm light grey brown slightly sandy slightly gravelly SILT/CLAY with a low cobble content.		0.30	71.95		AA71165	B	0.50		
	Firm to stiff grey brown very gravelly CLAY with a medium cobble content. Gravel is subangular fine to coarse of limestone.		0.70	71.55						
1.0						AA71166	B	1.00		
	Possible Highly Weathered recovered as firm to stiff dark grey slightly sandy very gravelly CLAY with a high cobble content and a low boulder content (up to 400mm). Gravel is angular to subangular fine to coarse of argillaceous limestone and mudstone.		1.60	70.65						
2.0						AA71167	B	2.00		
	Possible Highly Weathered Rockhead recovered as grey black slightly clayey angular GRAVEL		2.60	69.65	1 (Moderate)	AA71168	B	2.60		
	End of Trial Pit at 2.70m		2.70	69.55						

Groundwater Conditions
Groundwater at 2.60m

Stability
Good

General Remarks

IGSL TP LOG 20544.GPJ IGSL.GDT 22/12/17

TRIAL PIT RECORD

REPORT NUMBER 20544

CONTRACT	Cyrus One, Grange Castle	TRIAL PIT NO.	TP06
		SHEET	Sheet 1 of 1
LOGGED BY	L. Daniels	CO-ORDINATES	702,833.88 E 730,650.03 N
		DATE STARTED	07/11/2017
		DATE COMPLETED	07/11/2017
CLIENT	Cyrus One	GROUND LEVEL (m)	73.14
ENGINEER	Downes Associates	EXCAVATION METHOD	JCB 3CX eco

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL									
Firm brown gravelly CLAY		0.40	72.74		AA71169	B	0.50		
Firm grey slightly sandy very gravelly CLAY with a medium cobble content and low boulder content (up to 300mm).		0.90	72.24		AA71170	B	1.10		
2.0 Possible Highly Weathered Rockhead recovered as brown mottled grey slightly sandy silty/clayey fine to coarse angular to subangular GRAVEL with a high cobble content		1.90	71.24		AA71171	B	2.00		
Pit terminated on Possible Rockhead / Boulders of limestone End of Trial Pit at 2.50m		2.50	70.64						

Groundwater Conditions
Dry

Stability
Good

General Remarks

IGSL TP LOG 20544.GPJ IGSL.GDT 22/12/17

TRIAL PIT RECORD

REPORT NUMBER 20544

CONTRACT	Cyrus One, Grange Castle	TRIAL PIT NO.	TP07
		SHEET	Sheet 1 of 1
LOGGED BY	L. Daniels	CO-ORDINATES	702,873.60 E 730,639.46 N
		DATE STARTED	07/11/2017
		DATE COMPLETED	07/11/2017
CLIENT	Cyrus One	GROUND LEVEL (m)	73.62
ENGINEER	Downes Associates	EXCAVATION METHOD	JCB 3CX eco

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL									
		0.40	73.22						
Firm light grey brown very gravelly CLAY with a low cobble content. Gravel is subangular fine to coarse of limestone.					AA71172	B	0.50		
		0.70	72.92						
Firm to stiff grey brown sandy very gravelly CLAY with a medium cobble content and a low boulder content (up to 400mm). Gravel is angular to subangular fine to coarse of limestone.									
1.0					AA71173	B	1.00		
		1.80	71.82						
Possible Weathered Rockhead recovered as dark grey slightly sandy clayey fine to coarse angular to subangular GRAVEL with a high cobble content and a low boulder content (up to 400mm).									
2.0					AA71174	B	2.00		
		2.40	71.22						
Possible Rockhead recovered as Angular to subangular COBBLES of limestone with a little brown gravelly CLAY		2.50	71.12						
Pit terminated on Possible Rockhead / Boulders of limestone End of Trial Pit at 2.50m									

Groundwater Conditions
Dry

Stability
Good

General Remarks

IGSL TP LOG 20544.GPJ IGSL.GDT 22/12/17

TRIAL PIT RECORD

REPORT NUMBER 20544

CONTRACT	Cyrus One, Grange Castle	TRIAL PIT NO.	TP13
		SHEET	Sheet 1 of 1
LOGGED BY	L. Daniels	CO-ORDINATES	702,897.44 E 730,623.03 N
		DATE STARTED	07/11/2017
		DATE COMPLETED	07/11/2017
CLIENT	Cyrus One	GROUND LEVEL (m)	74.16
ENGINEER	Downes Associates	EXCAVATION METHOD	JCB 3CX eco

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL									
Firm brown slightly gravelly SILT/CLAY with a low cobble content		0.30	73.86		AA71175	B	0.50		
1.0 Firm to stiff grey brown sandy very gravelly SILT/CLAY with a medium cobble content and a low boulder content (up to 400mm).		1.10	73.06		AA71176	B	1.20		
2.0 Possible Weathered Rockhead recovered as dark grey slightly sandy very clayey fine to coarse angular to subangular GRAVEL of limestone and mudstone with a high cobble content and low boulder content (up to 400mm)		2.00	72.16		AA71177	B	2.20		
Pit terminated on Possible Rockhead / Boulders of limestone End of Trial Pit at 2.50m		2.50	71.66	(Moderate)					

Groundwater Conditions
Groundwater at 2.50m

Stability
Good

General Remarks

IGSL TP LOG 20544.GPJ IGSL.GDT 22/12/17

TRIAL PIT RECORD

REPORT NUMBER 20544

CONTRACT	Cyrus One, Grange Castle	TRIAL PIT NO.	TP14
		SHEET	Sheet 1 of 1
LOGGED BY	L. Daniels	CO-ORDINATES	702,934.43 E 730,607.67 N
		DATE STARTED	07/11/2017
		DATE COMPLETED	07/11/2017
CLIENT	Cyrus One	GROUND LEVEL (m)	75.12
ENGINEER	Downes Associates	EXCAVATION METHOD	JCB 3CX eco

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL									
Firm brown slightly gravelly SILT/CLAY		0.40	74.72		AA71178	B	0.50		
Firm to stiff grey and grey brown sandy very gravelly CLAY with a medium cobble content		0.90	74.22		AA71179	B	1.10		
2.0 Possible Weathered Rockhead recovered as dark grey slightly sandy clayey fine to coarse angular to subangular GRAVEL with a high cobble content and a low boulder content (up to 400mm).		1.90	73.22		AA71180	B	2.10		
Pit terminated on Possible Rockhead / Boulders of limestone End of Trial Pit at 2.20m		2.20	72.92						

Groundwater Conditions
Dry

Stability
Good

General Remarks

IGSL TP LOG 20544.GPJ IGSL.GDT 22/12/17

TRIAL PIT RECORD

REPORT NUMBER 20544

CONTRACT	Cyrus One, Grange Castle	**TRIAL PIT NO.**	**TP17**
		SHEET	Sheet 1 of 1
LOGGED BY	JL	**CO-ORDINATES**	703,136.66 E 730,641.25 N
		DATE STARTED	06/11/2017
		DATE COMPLETED	06/11/2017
CLIENT	Cyrus One	**GROUND LEVEL (m)**	74.57
ENGINEER	Downes Associates	**EXCAVATION METHOD**	JCB 3CX eco

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL: Soft brown sandy slightly gravelly CLAY with occasional rootlets. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse of limestone.									
Firm light grey brown and orange sandy gravelly clayey SILT with a medium cobble content. Sand is fine to medium. Gravel is angular to subangular fine to coarse of limestone. Cobbles are angular platy of limestone.		0.30	74.27		AA70605	B	0.40-0.50		
1.0 Firm to stiff grey brown mottled light brown sandy gravelly CLAY with a medium cobble content. Sand is fine to medium. Gravel is angular to subangular fine to coarse of limestone. Cobbles are angular elongate of limestone.		1.05	73.52		AA70606	B	1.20-1.30		
1.35m Angular boulder-sized tabular fragments of limestone (up to 400mm)		1.40	73.17						
Possible Weathered Rockhead recovered as Angular tabular COBBLES and BOULDERS of medium strong dark grey argillaceous limestone with some (moist) firm grey brown very gravelly CLAY. Gravel is angular to subangular platy of limestone.				1 (Seepage)	AA70607	B	1.50-1.60		
2.0				2 (Moderate)					
Possible Highly Weathered Mudstone recovered as Soft to firm dark grey sandy gravelly SILT with a medium cobble and low boulder content. Sand is fine to medium. Gravel is angular to subangular fine to coarse of mudstone and argillaceous limestone. Cobbles and boulders are angular of limestone.		2.40	72.17		AA70608	B	2.40-2.50		
Pit terminated on Possible Rockhead / Boulders of limestone End of Trial Pit at 2.80m		2.80	71.77						

Groundwater Conditions
Seepage at 1.75m. Groundwater entering base at 2.10m.

Stability
Poor stability from 1.50m

General Remarks
Toothless bucket used from ground level to 1.30m bgl. Toothed bucket deployed from 1.30m to assist dig.

IGSL TP LOG 20544.GPJ IGSL.GDT 22/12/17

TRIAL PIT RECORD

REPORT NUMBER 20544

CONTRACT	Cyrus One, Grange Castle	TRIAL PIT NO.	TP18
		SHEET	Sheet 1 of 1
LOGGED BY	JL	CO-ORDINATES	703,129.76 E 730,674.76 N
		DATE STARTED	06/11/2017
		DATE COMPLETED	06/11/2017
CLIENT	Cyrus One	GROUND LEVEL (m)	74.12
ENGINEER	Downes Associates	EXCAVATION METHOD	JCB 3CX eco

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL: Soft brown sandy CLAY with occasional rootlets. Sand is fine to medium.									
Firm and firm to stiff light grey brown occasionally mottled orange brown sandy gravelly CLAY with a medium cobble content. Sand is fine to medium. Gravel is angular to subangular fine to coarse elongate of argillaceous limestone. Cobbles are angular to subangular of limestone.		0.30	73.82		AA70601	B	0.40-0.50		
1.0									
1.25m Occasional subangular tabular boulder of limestone (up to 400mm)		1.30	72.82		AA70602	B	1.30-1.40		
Firm to stiff grey brown sandy very gravelly CLAY with a medium cobble content and a low boulder content. Sand is fine to medium. Gravel is angular tosubangular fine to coarse occasionally platy of argillaceous limestone. Cobbles and boulders are angular tabular of limestone.		1.50	72.62						
Possible Highly Weathered Rockhead recovered as firm dark grey slightly sandy very gravelly CLAY with a low to medium cobble content. Sand is fine to medium. Gravel is angular to subangular platy of weak and medium strong argillaceous limestone with occasional mudstone.					AA70603	B	1.70-1.80		
2.0									
Weathered Rockhead recovered as Angular COBBLE and BOULDER-sized fragments of medium strong dark grey limestone with a little dark grey CLAY and occasional pocket of weak dark grey fissile shaley mudrock.		2.10	72.02	1 (Moderate)	AA70604	B	2.10-2.20		
End of Trial Pit at 2.25m		2.25	71.87						

Groundwater Conditions
Moist at 1.80m. Groundwater entering base of pit at 2.20m.

Stability
Slight spalling from 1.50m

General Remarks
Toothless bucket used from ground level to 1.25m bgl. Toothed bucket deployed from 1.25m to assist dig.

IGSL TP LOG 20544.GPJ IGSL.GDT 22/12/17

TRIAL PIT RECORD

REPORT NUMBER 20544

CONTRACT	Cyrus One, Grange Castle	TRIAL PIT NO.	TP20
		SHEET	Sheet 1 of 1
LOGGED BY	L. Daniels	CO-ORDINATES	702,842.81 E 730,798.32 N
		DATE STARTED	06/11/2017
		DATE COMPLETED	06/11/2017
CLIENT	Cyrus One	GROUND LEVEL (m)	70.93
ENGINEER	Downes Associates	EXCAVATION METHOD	JCB 3CX eco

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL									
Firm light grey brown very gravelly CLAY with a medium cobble content and a low boulder content (up to 400mm)		0.30	70.63		AA71154	B	0.50		
1.0					AA71155	B	1.50		
2.0 Possible Highly Weathered Rockhead recovered as firm dark grey slightly sandy very gravelly CLAY with a medium cobble content and a medium boulder content (<300mm). Cobbles and boulders are of argillaceous limestone.		1.90	69.03		AA71156	B	2.20		
OBSTRUCTION End of Trial Pit at 2.40m		2.40	68.53	(Moderate)					

Groundwater Conditions
Groundwater at 2.40m

Stability
Wall collapse from 1.40m

General Remarks

IGSL TP LOG 20544.GPJ IGSL.GDT 22/12/17

TRIAL PIT RECORD

REPORT NUMBER 20544

CONTRACT	Cyrus One, Grange Castle (Part 2)	TRIAL PIT NO.	TP08
		SHEET	Sheet 1 of 1
LOGGED BY	JB	CO-ORDINATES	
		DATE STARTED	13/03/2018
		DATE COMPLETED	13/03/2018
CLIENT	Cyrus One	GROUND LEVEL (m)	
ENGINEER	Pinnacle / AWN	EXCAVATION METHOD	JCB 3CX eco

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft brown slightly gravelly sandy CLAY with occasional rootlets. Sand is fine. Gravel is subangular fine.									
	Soft brown slightly gravelly sandy CLAY with a low cobble content and occasional rootlets. Sand is fine. Gravel is subangular fine. Cobbles are subangular platy.		0.30							
	Firm brown grey gravelly sandy CLAY/SILT with a low to medium cobble content and boulder content. Sand is fine. Gravel is subangular medium. Cobbles and boulders are angular to subangular tabular.		0.60				B	0.80-1.00		
1.0	1.0m - Orange colour mottling									
	Firm to stiff brown grey gravelly sandy CLAY/SILT with a medium cobble content. Sand is fine. Gravel is subangular medium. Cobbles are angular to subangular platy.		1.30		1 (Slow)		B	1.30-1.50		
	Possible Very Highly Weathered Rockhead recovered as firm to stiff brown grey gravelly sandy CLAY/SILT with a high cobble and boulder content. Sand is fine. Gravel is subangular medium. Cobbles are angular tabular.		1.50				B	1.60-1.80		
2.0	End of Trial Pit at 2.00m		2.00							

Groundwater Conditions
Slow flow at 1.30m

Stability
Poor stability from 1.30m with sidewall collapse

General Remarks
Pit terminated on obstruction / possible weathered rockhead

IGSL TP LOG 20544 PART 2.GPJ IGSL.GDT 20/3/18

TRIAL PIT RECORD

REPORT NUMBER 20544

CONTRACT	Cyrus One, Grange Castle (Part 2)	TRIAL PIT NO.	TP09
		SHEET	Sheet 1 of 1
LOGGED BY	JL	CO-ORDINATES	
		DATE STARTED	13/03/2018
		DATE COMPLETED	13/03/2018
CLIENT	Cyrus One	GROUND LEVEL (m)	
ENGINEER	Pinnacle / AWN	EXCAVATION METHOD	JCB 3CX eco

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL: Soft brown slightly sandy CLAY with occasional rootlets. Sand is fine to medium.									
Soft to firm yellow brown and brown sandy SILT/CLAY. Sand is fine to medium.		0.40							
Firm brown and grey brown sandy very gravelly CLAY/SILT with a medium to high cobble content and low to medium boulder content. Sand is fine to medium. Gravel is angular to subangular tabular of limestone (up to 300mm).		0.60			AA70621	B	0.70-0.80		
1.0 Firm to stiff grey brown sandy gravelly CLAY with a medium to high cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of limestone. Cobbles are angular to subangular frequently platy tabular of limestone.		1.10			AA70622	B	1.20-1.30		
Possible Highly Weathered Rockhead recovered as Angular platy fine to coarse GRAVEL of moderately weak grey black Mudstone with some clayey sand and a medium cobble content. Sand is fine to coarse. Cobbles are angular to subangular of mudstone.		1.85		(Moderate)	AA70623	B	1.85-1.90		
2.0 End of Trial Pit at 1.90m		1.90							

Groundwater Conditions
Moderate infow in base of pit at 1.85m

Stability
Good

General Remarks
Pit terminated on obstruction / possible weathered rockhead

IGSL TP LOG 20544 PART 2.GPJ IGSL.GDT 20/3/18

TRIAL PIT RECORD

REPORT NUMBER 20544

CONTRACT	Cyrus One, Grange Castle (Part 2)	TRIAL PIT NO.	TP10
		SHEET	Sheet 1 of 1
LOGGED BY	JL	CO-ORDINATES	
		DATE STARTED	13/03/2018
		DATE COMPLETED	13/03/2018
CLIENT	Cyrus One	GROUND LEVEL (m)	
ENGINEER	Pinnacle / AWN	EXCAVATION METHOD	JCB 3CX eco

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL: Soft brown slightly sandy CLAY with occasional rootlets. Sand is fine to medium.									
Soft to firm yellow brown sandy SILT/CLAY. Sand is fine to medium.		0.30							
Firm to stiff brown mottled orange brown slightly sandy gravelly CLAY with a medium cobble and boulder content. Sand is fine to medium. Gravel is angular to subrounded fine to coarse of limestone. Cobbles and boulders are angular to subangular of limestone (up to 250mm).		0.45			AA70617	B	0.50-0.60		
(Uncompact) Dark grey slightly silty/clayey very gravelly coarse SAND. Gravel is subangular to subrounded fine to medium of limestone.		0.90			AA70618	B	1.10-1.20		
Angular COBBLES AND BOULDERS of limestone (up to 350mm)		1.30							
(Uncompact) Grey brown slightly clayey/silty very sandy GRAVEL with a medium cobble content and occasional pocket of soft grey and brown silty CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to medium of limestone.		1.45		1 (Seepage)	AA70619	B	1.50-1.60		
2.0 (Uncompact) Grey clayey/silty sandy GRAVEL with a medium cobble and boulder content. Gravel is angular platy of mudstone. Cobbles and boulders are angular tabular of mudstone.		2.00			AA70620	B	2.65-2.85		
End of Trial Pit at 2.85m		2.85							

Groundwater Conditions
Multiple seepages at 1.65m bgl. Upon completion of dig, water level at 2.30m after 20min

Stability
Poor stability from 0.90m in gravelly Sand with multiple sidewall collapse

General Remarks
Pit terminated on obstruction / possible boulder or weathered rockhead

IGSL TP LOG 20544 PART 2.GPJ IGSL.GDT 20/3/18

TRIAL PIT RECORD

REPORT NUMBER 20544

CONTRACT	Cyrus One, Grange Castle (Part 2)	TRIAL PIT NO.	TP11
		SHEET	Sheet 1 of 1
LOGGED BY	JL	CO-ORDINATES	
		DATE STARTED	13/03/2018
		DATE COMPLETED	13/03/2018
CLIENT	Cyrus One	GROUND LEVEL (m)	
ENGINEER	Pinnacle / AWN	EXCAVATION METHOD	JCB 3CX eco

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL: Soft brown slightly sandy CLAY with occasional rootlets. Sand is fine to medium.									
Firm brown slightly sandy slightly gravelly SILT/CLAY. Sand is fine to medium. Gravel is subangular to subrounded fine to medium of limestone.		0.35							
Firm brown to light brown very gravelly sandy CLAY with a medium to high cobble content and a low boulder content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles and boulders are angular to subangular occasionally elongate / tabular of limestone (up to 250mm).		0.65			AA70615	B	0.70-0.80		
1.0									
Firm grey brown mottled orange slightly sandy very gravelly CLAY with a high cobble and medium boulder content. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles and boulders are angular to subangular occasionally blocky of muddy limestone (up to 500mm).		1.80							
2.0					AA70616	B	2.20-2.30		
				1 (Seepage)					
End of Trial Pit at 2.70m		2.70							

Groundwater Conditions
Becoming moist at 1.70m. Seepage from 2.65m. Upon completion of dig, water level measured at 2.50m.

Stability
Moderate stability from 1.40m to 2.0m, otherwise good.

General Remarks
Pit terminated on obstruction / possible weathered rockhead

IGSL TP LOG 20544 PART 2.GPJ IGSL.GDT 20/3/18

TRIAL PIT RECORD

REPORT NUMBER 20544

CONTRACT	Cyrus One, Grange Castle (Part 2)	TRIAL PIT NO.	TP12
		SHEET	Sheet 1 of 1
LOGGED BY	JL	CO-ORDINATES	
		DATE STARTED	13/03/2018
		DATE COMPLETED	13/03/2018
CLIENT	Cyrus One	GROUND LEVEL (m)	
ENGINEER	Pinnacle / AWN	EXCAVATION METHOD	JCB 3CX eco

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL: Soft brown slightly sandy slightly gravelly CLAY with occasional rootlets. Sand is fine to medium. Gravel is subangular to subrounded fine to medium of limestone.									
Firm brown sandy gravelly CLAY with a low to medium cobble content. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles are subangular to subrounded of limestone.		0.35			AA70612	B	0.40-0.50		
Stiff brown sandy very gravelly CLAY with a high cobble content and a low boulder content. Sand is fine to medium. Gravel is angular to subangular fine to coarse of limestone. Cobbles and boulders are subangular occasionally elongate of limestone (up to 250mm).		0.80			AA70613	B	0.80-0.90		
1.0				1 (Slow)					
Possible Weathered Rockhead recovered as Angular to subangular COBBLE- and BOULDER-sized fragments of strong limestone.		1.80			AA70614	B	1.80-1.85		
2.0 End of Trial Pit at 1.85m		1.85							

Groundwater Conditions
Becoming moist at 1.65m. Slow water entry from 1.75m.

Stability
Good

General Remarks
Pit terminated on obstruction / possible weathered rockhead

IGSL TP LOG 20544 PART 2.GPJ IGSL.GDT 20/3/18

TRIAL PIT RECORD

REPORT NUMBER 20544

CONTRACT	Cyrus One, Grange Castle (Part 2)	TRIAL PIT NO.	TP15
		SHEET	Sheet 1 of 1
LOGGED BY	JB	CO-ORDINATES	
		DATE STARTED	14/03/2018
		DATE COMPLETED	14/03/2018
CLIENT	Cyrus One	GROUND LEVEL (m)	
ENGINEER	Pinnacle / AWN	EXCAVATION METHOD	JCB 3CX eco

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL: Soft brown sandy slightly gravelly CLAY with occasional rootlets. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse of limestone.									
Soft to firm brown very sandy CLAY/SILT. Sand is fine to medium. Gravel is subangular fine to medium of limestone		0.30				B	0.70-0.80		
Firm to stiff light grey mottled yellow brown slightly sandy gravelly SILT with a high cobble content. Sand is fine. Gravel is angular to subangular fine to course of limestone. Cobbles are angular tabular of limestone.		0.85				B	0.90-1.00		
1.0									
Firm occasionally soft to firm (moist) dark grey gravelly sandy CLAY with a high cobble content. Sand is fine. Gravel is subangular platy medium. Cobbles are angular tabular of limestone.		1.90		1 (Seepage)		B	2.00-2.10		
2.0									
End of Trial Pit at 2.45m		2.45		2 (Slow)					

Groundwater Conditions
Seepage at 1.90m. Slow ingress at 2.45m.

Stability
Moderate to poor from 1.80m

General Remarks
Pit terminated on obstruction / possible weathered rockhead

IGSL TP LOG 20544 PART 2.GPJ IGSL.GDT 20/3/18

TRIAL PIT RECORD

REPORT NUMBER 20544

CONTRACT	Cyrus One, Grange Castle (Part 2)	TRIAL PIT NO.	TP16
		SHEET	Sheet 1 of 1
LOGGED BY	JB	CO-ORDINATES	
		DATE STARTED	14/03/2018
		DATE COMPLETED	14/03/2018
CLIENT	Cyrus One	GROUND LEVEL (m)	
ENGINEER	Pinnacle / AWN	EXCAVATION METHOD	JCB 3CX eco

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL: Soft brown slightly gravelly sandy CLAY with rootlets. Sand is fine. Gravel is subangular fine of limestone.									
Soft brown slightly gravelly sandy CLAY with a medium cobble content and rare rootlets. Sand is fine. Gravel is subangular fine of limestone. Cobbles are subangular tabular of limestone.		0.35							
Firm grey gravelly sandy CLAY with a high cobble content. Sand is fine. Gravel is subangular fine of limestone. Cobbles are subangular tabular of limestone.		0.70				B	0.80-0.90		
1.0									
Possible Highly Weathered Rockhead recovered as Firm to stiff grey gravelly sandy CLAY with a high cobble content and medium boulder content. Sand is fine. Gravel is subangular fine of limestone. Cobbles and boulders are subangular tabular of limestone.		1.20		1 (Seepage)		B	1.20-1.30		
2.0						B	2.00-2.10		
End of Trial Pit at 2.00m		2.10							

Groundwater Conditions
Seepage at 1.70m

Stability
Poor with side wall collapse from 0.70m

General Remarks
Pit terminated on obstruction / possible weathered rockhead

IGSL TP LOG 20544 PART 2.GPJ IGSL.GDT 20/3/18

TRIAL PIT RECORD

REPORT NUMBER 20544

CONTRACT	Cyrus One, Grange Castle (Part 2)	TRIAL PIT NO.	TP19
		SHEET	Sheet 1 of 1
LOGGED BY	JB	CO-ORDINATES	
		DATE STARTED	13/03/2018
		DATE COMPLETED	13/03/2018
CLIENT	Cyrus One	GROUND LEVEL (m)	
ENGINEER	Pinnacle / AWN	EXCAVATION METHOD	JCB 3CX eco

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL: Soft brown slightly gravelly SILT/CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of limestone.									
Firm brown occasionally mottled orange sandy gravelly CLAY with a medium cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles are subangular of dark grey limestone.		0.40							
Firm becoming firm to stiff brown mottled orange and grey sandy gravelly CLAY with a medium cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of limestone. Cobbles are angular to subangular of limestone.		0.80				B	0.90-1.10		
1.0						B	1.30-1.50		
						B	1.50-1.70		
Possible Rockhead / Obstruction End of Trial Pit at 1.80m		1.80							
2.0									

Groundwater Conditions
Dry

Stability
Poor stability from 1.0m with sidewall collapse

General Remarks
Pit terminated on obstruction / possible weathered rockhead

IGSL TP LOG 20544 PART 2.GPJ IGSL.GDT 20/3/18

Appendix 7.3 Soil Chemical Test Analysis Results IGSL Ltd 2017/2018 (IGSL, 2018)

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.co.uk

Amended Report

Report No.:	18-08183-2		
Initial Date of Issue:	03-Apr-2018	**Date of Re-Issue:**	04-Apr-2018
Client	IGSL		
Client Address:	M7 Business Park Naas County Kildare Ireland		
Contact(s):	Darren Keogh John Clancy		
Project	Cyrus One_15 Acre_Phase 1		
Quotation No.:		**Date Received:**	23-Mar-2018
Order No.:		**Date Instructed:**	23-Mar-2018
No. of Samples:	8		
Turnaround (Wkdays):	5	**Results Due:**	29-Mar-2018
Date Approved:	03-Apr-2018		
Approved By:			
Details:	Robert Monk, Technical Manager		

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: Cyrus 1

Client: IGSL					Chemtest Job No.:	18-08183	18-08183	18-08183	18-08183	18-08183
Quotation No.:					Chemtest Sample ID.:	597065	597066	597067	597068	597069
Order No.:					Client Sample Ref.:	TP8	TP9	TP10	TP11	TP16
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	0.80	1.85	1.10	0.70	0.80
					Bottom Depth (m):		1.90	1.20	0.80	0.90
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Ammonium	U	1220	mg/l	0.050	0.14	0.058	0.17	0.12	< 0.050	
Ammonium	N	1220	mg/kg	0.10	1.4	0.58	1.7	1.2	0.39	
Boron (Dissolved)	U	1450	µg/l	20	< 20	< 20	< 20	< 20	< 20	
Boron (Dissolved)	U	1450	mg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	

Chemtest
The right chemistry to deliver results

Results - Soil

Project: Cyrus 1

Client: IGSL					Chemtest Job No.:	18-08183	18-08183	18-08183	18-08183	18-08183
Quotation No.:					Chemtest Sample ID.:	597065	597066	597067	597068	597069
Order No.:					Client Sample Ref.:	TP8	TP9	TP10	TP11	TP16
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	0.80	1.85	1.10	0.70	0.80
					Bottom Depth (m):		1.90	1.20	0.80	0.90
					Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
ACM Type	U	2192		N/A	-	-	-	-	-	
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	
Moisture	N	2030	%	0.020	13	13	11	13	16	
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	
Sulphur (Elemental)	U	2180	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	
Cyanide (Total)	U	2300	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	
Sulphide (Easily Liberatable)	U	2325	mg/kg	0.50	[A] 34	[A] 31	[A] 16	[A] 14	[A] 37	
Sulphate (Acid Soluble)	U	2430	%	0.010	[A] 0.011	[A] 0.015	[A] < 0.010	[A] 0.030	[A] 0.014	
Arsenic	U	2450	mg/kg	1.0	35	39	30	36	33	
Barium	U	2450	mg/kg	10	19	20	23	100	23	
Cadmium	U	2450	mg/kg	0.10	0.89	1.0	0.89	1.7	1.5	
Chromium	U	2450	mg/kg	1.0	11	11	16	17	11	
Molybdenum	U	2450	mg/kg	2.0	3.2	3.0	2.6	4.0	5.0	
Antimony	N	2450	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	
Copper	U	2450	mg/kg	0.50	28	28	25	34	26	
Mercury	U	2450	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	
Nickel	U	2450	mg/kg	0.50	59	55	38	69	55	
Lead	U	2450	mg/kg	0.50	9.7	9.0	11	13	10	
Selenium	U	2450	mg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	
Zinc	U	2450	mg/kg	0.50	47	57	55	66	65	
Chromium (Trivalent)	N	2490	mg/kg	1.0	11	11	16	17	11	
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	
Total Organic Carbon	U	2625	%	0.20	[A] 0.38	[A] 0.44	[A] 0.48	[A] 0.55	[A] 0.50	
Mineral Oil	N	2670	mg/kg	10	< 10	< 10	< 10	< 10	< 10	
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	

Chemtest
The right chemistry to deliver results

Results - Soil

Project: Cyrus 1

Client: IGSL		Chemtest Job No.:			18-08183	18-08183	18-08183	18-08183	18-08183
Quotation No.:		Chemtest Sample ID.:			597065	597066	597067	597068	597069
Order No.:		Client Sample Ref.:			TP8	TP9	TP10	TP11	TP16
		Sample Type:			SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			0.80	1.85	1.10	0.70	0.80
		Bottom Depth (m):				1.90	1.20	0.80	0.90
		Asbestos Lab:			COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**					
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	[A] < 10	[A] < 10	[A] < 10	[A] < 10	[A] < 10
Benzene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Toluene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Ethylbenzene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
m & p-Xylene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
o-Xylene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Methyl Tert-Butyl Ether	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Naphthalene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Coronene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2800	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
PCB 28	U	2815	mg/kg	0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010
PCB 52	U	2815	mg/kg	0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010
PCB 90+101	U	2815	mg/kg	0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010
PCB 118	U	2815	mg/kg	0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010
PCB 153	U	2815	mg/kg	0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010
PCB 138	U	2815	mg/kg	0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010
PCB 180	U	2815	mg/kg	0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010
Total PCBs (7 Congeners)	N	2815	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] < 0.10	[A] < 0.10	[A] < 0.10
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30

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Results - Single Stage WAC

Project: Cyrus 1

Chemtest Job No:				18-08183		Landfill Waste Acceptance Criteria Limits		
Chemtest Sample ID:				597065				
Sample Ref:				TP8				
Sample ID:						**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Top Depth(m):				0.80				
Bottom Depth(m):								
Sampling Date:								
Determinand	**SOP**	**Accred.**	**Units**					
Total Organic Carbon	2625	U	%	[A] 0.38		3	5	6
Loss On Ignition	2610	U	%	2.5		--	--	10
Total BTEX	2760	U	mg/kg	[A] < 0.010		6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10		1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	[A] < 10		500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0		100	--	--
pH	2010	U		8.7		--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.084		--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**		**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050		0.5	2	25
Barium	1450	U	0.0012	< 0.50		20	100	300
Cadmium	1450	U	< 0.00010	< 0.010		0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050		0.5	10	70
Copper	1450	U	< 0.0010	< 0.050		2	50	100
Mercury	1450	U	< 0.00050	< 0.0050		0.01	0.2	2
Molybdenum	1450	U	< 0.0010	< 0.050		0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050		0.4	10	40
Lead	1450	U	< 0.0010	< 0.010		0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010		0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010		0.1	0.5	7
Zinc	1450	U	0.0018	< 0.50		4	50	200
Chloride	1220	U	1.4	14		800	15000	25000
Fluoride	1220	U	0.094	< 1.0		10	150	500
Sulphate	1220	U	< 1.0	< 10		1000	20000	50000
Total Dissolved Solids	1020	N	22	220		4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30		1	-	-
Dissolved Organic Carbon	1610	U	11	110		500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	13

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

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Results - Single Stage WAC

Project: Cyrus 1

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	18-08183						
Chemtest Sample ID:	597066						
Sample Ref:	TP9						
Sample ID:							
Top Depth(m):	1.85						
Bottom Depth(m):	1.90						
Sampling Date:							
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	[A] 0.44	3	5	6
Loss On Ignition	2610	U	%	2.6	--	--	10
Total BTEX	2760	U	mg/kg	[A] < 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	[A] < 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	U		8.6	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.076	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	< 0.0010	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	< 0.0010	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.50	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.088	< 1.0	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	20	200	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	8.6	86	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	13

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

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Results - Single Stage WAC

Project: Cyrus 1

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	18-08183						
Chemtest Sample ID:	597067						
Sample Ref:	TP10						
Sample ID:							
Top Depth(m):	1.10						
Bottom Depth(m):	1.20						
Sampling Date:							
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	[A] 0.48	3	5	6
Loss On Ignition	2610	U	%	1.9	--	--	10
Total BTEX	2760	U	mg/kg	[A] < 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	[A] < 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	U		8.6	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.0090	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	< 0.0010	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	< 0.0010	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0019	< 0.50	4	50	200
Chloride	1220	U	1.7	17	800	15000	25000
Fluoride	1220	U	0.094	< 1.0	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	20	200	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	13	130	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	11

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

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Results - Single Stage WAC

Project: Cyrus 1

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	18-08183						
Chemtest Sample ID:	597068						
Sample Ref:	TP11						
Sample ID:							
Top Depth(m):	0.70						
Bottom Depth(m):	0.80						
Sampling Date:							
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	[A] 0.55	3	5	6
Loss On Ignition	2610	U	%	2.5	--	--	10
Total BTEX	2760	U	mg/kg	[A] < 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	[A] < 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	U		8.6	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.022	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0013	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	< 0.0010	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0036	< 0.50	4	50	200
Chloride	1220	U	4.0	40	800	15000	25000
Fluoride	1220	U	0.096	< 1.0	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	22	220	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	11	110	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	13

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

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Results - Single Stage WAC

Project: Cyrus 1

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	18-08183						
Chemtest Sample ID:	597069						
Sample Ref:	TP16						
Sample ID:							
Top Depth(m):	0.80						
Bottom Depth(m):	0.90						
Sampling Date:							
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	[A] 0.50	3	5	6
Loss On Ignition	2610	U	%	2.9	--	--	10
Total BTEX	2760	U	mg/kg	[A] < 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	[A] < 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	U		8.6	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.051	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0010	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	< 0.0010	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.50	4	50	200
Chloride	1220	U	1.1	11	800	15000	25000
Fluoride	1220	U	0.097	< 1.0	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	21	210	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	13	130	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	16

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

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Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample ID:	Sample Ref:	Sample ID:	Sampled Date:	Deviation Code(s):	Containers Received:
597065	TP8			A	Amber Glass 250ml
597065	TP8			A	Amber Glass 60ml
597066	TP9			A	Amber Glass 250ml
597066	TP9			A	Amber Glass 60ml
597067	TP10			A	Amber Glass 250ml
597067	TP10			A	Amber Glass 60ml
597068	TP11			A	Amber Glass 250ml
597068	TP11			A	Amber Glass 60ml
597069	TP16			A	Amber Glass 250ml
597069	TP16			A	Amber Glass 60ml

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Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2180	Sulphur (Elemental) in Soils by HPLC	Sulphur	Dichloromethane extraction / HPLC with UV detection
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection

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Test Methods

SOP	Title	Parameters included	Method summary
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

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Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.co.uk

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Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.co.uk

Amended Report

Report No.:	18-08183-2		
Initial Date of Issue:	03-Apr-2018	**Date of Re-Issue:**	04-Apr-2018
Client	IGSL		
Client Address:	M7 Business Park Naas County Kildare Ireland		
Contact(s):	Darren Keogh John Clancy		
Project	Cyrus One_7 Acre_Phase 1		
Quotation No.:		**Date Received:**	23-Mar-2018
Order No.:		**Date Instructed:**	23-Mar-2018
No. of Samples:	8		
Turnaround (Wkdays):	5	**Results Due:**	29-Mar-2018
Date Approved:	03-Apr-2018		
Approved By:			
Details:	Robert Monk, Technical Manager		

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Results - Leachate

Project: Cyrus 1

Client: IGSL					Chemtest Job No.:	18-08183	18-08183	18-08183
Quotation No.:					Chemtest Sample ID.:	597062	597063	597064
Order No.:					Client Sample Ref.:	TP1	TP2	TP5
					Sample Type:	SOIL	SOIL	SOIL
					Top Depth (m):	0.80	1.40	0.90
					Bottom Depth (m):	0.90	1.50	1.00
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Ammonium	U	1220	mg/l	0.050		0.11	0.15	0.085
Ammonium	N	1220	mg/kg	0.10		1.1	1.5	0.85
Boron (Dissolved)	U	1450	µg/l	20		< 20	< 20	< 20
Boron (Dissolved)	U	1450	mg/kg	0.20		< 0.20	< 0.20	< 0.20

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Chemtest
The right chemistry to deliver results

Results - Soil

Project: Cyrus 1

Client: IGSL					Chemtest Job No.:	18-08183	18-08183	18-08183
Quotation No.:					Chemtest Sample ID.:	597062	597063	597064
Order No.:					Client Sample Ref.:	TP1	TP2	TP5
					Sample Type:	SOIL	SOIL	SOIL
					Top Depth (m):	0.80	1.40	0.90
					Bottom Depth (m):	0.90	1.50	1.00
					Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
ACM Type	U	2192		N/A		-	-	-
Asbestos Identification	U	2192	%	0.001		No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020		12	12	12
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40		< 0.40	< 0.40	< 0.40
Sulphur (Elemental)	U	2180	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0
Cyanide (Total)	U	2300	mg/kg	0.50		[A] < 0.50	[A] < 0.50	[A] < 0.50
Sulphide (Easily Liberatable)	U	2325	mg/kg	0.50		[A] 20	[A] 34	[A] 19
Sulphate (Acid Soluble)	U	2430	%	0.010		[A] 0.017	[A] 0.030	[A] 0.030
Arsenic	U	2450	mg/kg	1.0		30	37	36
Barium	U	2450	mg/kg	10		31	41	61
Cadmium	U	2450	mg/kg	0.10		1.5	1.7	1.3
Chromium	U	2450	mg/kg	1.0		14	11	17
Molybdenum	U	2450	mg/kg	2.0		3.6	4.6	2.6
Antimony	N	2450	mg/kg	2.0		< 2.0	< 2.0	< 2.0
Copper	U	2450	mg/kg	0.50		20	28	20
Mercury	U	2450	mg/kg	0.10		< 0.10	< 0.10	< 0.10
Nickel	U	2450	mg/kg	0.50		44	51	55
Lead	U	2450	mg/kg	0.50		12	11	11
Selenium	U	2450	mg/kg	0.20		< 0.20	< 0.20	< 0.20
Zinc	U	2450	mg/kg	0.50		62	68	59
Chromium (Trivalent)	N	2490	mg/kg	1.0		14	11	17
Chromium (Hexavalent)	N	2490	mg/kg	0.50		< 0.50	< 0.50	< 0.50
Total Organic Carbon	U	2625	%	0.20		[A] 0.50	[A] 0.50	[A] 0.38
Mineral Oil	N	2670	mg/kg	10		< 10	< 10	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0		[A] < 5.0	[A] < 5.0	[A] < 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0

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The right chemistry to deliver results

Results - Soil

Project: Cyrus 1

Client: IGSL		Chemtest Job No.:			18-08183	18-08183	18-08183
Quotation No.:		Chemtest Sample ID.:			597062	597063	597064
Order No.:		Client Sample Ref.:			TP1	TP2	TP5
		Sample Type:			SOIL	SOIL	SOIL
		Top Depth (m):			0.80	1.40	0.90
		Bottom Depth (m):			0.90	1.50	1.00
		Asbestos Lab:			COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	[A] < 10	[A] < 10	[A] < 10
Benzene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Toluene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Ethylbenzene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
m & p-Xylene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
o-Xylene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Methyl Tert-Butyl Ether	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Naphthalene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Coronene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2800	mg/kg	2.0	< 2.0	< 2.0	< 2.0
PCB 28	U	2815	mg/kg	0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010
PCB 52	U	2815	mg/kg	0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010
PCB 90+101	U	2815	mg/kg	0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010
PCB 118	U	2815	mg/kg	0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010
PCB 153	U	2815	mg/kg	0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010
PCB 138	U	2815	mg/kg	0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010
PCB 180	U	2815	mg/kg	0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010
Total PCBs (7 Congeners)	N	2815	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] < 0.10
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30

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Results - Single Stage WAC

Project: Cyrus 1

Chemtest Job No:				18-08183		Landfill Waste Acceptance Criteria Limits		
Chemtest Sample ID:				597062				
Sample Ref:				TP1				
Sample ID:						**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Top Depth(m):				0.80				
Bottom Depth(m):				0.90				
Sampling Date:								
Determinand		**SOP**	**Accred.**	**Units**				
Total Organic Carbon		2625	U	%	[A] 0.50	3	5	6
Loss On Ignition		2610	U	%	2.5	--	--	10
Total BTEX		2760	U	mg/kg	[A] < 0.010	6	--	--
Total PCBs (7 Congeners)		2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)		2670	U	mg/kg	[A] < 10	500	--	--
Total (Of 17) PAH's		2800	N	mg/kg	< 2.0	100	--	--
pH		2010	U		8.8	--	>6	--
Acid Neutralisation Capacity		2015	N	mol/kg	0.21	--	To evaluate	To evaluate
Eluate Analysis				**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic		1450	U	< 0.0010	< 0.050	0.5	2	25
Barium		1450	U	< 0.0010	< 0.50	20	100	300
Cadmium		1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium		1450	U	< 0.0010	< 0.050	0.5	10	70
Copper		1450	U	< 0.0010	< 0.050	2	50	100
Mercury		1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum		1450	U	< 0.0010	< 0.050	0.5	10	30
Nickel		1450	U	< 0.0010	< 0.050	0.4	10	40
Lead		1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony		1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium		1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc		1450	U	0.0011	< 0.50	4	50	200
Chloride		1220	U	1.3	13	800	15000	25000
Fluoride		1220	U	0.089	< 1.0	10	150	500
Sulphate		1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids		1020	N	21	210	4000	60000	100000
Phenol Index		1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon		1610	U	8.1	81	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	12

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

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Results - Single Stage WAC

Project: Cyrus 1

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	18-08183						
Chemtest Sample ID:	597063						
Sample Ref:	TP2						
Sample ID:							
Top Depth(m):	1.40						
Bottom Depth(m):	1.50						
Sampling Date:							
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	[A] 0.50	3	5	6
Loss On Ignition	2610	U	%	2.0	--	--	10
Total BTEX	2760	U	mg/kg	[A] < 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	[A] < 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	U		8.5	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.15	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0018	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	0.0011	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0017	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0020	< 0.50	4	50	200
Chloride	1220	U	6.2	62	800	15000	25000
Fluoride	1220	U	0.091	< 1.0	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	21	210	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	6.1	61	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	12

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

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Results - Single Stage WAC

Project: Cyrus 1

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	18-08183						
Chemtest Sample ID:	597064						
Sample Ref:	TP5						
Sample ID:							
Top Depth(m):	0.90						
Bottom Depth(m):	1.00						
Sampling Date:							
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	[A] 0.38	3	5	6
Loss On Ignition	2610	U	%	1.7	--	--	10
Total BTEX	2760	U	mg/kg	[A] < 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	[A] < 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	U		8.5	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.058	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	< 0.0010	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	< 0.0010	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.50	4	50	200
Chloride	1220	U	1.2	12	800	15000	25000
Fluoride	1220	U	0.098	< 1.0	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	22	220	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	12	120	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	12

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

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Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample ID:	Sample Ref:	Sample ID:	Sampled Date:	Deviation Code(s):	Containers Received:
597062	TP1			A	Amber Glass 250ml
597062	TP1			A	Amber Glass 60ml
597063	TP2			A	Amber Glass 250ml
597063	TP2			A	Amber Glass 60ml
597064	TP5			A	Amber Glass 250ml
597064	TP5			A	Amber Glass 60ml

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Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2180	Sulphur (Elemental) in Soils by HPLC	Sulphur	Dichloromethane extraction / HPLC with UV detection
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection

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Test Methods

SOP	Title	Parameters included	Method summary
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

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Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.co.uk

CHAPTER 8 - HYDROLOGY

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

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

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 Monitoring Details 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 building. 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*.

DGMR iNoise is a proprietary noise calculation package for computing noise levels in the vicinity of noise sources. iNoise 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 9.2.1 below:

Table 9.2.1 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.

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 scheme architects.
Local Area The location of noise sensitive locations has been obtained from a combination of site drawings provided by scheme architects and others obtained from Ordinance Survey Ireland (OSI).
Heights The heights of buildings on site have been obtained from site drawings forwarded by HJL Architects. Off-site buildings have been assumed to be 8m high for houses 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 scheme architects 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).

Table 9.2.2 Source Noise Data for Chillers & Transformers

Ref	Octave Band Centre Frequency Hz (dB Linear)								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Proposed max. Sound Pressure Level per Chiller at 10m	41	41	40	36	40	28	29	26	42
Proposed max. Sound Power Level per Chiller	69	69	68	64	68	56	57	54	70
Transformers	64	66	69	74	72	68	63	53	78

The noise levels for the proposed Chillers as outlined in Table 9.2.2 should be considered the maximum permissible noise levels for the purposes of detailed design. Noise emissions from the Chillers should not contain tonal noise characteristics at any nearby residences.

Table 9.2.3 L_{wA} levels Utilised in Noise Model – Standby Generators

Source	L_{wA} - Octave Band Centre Frequency								dB (A)
	63	125	250	500	1k	2k	4k	8k	
Air Inlet Louvre	72	86	79	72	70	75	75	94	95
Air Outlet Louvre	76	86	88	72	75	82	76	89	93
Engine Exhaust Duct	66	77	77	68	71	72	70	78	83
Casing Side	79	89	87	80	79	85	80	91	95
Casing Top	79	89	87	80	79	85	80	91	95
Stack	69	59	55	57	56	50	40	29	70

Noise source data for the proposed standby generators have been provided by the project team for the purposes of this noise impact assessment. A maximum permissible sound pressure level of 82dB(A) at 1 metre distance, per generator has been proposed. This value should be considered the maximum permissible noise level per generator for the purposes of detailed design.

Note A The following extract from *the "EirGrid Evidence Based Environmental Studies Study 8: Noise – Literature review and evidence-based field study on the noise effects of high voltage transmission development (May 2016)* states the following in relation to noise impacts associated with 110KvA transformer installations:

"The survey on the 110kV substation at Dunfirth indicated that measured noise levels (L_{Aeq}) were less than 40dB(A) at 5m from each of the boundaries of the substation. This is below the WHO night-time free-field threshold limit of 42dB for preventing effects on sleep and well below the WHO daytime threshold limits for serious and moderate annoyance in outdoor living areas (i.e. 55dB and 50dB

respectively). Spectral analysis of the data recorded at this site demonstrated that there were no distinct tonal elements to the recorded noise level. To avoid any noise impacts from 110kV substations at sensitive receptors, it is recommended that a minimum distance of 5m is maintained between 110kV substations and the land boundary of any noise sensitive property."

Assuming the proposed substation installation has comparable noise emissions to the 110kV unit discussed above and considering the distance between the 110kV substation and the nearest off site i.e. >250m) noise from this installation is not predicted to be an issue off site.

Considering the above, it is concluded that there will be no significant noise emissions from the operation of the cable installations or substation. Consequently, there is no requirement to assess any operational noise emissions.

It is assumed that the plant parapets will be at least 0.5m higher than the highest dimension of the roof mounted plant.

Modelling Calculation Parameters[12]

Prediction calculations for plant noise have been conducted in accordance with *ISO 9613: Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation, 1996*.

Ground attenuation factors of 1.0 have been assumed. No metrological corrections were assumed for the calculations. The atmospheric attenuation outlined in Table 9.2.4 has been assumed for all calculations.

Table 9.2.4 Atmospheric Attenuation Assumed for Noise Calculations (dB per km)

Temp (ºC)	% 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

[12] See Appendix 9.4 for further discussion of calculation parameters.

Appendix 9.3 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.

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*[13] which indicates the following criteria and hours of operation.

Table 9.3.1 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 9.3. 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 9.3.2 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.

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

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.

Appendix 9.4 Noise Model Parameters

Prepared by AWN Consulting Limited

Prediction calculations for noise emissions have been conducted in accordance with *ISO 9613: Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation, 1996*. The following are the main aspects that have been considered in terms of the noise predictions presented in this instance.

Directivity Factor: The directivity factor (D) allows for an adjustment to be made where the sound radiated in the direction of interest is higher than that for which the sound power level is specified. In this case the sound power level is measures in a down wind direction, corresponding to the worst-case propagation conditions and needs no further adjustment.

Ground Effect: Ground effect is the result of sound reflected by the ground interfering with the sound propagating directly from source to receiver. The prediction of ground effects is inherently complex and depend on source height receiver height propagation height between the source and receiver and the ground conditions. The ground conditions are described according to a variable defined as G, which varies between 0.0 for hard ground (including paving, ice concrete) and 1.0 for soft ground (includes ground covered by grass trees or other vegetation) Our predictions have been carried out using various source height specific to each plant item, a receiver heights of 1.6m for single storey properties and 4m for double. An assumed ground factor of G = 1.0 has been applied off site. Noise contours presented in the assessment have been predicted to a height of 4m in all instances. For construction noise predictions have been made at a level of 1.6m as these activities will not occur at night.

Geometrical Divergence This term relates to the spherical spreading in the free-field from a point sound source resulting in attenuation depending on distance according to the following equation:

$$A_{geo} = 20 \times \log (\text{distance from source in meters}) + 11$$

Atmospheric Absorption 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.

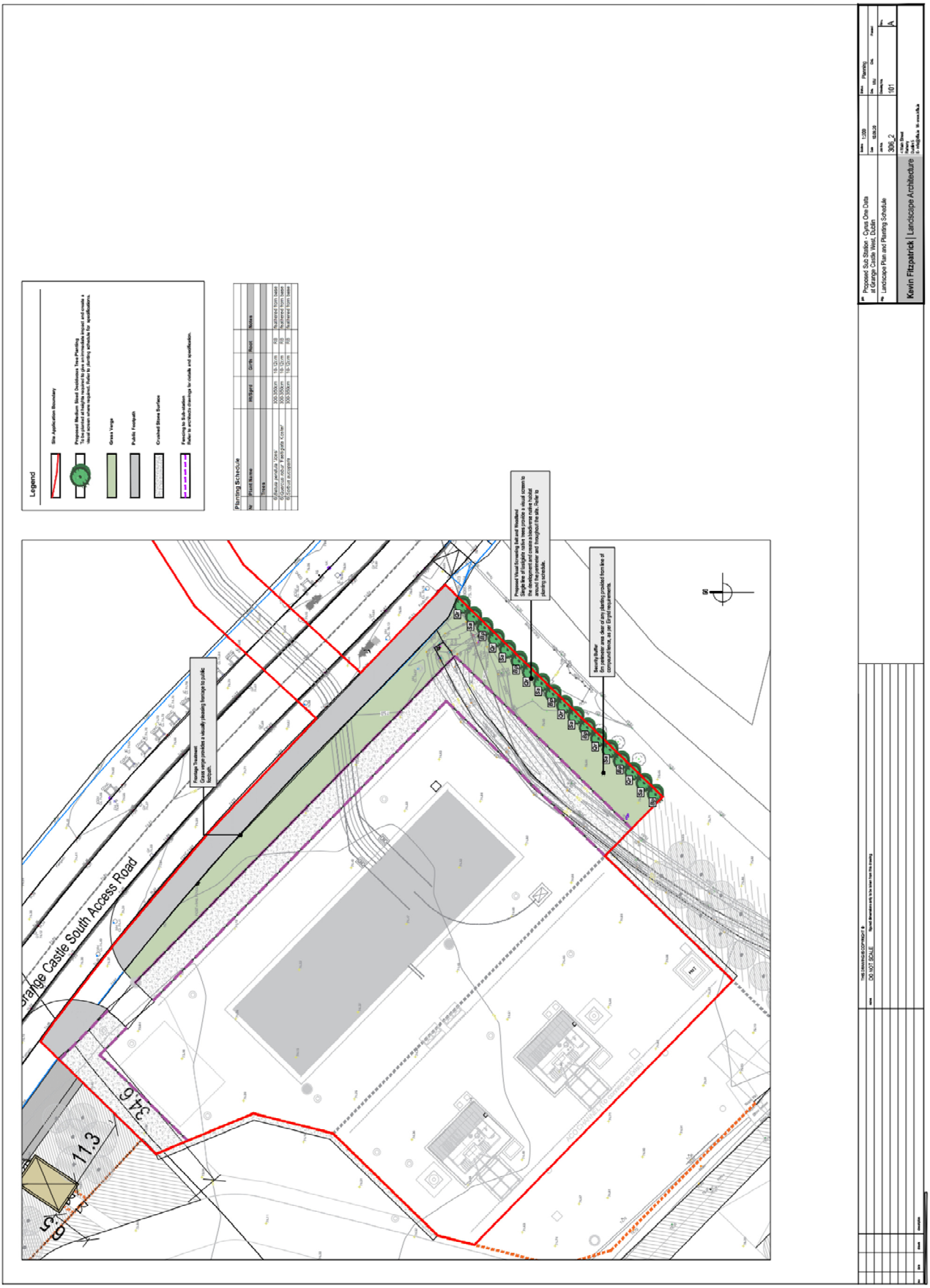
Table 9.4.1 Atmospheric Attenuation Assumed for Noise Calculations (dB per km)

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

Barrier Attenuation The effect of any barrier between the noise source and the receiver position is that noise will be reduced according to the relative heights of the source, receiver and barrier and the frequency spectrum of the noise.

CHAPTER 11 - LANDSCAPE AND VISUAL IMPACT

Appendix 11.1 Proposed Landscape master plan in relation to the proposed 110kV substation



Cyrus one - 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.

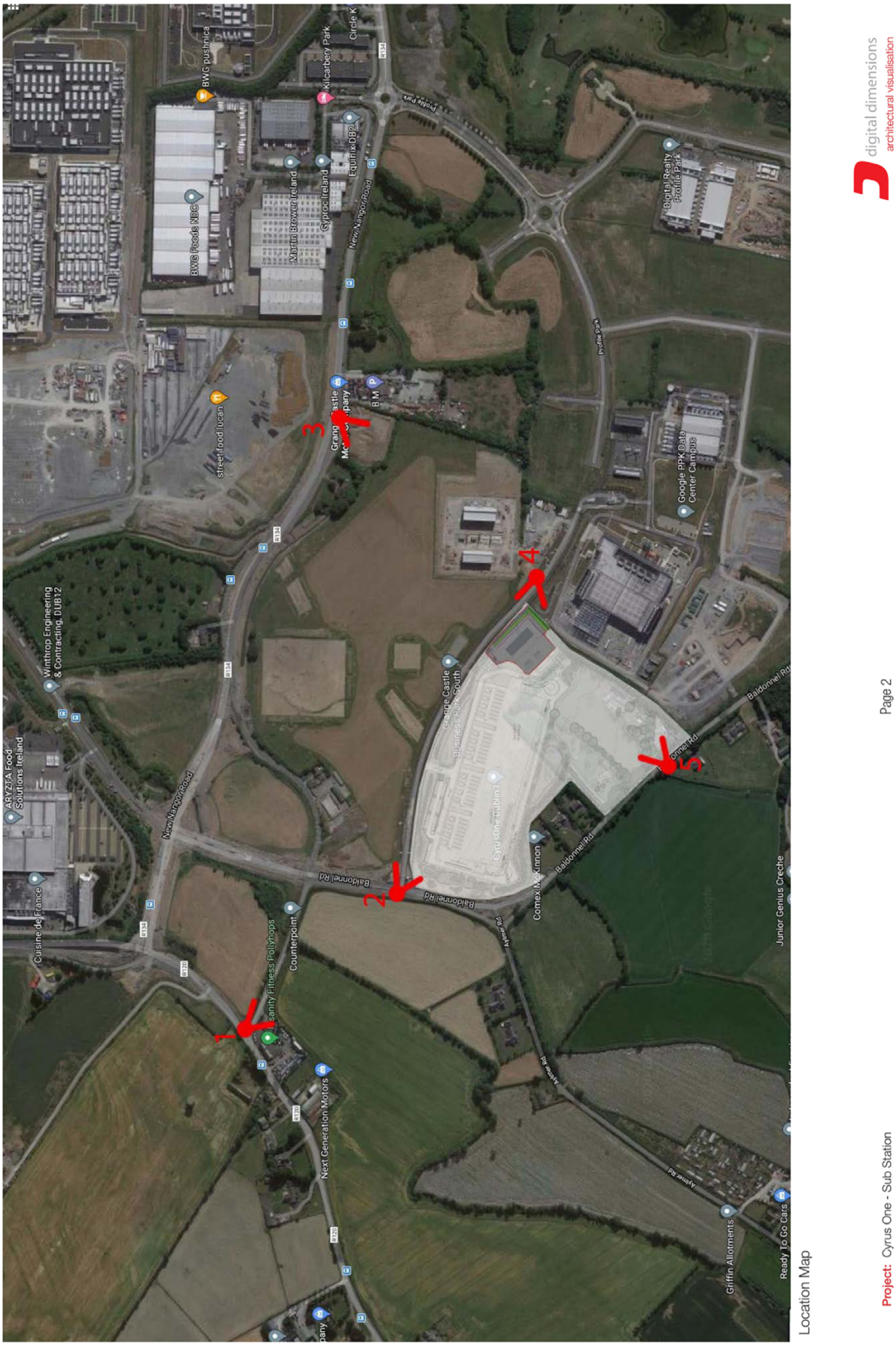
6. The proposed development is output from the 3D software using this camera and the image is then blended with the original photograph to give an accurate image of what the proposed development will look like in its proposed setting.

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.

digital dimensions
architectural visualisation



Location Map
Project: Cyrus One - Sub Station
Page 2
digital dimensions
architectural visualisation
1
2
3
4
5
Baldonnel Rd
New Nangor Road
Aylmer Rd
Profile Park

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 1 Existing	28-09-2020	73°	24mm	677m	Canon EOS 5DS

digital dimensions
architectural visualisation

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Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 1 Proposed	28-09-2020	73°	24mm	677m	Canon EOS 5DS

digital dimensions
architectural visualisation

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Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 2 Existing	28-09-2020	73°	24mm	396m	Canon EOS 5DS

digital dimensions
architectural visualisation

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Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 2 Proposed	28-09-2020	73°	24mm	396m	Canon EOS 5DS

digital dimensions
architectural visualisation

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Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 3 Existing	28-09-2020	73°	24mm	411m	Canon EOS 5DS

digital dimensions
architectural visualisation

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Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 3 Proposed	28-09-2020	73°	24mm	411m	Canon EOS 5DS

digital dimensions
architectural visualisation

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Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 4 Existing	17-12-2020	97°	16mm	25m	Canon EOS 5DS

digital dimensions
architectural visualisation

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Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 4 Proposed	17-12-2020	97°	16mm	25m	Canon EOS 5DS

digital dimensions
architectural visualisation

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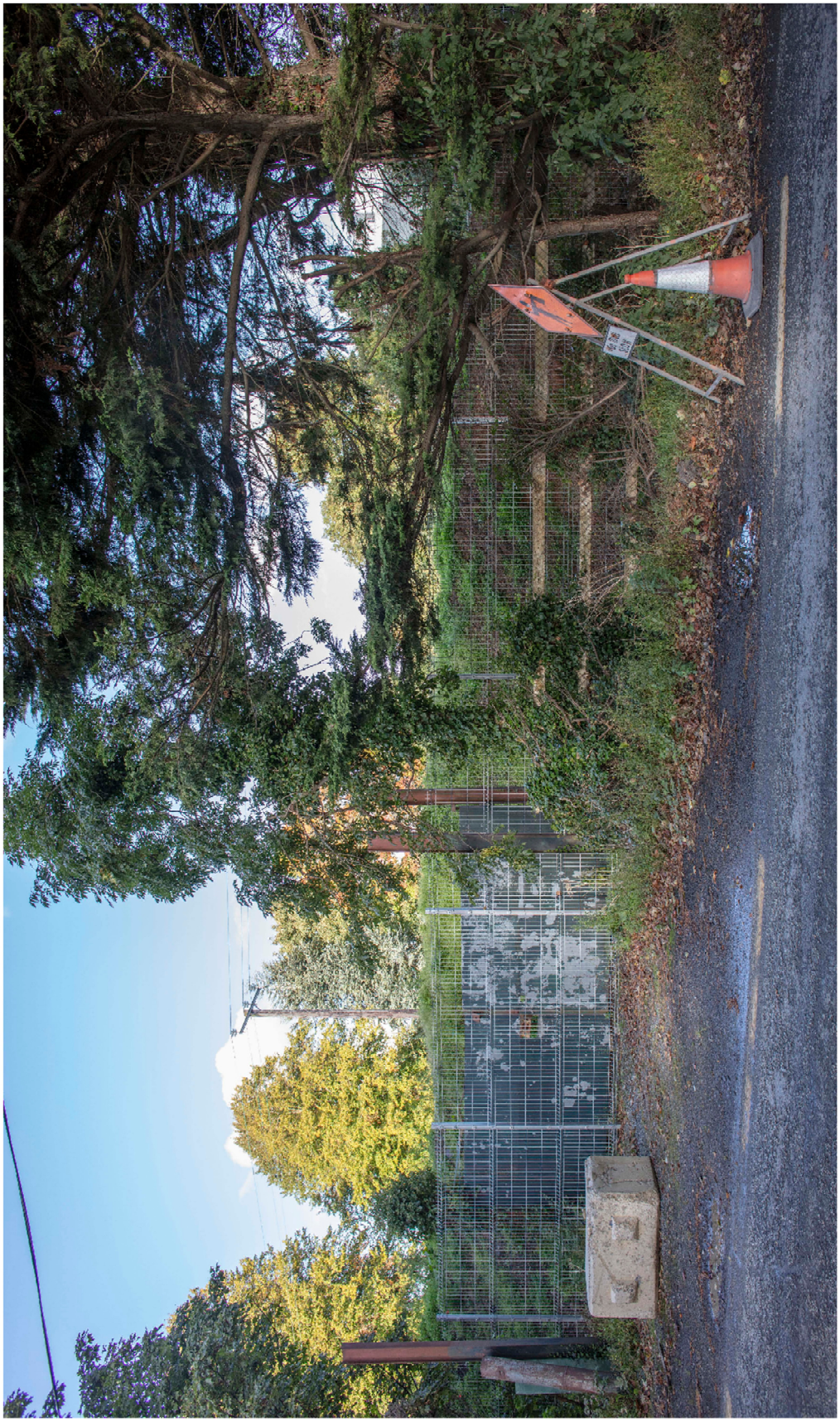

Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 5 Existing	28-09-2020	73°	24mm	279m	Canon EOS 5DS

digital dimensions
architectural visualisation

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Location	Date	Field of view	35mm equivalent	Distance to site	Camera model
View 5 Proposed	28-09-2020	73°	24mm	279m	Canon EOS 5DS

digital dimensions
architectural visualisation

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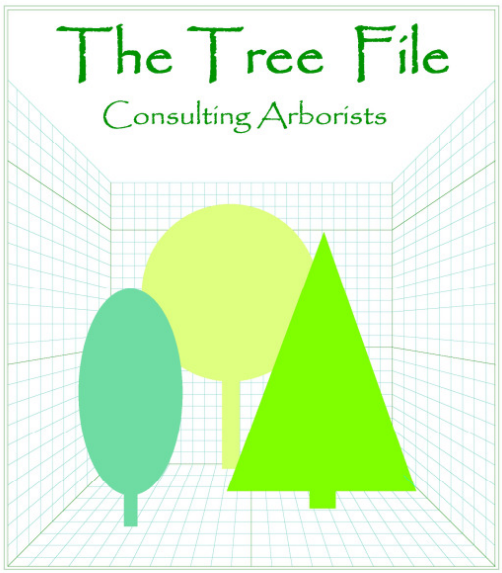
Appendix 11.3 Tree survey



Preliminary Tree Survey and Report
Trees at Proposed Site at
Grange Castle South
Dublin 22

March 2018

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

Contents

Executive Summary, Findings and Recommendations

This report was commissioned by KFLA Landscape Architecture

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

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 site in question.

This information has been provided without any review of possible development works. This information does not include a full "Arboricultural Implication Assessment" and it does not provide an "Arboricultural Method Statement" or "Tree Protection Plan". It does however provide much of the basic information that would assist in the compilation of such documentation, should it be requested in the future and with the provision of suitable information regarding the nature and extent of any proposed development works.

This tree report should be read in conjunction with the combined tree constraints and basic impacts plan drawing "D1-Grange Castle-TCP-03-18". This drawing provides a graphic representation of the tree survey depicting the constraints of those trees potentially affected by work as well as 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 quantification of sustainable trees within any proposed development.

Site Tree Review

The review of trees has illustrated 2 distinct vegetation types across the site, those being that which relates to Thorn based field boundary hedges and subsequent emergent tree populations and secondly, the more managed and garden orientated plantings of the dwelling sites to the south-east of the broader site.

Most of the hedges appear to exist in conjunction with each and embankment or other than earthen features. It is appreciated that hedge 1 coincides with a town land boundary.

Except for "Hedge 1", most other hedges were found to be in a broadly dilapidated state with the originally intended Hawthorn element being recessive at best. In many instances, continuity within the alignment was best provided for by a combination of thicket effect, commonly dominated by Bramble or Elder.

Many of these hedges support notable emergent tree populations typically comprising ash, which Elm Sycamore. The number of which Elm is relatively high however, it is equally noted that most specimens tend to be relatively young and thus arose after the Dutch Elm disease epidemic of the nineteen eighties. Unfortunately, and as already recorded on the site, tree deaths have occurred of a nature that suggests Dutch Elm disease attack an issue that should be considered unsurprising considering the prevalence of the disease within the broader Dublin area.

Consequently, it is advised that though numerous healthy specimens exist at present, the Elm proportion of the population should be viewed with caution and regarding what is likely to be particularly limited sustainability.

Of the Ash and Sycamore, Ash are more numerous. Whilst the number of reasonable quality specimens exist, many are distorted and or multi-stemmed raising some concern in respect of mechanical stability and suitability for retention, for example within areas of high occupation and use.

In respect of all such trees and hedges, the fact that they arise from earth and features such as ditches and embankments must also be considered. Particularly, and regarding Hedge 7 the fact that there is a substantial stream

feature running to the north of these trees must be appreciated as acting as a substantial constraint to natural root development in a northerly direction.

In respect of the garden plots towards the South and south-east of the site, note was made of no particularly interesting species and much of the material encountered would be regarded as being commonplace. Substantial issues arise in respect of sustainability, relating both to past management and the selection and use of various species. In many instances, note was made of harsh/severe cutting that is effectively undermined both ornamental value and sustainability over time. Many such specimens have been recommended for removal on these grounds.

In other instances, and regarding Tree Groups 1 and 2, substantial concerns relate to the cumulative use of species such as Leyland cypress as these have particularly poor reputations regarding manageability and sustainability over time. As these trees are already of substantial site size then such issues will likely be becoming apparent within the short-term and cannot be addressed by the application of pruning type management. Accordingly, the suitability for retention and sustainability over time in respect of these trees must be regarded as minimal.

Note has been made of some specimens within the garden areas that were found to be in typically good condition. Such trees might offer some degree of sustainability should their retention prove suitable within any proposed development context. Nonetheless, and in line with the typical age profile associated with the gardens, many such trees tend to be comparatively small and therefore, there retention as is might be considered against their potential for being replaced, for example with advanced or larger nursery stock.

Management Recommendations

Preliminary management recommendations have been put forward within the context of the survey table. Such recommendations are based on the current site scenario and pay no respect to any possible site developments or the effects that these may have on the trees. It will be necessary for the project Arborist to re-assess all retained trees after primary site clearance, so that changes in site usage, aspect and shelter loss can be better assessed and accounted for.

As shelter-loss is already an issue on this site, then it should be considered as likely that additional works will be recommended that are orientated towards addressing such issues, such as the application of crown-reduction type works.

In respect of this and regardless of any possible site development, it is advised that all 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 many of the concerns raised by the tree survey were founded 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.

Development Implications

This document comprises only a review of trees that exist upon or adjoining the site in respect to its existing context. 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, it is advised that any development proposals are 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.

This survey has been undertaken at the instruction of: -

Kevin Fitzpatrick | Landscape Architecture
7 Abbey Business Park
Grange Drive
Baldoyle
Dublin
D13 R1W1

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.

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.

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 and a brief resume of the typical application of Tree Protection measures as defined within the above standard and as relates to the "RPA" zones defined both within the survey table and on the "TCP" drawing.

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 suitability for retention.

Drawing References

The survey should be read in conjunction with drawing "D1-Grange Castle-TCP-03-18" regarding the representation of tree positions, crown forms, "RPA" extents and colour reference to category systems. Where tree positions were not indicated on the supplied drawing, their positions may have been given "sketched" locations within "D1-Grange Castle-TCP-03-18". 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 circle, 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 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 highlight the extent and nature of material of Arboricultural interest on the site in question.

Site Description

The site in question is located south of the westernmost access road to the Grange Castle South Technology Park. The site is of irregular shape, defined to the North by the existing Grange Castle S. Technology Park Access Rd but also by public roads to the West and to the south-west. The sites easternmost boundary is defined by an adjoining technology Park neighbour and by a neighbouring domiciliary plot to the south-east.

Much of the northern portion of the site is broadly open, apparently comprising pasture but now partially excavated because of archaeological investigations. Towards the South of the site, 3 apparent dwellings that accessed the laneway to the south-west are excluded from the site area as is the dwelling towards the South easternmost corner. 2 other dwellings consuming a substantial proportion of the south-eastern side are included within the site area as is a substantial pasture defined by a driveway and stables close to the south-eastern corner.

Broadly speaking, much of the site appears to be level except for features such as ditches and embankments.

Much of the site is devoid of vegetation with the greatest proportion being associated with the gardens and hedged enclosures towards the south-east of the site.

Survey Data Collection and Methodology

The Survey
The primary survey was carried out in March of 2018. 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 late 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.

Tree Protection and Management within the Scope of a Development

The design and management recommendations as set out in BS5837: 2012 are considered "best practice" regarding the selection, retention, protection and management of tree within the scope of a new development.

The development of a Tree Constraints Plan (TCP) provides a design tool regarding tree retention. Such a plan combines the topographical land survey drawing with additional information as provided by the tree survey. The aspects of the tree's existence recorded on the "TCP" are, firstly, the tree canopies, represented in accordance with the four cardinal compass point radii (Sp: R in survey Table 1). Secondly, each tree's Root Protection Area (RPA) is represented in accordance with paragraphs 4.6.1, 4.6.2 and 4.6.3 of BS5837: 2012.

The "Tree Constraints Plan" (TCP) depicts the extent and location of constraints, placed upon the site by the trees. The "TCP" drawing represents both the true canopy form (north, east, south and west radii) and the "RPA" as defined above. These constraints must be considered regarding the design and layout of a proposed development.

Tree Protection

All protection, whether vertical or horizontal, must conform or equate to the recommendations of Section 9, BS5837: 2012, must be fit for purpose and commensurate with the nature of development and the expected day-to-day activities of the site works.

Appendix 1 – Tree Data Table

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural Condition	PMR	Yrs	Cat
1	Manna Ash *(Fraxinus ornus)*	S/M	F/P	4.50	0.00	0.50	3.00	2.50	0.50	2	197	2.37	Squat, suppressed and heavily divided from ground level. Is unbalanced to south-west.		S	C2
2	Ash *(Fraxinus excelsior)*	S/M	G/F	12.00	4.00	2.50	43.00	3.50	2.50	1	302	3.63	Slightly unbalanced to south-west but of good form and vigour.		L	B2
3	Ash *(Fraxinus excelsior)*	E/M	G/F	12.00	2.50	3.00	4.00	2.00	2.00	1	274	3.29	Unbalanced to south-west but of good vigour and vitality.		L	B2
4	Silver Birch *(Betula pendula)*	S/M	G	9.50	2.00	4.00	4.00	2.00	0.50	1	267	3.21	Unbalanced to south-west but of good form and vigour.		L	B2
5	Ash *(Fraxinus excelsior)*	S/M	F/P	7.50	0.00	0.00	4.50	2.00	0.00	1	207	2.48	Chronically unbalanced to south west because of suppression. Is considered unsustainable.	Remove.	N/A	U
6	Ash *(Fraxinus excelsior)*	E/M	F	13.00	2.50	3.50	4.50	4.50	5.00	1	376	4.51	An emergent specimen from overall alignment. Appears to be maintaining good vigour and vitality but is heavily obscured by dense ivy cover. Proximity to adjoining structure raises some concern in respect of growth potential for root related damage over time.		M	C2
7	Ash *(Fraxinus excelsior)*	E/M	F	12.00	2.50	2.00	4.00	2.00	4.00	3	306	3.67	A multi-stemmed and naturally arising group within overall thicket development at between 2 larger specimens. This be maintaining good general vigour and vitality though structural form is impaired to an extent that that may undermine sustainability.	Review regularly.	M	C2

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No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural Condition	PMR	Yrs	Cat
8	Ash *(Fraxinus excelsior)*	E/M	F	13.00	2.50	5.00	5.50	4.00	5.00	3	430	5.16	A large multi-stem specimen of good vigour but poor physical form.	Cut ivy and review regularly.	M	C2
9	Ash Group *(Fraxinus excelsior)*	E/M	F	12.00	2.00	5.00	6.50	5.00	5.00	4	427	5.12	The dispersed and multi-stemmed group combining to create a singular and broader canopy. Tree is obscured by dense ivy cover but appears be maintaining reasonable vigour and vitality.	Cut ivy and re-evaluate after shedding.	M	C2
10	Sycamore *(Acer pseudoplatanus)*	E/M	G/F	10.00	2.00	6.00	5.50	4.50	5.00	1	535	6.42	Relatively young and still vigorous. Is likely to have been previously affected by drive/wing-wall development and proximity of roadway.	Review regularly.	L	B2
11	Silver Birch *(Betula pendula)*	E/M	G/F	10.00	2.00	4.50	3.00	2.50	2.50	1	290	3.48	Of variable vigour with evidence of suppression at lower levels possibly attributable to proximity to adjoining cypress line.	Cleanout review regularly.	L	B2
12	Lawson Cypress *(Chamaecyparis lawsoniana)*	M	F	5.00	0.00	2.00	2.00	2.00	2.00	1	350	4.20	Still vigorous but of a variety and form that will be subject to mechanical failure at maturity. Tree provides limited visual sustainability.		M	C2
13	Ornamental Cherry *(Prunus variety)*	E/M	F	4.50	0.50	1.50	2.50	2.00	2.50	1	175	2.10	Slightly suppressed and has suffered minor basal damage. Tree is otherwise of good vigour.	Review regarding retention context.	M	C2
14	Western Red Cedar *(Thuja plicata "Brabant")*	E/M	F	4.50	0.50	0.40	0.40	0.40	0.40	1	159	1.91	3 individual alignments combined to define a garden area. Trees remain of good vigour and vitality and offer notable sustainability.		L	B2
15	Wych Elm *(Ulmus glabra)*	E/M	F	11.00	1.00	4.50	3.50	5.00	5.00	1	388	4.66	Appears to be maintaining reasonable vigour and vitality however species predisposition to attack by Dutch elm disease raises substantial concerns in respect of sustainability over time considering the prevalence of disease in broader Dublin area.	Review regularly.	M	B2

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No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural Condition	PMR	Yrs	Cat
16	Wych Elm *(Ulmus glabra)*	E/M	F	12.00	3.00	4.00	2.50	2.00	2.50	2	376	4.51	Twin stemmed from ground level and supporting notable ivy cover. Concerns exist regarding predisposition towards attack by Dutch elm disease prevalence of this disease in Dublin area.	Review regularly.	M	C2
17	Wych Elm *(Ulmus glabra)*	E/M	F	13.00	2.00	4.50	5.00	5.00	5.00	1	442	5.31	Apparently of good vigour but of dubious sustainability considering prevalence of Dutch elm disease within Co Dublin area.	Review regularly.	M	C2
18	Ash *(Fraxinus excelsior)*	S/M	F	6.00	2.00	3.00	2.50	1.00	2.00	1	185	2.22	Squat and slightly suppressed, unbalanced to north.	Review regularly.	L	C2
19	Ash *(Fraxinus excelsior)*	E/M	F	12.00	2.50	4.50	5.00	5.00	4.50	1	535	6.42	Previously cut with major stem loss noted to south west. Remaining tree maintains reasonable vigour and vitality at present though deterioration of prior wound will undermine longevity.	Cleanout remove storm damage and review regularly.	M	C2
20	Ash *(Fraxinus excelsior)*	S/M	F	9.00	1.00	2.00	4.50	4.50	4.00	2	334	4.01	Heavily divided from ground level and considered to be mechanically poor specimen. Current stature presents limited threat.	Review regarding retention context.	S	C2
21	Wych Elm *(Ulmus glabra)*	S/M	F	8.00	2.50	0.50	2.00	2.00	2.50	1	204	2.44	Young and still vigorous though one sided. Will be predisposed to attack by Dutch elm disease.	Review regularly.	S	C2
22	Wych Elm *(Ulmus glabra)*	E/M	F/P	11.00	2.00	6.00	5.00	2.00	5.00	1	449	5.39	Wholly one-sided and unbalanced to north because of suppression by near neighbour. Tree is of poor quality and is of dubious sustainability considering prevalence of Dutch elm disease.	Cut ivy and review regularly regarding ongoing sustainability.	S	C2

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural Condition	PMR	Yrs	Cat
23	Wych Elm *(Ulmus glabra)*	E/M	F	17.00	4.00	5.00	5.50	5.00	5.00	1	780	9.36	A large specimen having sustained notable recent lower crown mechanical damage. General vigour and vitality remains good however concerns exist relating to sustainability considering prevalence of Dutch elm disease in broader Dublin area.	Cleanout and review regularly.	M	C2
24	Wych Elm *(Ulmus glabra)*	E/M	P	6.00	1.50	3.00	4.50	1.00	0.00	1	462	5.54	Exists as a truncated stump after massive failure of crown.	Remove immediately.	N/A	U
25	Wych Elm *(Ulmus glabra)*	E/M	F	13.00	3.50	4.50	3.50	2.00	4.00	1	334	4.01	A tall but somewhat distorted specimen supporting notable ivy cover. Middle crown has sustained prior storm damage. Sustainability concerns relate to predisposition towards attack by Dutch elm disease.	Review regularly.	S	C2
26	Wych Elm *(Ulmus glabra)*	E/M	F	15.00	2.00	4.00	5.50	3.00	1.00	2	430	5.16	Drawn up and unbalanced to east. Is adjoined by major stump to south-west suggesting pastoral cutting of multi-stemmed group. Is of dubious sustainability considering prevalence of Dutch elm disease in Co Dublin area.	Review regularly.	M	C2
27	Wych Elm *(Ulmus glabra)*	E/M	F	13.00	2.50	5.00	4.50	4.00	3.00	1	420	5.04	A tall and drawn up specimen of distorted multi-stem form. Lower crown supports notable ivy cover. Concerns exist regarding sustainability considering prevalence of Dutch elm disease in Co Dublin area.		S	C2
28	Sycamore *(Acer pseudoplatanus)*	E/M	G/F	13.00	3.00	4.50	4.50	5.00	5.00	1	452	5.42	Young and still vigorous though heavily divided at 2.50 m.	Review regularly.	L	B2
29	Wych Elm *(Ulmus glabra)*	E/M	P	11.00	3.50	4.50	4.00	0.00	0.00	1	290	3.48	Young and vigorous but has suffered chronic mechanical failure.	Remove immediately.	N/A	U

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural Condition	PMR	Yrs	Cat
30	Ash *(Fraxinus excelsior)*	E/M	F	13.00	2.25	5.00	7.00	7.00	6.50	2	910	10.92	Large multi-stem specimen of poor mechanical form but this is maintaining good vigour and vitality. Much of crown is obscured by dense ivy cover.	Cut ivy and re-evaluate.	M	C2
31	Wych Elm *(Ulmus glabra)*	S/M	D	9.00	1.25	2.00	4.00	3.50	3.00	1	226	2.71	A young tree already affected by Dutch elm disease and almost completely dead.	Remove.	N/A	U
32	Wych Elm *(Ulmus glabra)*	E/M	F	12.00	1.50	4.50	4.50	3.50	3.50	1	293	3.51	Relatively young specimen supporting some deadwood possibly indicative of Dutch elm disease attack. Sustainability is considered impaired because of prevalence of Dutch elm disease in Co Dublin area.	Review regularly.	S	C2
33	Wild Cherry *(Prunus avium)*	E/M	F	9.00	2.00	4.00	2.50	3.50	4.50	1	236	2.83	Unbalanced to west but maintaining good vigour and vitality.	Review regularly.	M	B2
34	Wych Elm *(Ulmus glabra)*	M	D	10.00	2.50	3.50	4.00	3.00	3.50	1	271	3.25	Completely dead, killed by Dutch elm disease.	Remove immediately.	N/A	U
35	Wych Elm *(Ulmus glabra)*	S/M	P	8.00	3.00	2.00	1.00	1.00	2.00	1	229	2.75	Young but of poor health, apparently affected by Dutch elm disease.	Remove.	N/A	U
36	Tree Cotoneaster *(Cotoneaster Sp)*	M	F	6.00	2.00	5.00	4.00	4.50	5.00	5	748	8.98	A large shrub of reasonable vigour and vitality, notwithstanding heavy ivy cover.	Cut ivy and review regularly.	M	B2
37	Ash *(Fraxinus excelsior)*	E/M	P	12.00	1.50	5.00	5.00	3.00	3.50	11	398	4.77	Once larger specimen has undergone substantial decapitation presumably in relation to proximity of overhead power cables. Is of dubious sustainability.	Consider early removal.	N/A	U

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural Condition	PMR	Yrs	Cat
38	Ash *(Fraxinus excelsior)*	M	F	17.00	1.50	2.50	6.50	7.00	5.00	1	684	8.21	Once larger specimen has undergone substantial cutting on northern side of crown to prevent encroachment on power cables. Accordingly, tree is now notably unbalanced to south. Tree is of dubious sustainability in respect of proximity to power cables.	Review regard retention context.	M	C2
39	Wych Elm *(Ulmus glabra)*	E/M	F	15.00	2.00	2.00	4.50	4.50	4.00	11	462	5.54	Young and apparently vigorous though predisposed to attack by Dutch elm disease and thus raising concerns over sustainability of time.	Review regularly.	M	C2
40	Ash *(Fraxinus excelsior)*	E/M	F	13.00	1.50	5.00	5.00	4.50	4.00	1	430	5.16	Young and relatively vigorous though slightly distorted and supporting extensive ivy cover.	Cut ivy, remove basal suckers and rereview.	M	C2
41	Wych Elm *(Ulmus glabra)*	E/M	P	8.00	0.00	2.00	2.00	2.00	2.00	1	535	6.42	A close-knit group of stems having sustained chronic decapitation and crown removal. Tree is considered unsustainable.	Consider early removal.	N/A	U
42	Cotoneaster *(Cotoneaster Sp)*	M	F	5.00	0.00	3.00	2.50	2.50	2.50	1	334	4.01	A large shrub previously decapitated and severely cut back. Is of dubious sustainability.		S	C2
43	Ornamental Cherry *(Prunus variety)*	M	P	4.50	0.50	1.00	1.00	2.00	2.50	1	376	4.51	Severely decapitated and existing as a large truncated stump. Is unsuitable for attention.	Remove.	N/A	U
44	Laburnum *(Laburnum anagyroides)*	M	P	4.50	1.00	2.50	1.50	1.00	2.50	1	366	4.39	Severely cut back and of poor quality.	Remove.	N/A	U
45	Laburnum *(Laburnum anagyroides)*	M	P	5.00	0.50	3.00	2.00	1.00	1.50	1	382	4.58	Exists as a large decapitated stump. Is unsuitable for attention.	Remove.	N/A	U
46	Tree Cotoneaster *(Cotoneaster Sp)*	M	G/F	7.00	1.00	2.50	4.00	4.00	3.00	5	398	4.77	A large and substantial shrub of reasonable vigour and vitality that has undergone substantial cutting in past.	Review regard retention context.	M	C2

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural Condition	PMR	Yrs	Cat
47	Silver Birch *(Betula pendula)*	E/M	F	12.00	0.50	3.00	4.50	4.00	2.50	1	385	4.62	Large specimen heavily suppressed on western side as result of proximity to adjoining cypress alignment. General vigour and vitality remains good though ivy development is noted on lower stem.	Cut ivy and review regularly.	L	B2
48	Laburnum *(Laburnum anagyroides)*	M	F/P	9.50	1.00	6.00	3.00	2.00	3.50	1	535	6.42	Large specimen notably unbalanced to north. Prior cutting has led to notable decay that will in time undermine structural integrity and lead to species typical failure.	Cleanout and review regularly in respect of short-term retention potential.	S	C2
49	Laburnum *(Laburnum anagyroides)*	M	F	9.00	1.00	4.50	4.50	4.50	3.00	1	548	6.57	Large and still vigorous specimen supporting extensive ivy cover.	Cut ivy and review.	M	B2
50	Stag Horn Sumach *(Rhus typhina)*	M	F	3.00	0.00	3.50	3.00	0.00	2.50	1	229	2.75	Heavily unbalanced and north because of suppression.	Review regarding retention context.	M	C2
51	Wild Cherry *(Prunus avium)*	S/M	F	6.50	0.00	4.00	3.50	3.50	4.00	3	293	3.51	Multi-stemmed, suppressed and supporting extensive ivy cover. Proximity to win wall raises concern regarding future growth and likelihood of mechanical damage.	Review regularly.	S	C2
52	Wych Elm *(Ulmus glabra)*	S/M	F	10.00	2.50	2.50	2.00	2.50	2.50	1	216	2.60	Tall and slender. Currently vigorous but will be predisposed to attack by Dutch elm disease.	Review regularly.	M	C2
53	Wych Elm *(Ulmus glabra)*	S/M	F	10.00	2.50	3.00	2.50	3.00	3.00	1	213	2.56	Young and vigorous but predisposed to attack by Dutch elm disease.		M	C2
54	Ash *(Fraxinus excelsior)*	S/M	F	11.00	4.00	3.00	3.50	3.50	2.50	1	261	3.13	Young and still vigorous with ivy development about middle crown. Asserts immense potential for continued growth over time.		L	B2
55	Ash *(Fraxinus excelsior)*	S/M	F	11.00	4.00	3.00	1.00	3.00	3.00	1	229	2.75	Suppressed, distorted and one-sided, typically unbalanced to west. Remains young and vigorous and offers some degree of sustainability.		M	C2

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural Condition	PMR	Yrs	Cat
56	Ash *(Fraxinus excelsior)*	S/M	F	11.00	2.50	3.00	1.50	3.00	4.00	1	261	3.13	Slightly one-sided and unbalanced to west but of good vigour. Supports notable ivy development.	Cut ivy and review.	M	B2
57	Wych Elm *(Ulmus glabra)*	E/M	F/P	16.00	4.00	4.00	4.00	3.00	3.00	2	462	5.54	A dominant stem with satellite stem to east. Dominant stem remains vigorous however stem to east exhibit evidence of dieback and apparent symptoms of Dutch elm disease. Unsuitable for retention.	Remove.	N/A	U
58	Lawson Cypress *(Chamaecyparis lawsoniana)*	E/M	P	6.00	2.00	2.00	1.00	4.00	1.00	2	261	3.13	Substantially suppressed with minimal viable canopy remaining. Unsuitable for retention.	Remove.	N/A	U
59	Rowan *(Sorbus aucuparia)*	E/M	G/F	6.50	2.00	4.00	4.00	3.00	3.00	1	271	3.25	Slightly distorted as result of suppression but maintaining reasonable vigour and vitality. Is affected by competitive plants including bramble, particularly at lower levels.	Clear ivy and other plants. Review regarding retention context.	S	C2
60	Rowan *(Sorbus aucuparia)*	E/M	F	5.00	1.50	3.00	3.00	1.50	2.50	1	242	2.90	Suppressed by extensive ivy cover but is maintaining reasonable vigour and vitality.	Cut ivy and review.	M	C2
61	Lime *(Tilia europea)*	E/M	G	17.00	1.50	5.00	3.50	5.00	5.00	1	579	6.95	Relatively young and still vigorous, thus presenting notable potential for continued growth over time.		L	B1-2
62	Lime *(Tilia europea)*	E/M	G	17.00	1.50	4.50	5.00	4.50	3.00	1	688	8.25	Relatively young and still vigorous, thus presenting notable potential for continued growth over time.		L	B1-2
63	Lime *(Tilia europea)*	E/M	G	17.00	1.50	5.00	5.00	5.00	4.50	1	694	8.33	Relatively young and still vigorous, thus presenting notable potential for continued growth over time.		L	B1-2
64	Lime *(Tilia europea)*	E/M	G	17.00	1.50	4.50	4.00	5.00	5.00	1	592	7.10	Relatively young and still vigorous, thus presenting notable potential for continued growth over time.		L	B1-2

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural Condition	PMR	Yrs	Cat
65	Lime *(Tilia europea)*	E/M	G	19.00	1.50	6.00	5.00	6.00	5.50	1	567	6.80	Heavily divided at 2.500 m. Relatively young and still vigorous, thus presenting notable potential for continued growth over time.		L	B1-2
66	Lime *(Tilia europea)*	E/M	G	19.00	1.50	5.00	5.00	5.00	4.50	1	598	7.18	Relatively young and still vigorous, thus presenting notable potential for continued growth over time.		L	B1-2
67	Lawson Cypress *(Chamaecyparis lawsoniana)*	M	F	9.00	2.00	3.00	3.00	3.00	3.00	1	493	5.92	Young and still vigorous but heavily cut at lower levels. Previously cut material is of poor visual appeal.	Cleanout review regularly.	M	C2
68	Sycamore Group *(Acer pseudoplatanus)*	S/M	P	6.00	0.00	4.00	4.00	4.00	4.00	6	398	4.77	Effectively comprises thicket regeneration dominated by sycamore. Is of poor quality having sustained prior decapitation and effectively comprising sucker regeneration. Will be regarded as unsuitable for retention.		N/A	U
69	Hawthorn *(Crataegus monogyna)*	M	F	5.50	1.50	2.50	2.50	2.50	2.50	1	229	2.75	Appears to be maintaining reasonable vigour and vitality but is being encroached upon particularly about southern canopy by ivy development.	Review regarding retention context.	M	C2
70	Sycamore *(Acer pseudoplatanus)*	S/M	F	6.50	0.75	2.50	2.50	2.50	2.50	1	220	2.64	Young and vigorous, naturally arising as part of general scrub redevelopment.	Review regarding retention context.	M	C2
71	Sycamore *(Acer pseudoplatanus)*	M	F	14.00	1.50	5.00	5.00	5.00	5.00	1	592	7.10	Vigour and vitality is fair but less than that expected retrieve this age suggesting possible effects relating to modification of ground levels to east. Ivy obscures much of crown.	Cut ivy and re-evaluate on regular basis.	M	C2
72	Ash *(Fraxinus excelsior)*	M	F	15.00	1.50	2.50	4.50	5.50	5.00	1	579	6.95	One-sided as result of proximity to near neighbour. Vigour and vitality appears fair though much of crown is obscure by dense ivy cover.	Cut ivy and review.	M	C2

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural Condition	PMR	Yrs	Cat
73	Ash *(Fraxinus excelsior)*	E/M	F	14.00	4.50	4.50	5.50	3.00	5.00	1	548	6.57	Distorted as result of proximity to near neighbours. Much of crown is heavily obscured by dense ivy cover raising some concern in respect of peculiar structural form.	Cut ivy and review.	S	C2
74	Sycamore *(Acer pseudoplatanus)*	S/M	F/P	6.00	0.00	3.00	1.00	2.00	4.00	1	261	3.13	Heavily suppressed and considered likely to arise as sucker regeneration from the stump of previous tree. Is considered unsuitable for retention.		N/A	U
75	Ash *(Fraxinus excelsior)*	M	F	14.00	1.50	5.00	5.00	4.50	5.00	3	748	8.98	Appears be maintaining good vigour and vitality though much of crown is obscure by dense ivy cover preventing detailed review at present.	Cut ivy and review.	M	C2
76	Wych Elm *(Ulmus glabra)*	E/M	D	10.00	1.50	3.00	2.50	2.50	4.00	1	293	3.51	Completely dead, killed by Dutch elm disease.	Remove.	N/A	U
77	Ash *(Fraxinus excelsior)*	E/M	G/F	9.00	4.50	2.50	3.00	3.50	3.00	1	229	2.75	Young and vigorous with immense potential for continued growth over time.		L	B2
78	Ash *(Fraxinus excelsior)*	E/M	F/P	9.00	0.00	4.50	3.50	1.00	3.00	1	334	4.01	Heavily unbalanced and north and undermined by bank erosion exacerbated by rabbit borrowing. Vigour is good though sustainability considering potential instability is highly questionable.		S	C2
79	Ash *(Fraxinus excelsior)*	M	G/F	14.00	3.50	6.00	5.50	4.50	5.50	1	716	8.59	Apparently vigorous but much of canopy is obscured by dense ivy cover.	Cut ivy and review.	L	B2
80	Sycamore *(Acer pseudoplatanus)*	S/M	F	12.00	0.00	2.50	0.00	2.50	4.00	1	229	2.75	Wholly one-sided because of suppression by larger neighbouring plants. Is unbalanced to west.	Review regarding retention context.	M	C2
81	Sycamore *(Acer pseudoplatanus)*	E/M	G	11.00	0.00	2.50	2.50	2.50	3.50	1	293	3.51	Young and still vigorous.		L	B2

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural Condition	PMR	Yrs	Cat
82	Ash *(Fraxinus excelsior)*	S/M	F	9.00	3.50	3.00	4.00	3.00	3.00	1	229	2.75	Young and vigorous though notably distorted.	Cut ivy and review regularly.	M	C2
83	Ash *(Fraxinus excelsior)*	E/M	F	12.00	3.00	5.00	5.00	4.50	4.50	3	694	8.33	Apparently vigorous but heavily obscured by dense ivy cover.	Cut ivy and review.	M	C2
84	Ash *(Fraxinus excelsior)*	M	F	14.00	3.00	6.00	7.00	6.00	5.50	1	748	8.98	A broad and spreading specimen of apparently good vigour and vitality. Much of crown is obscure by dense ivy cover. Tree exists on southern bank of substantial ditch suggesting likely physiological constraint to root development in a northerly direction.	Cut ivy and review.	L	B2
85	Ash *(Fraxinus excelsior)*	M	F	12.00	2.50	5.00	6.00	5.00	5.00	1	592	7.10	Appears vigorous but much of crown is obscure by dense ivy cover that prevents detailed review at present. Position to south of notable ditch suggests and natural constraint to root development in a northerly direction.	Cut ivy and review.	L	B2
86	Ash Group *(Fraxinus excelsior)*	S/M	F/P	9.00	0.00	4.50	4.50	4.00	4.00	6	462	5.54	Appears to comprise sucker regeneration from the stump of previous tree. Is of poor quality though small stature presents limited threat at present.	Cut ivy and review regularly.	S	C2
87	Sycamore Group *(Acer pseudoplatanus)*	E/M	P	10.00	0.00	4.50	3.00	4.50	4.50	2	462	5.54	Previously decapitated tree has tree socket from circa 1.50 m. Decay is noted a previous cutting point suggesting mechanical issues and limited sustainability. Small stature presents little threat in short-term.	Review regularly.	S	C2
88	Ash *(Fraxinus excelsior)*	M	F	15.00	5.00	4.50	4.50	5.00	3.00	1	522	6.26	Appears to be of variable crown vigour raising some concern in respect of health status. Much of crown is obscured by dense ivy cover.	Cut ivy and review after ivy shedding and on regular basis if retained.	S	C2

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural Condition	PMR	Yrs	Cat
89	Sycamore *(Acer pseudoplatanus)*	E/M	G/F	14.00	2.00	5.00	4.00	4.50	5.00	1	446	5.35	Young and still vigorous, asserting immense potential for continued growth over time. Position on southern side of ditch suggests minimal potential for root development to north.	Cut ivy and review regularly.	L	B2
90	Ash *(Fraxinus excelsior)*	M	G/F	18.00	2.50	5.00	4.50	5.00	4.50	1	589	7.07	A large specimen arising from embankment top to south of ditch thus suggesting limited potential for root development to north. Much of crown is heavily obscured by dense ivy cover. General vigour and vitality appears good.	Cut ivy and review.	L	B1-3
91	Ash *(Fraxinus excelsior)*	E/M	F	9.00	0.00	3.00	2.50	5.00	2.50	3	430	5.16	Multi-stemmed and distorted, appears likely to comprise sucker regeneration from the stump of previous tree. Is of poor quality though current small stature presents limited threat.	Cut ivy and review regularly regarding suitability pretension.	S	C2
92	Ash Group *(Fraxinus excelsior)*	M	F	17.00	2.00	7.00	7.50	6.00	6.00	3	844	10.12	Large, close-knit community of stems combining to create a singular overall crown form. Tree appears to be adjoined to west by small number of satellite stems. Vigour and vitality appears good though much of crown is obscure by dense ivy cover preventing detailed review at present. Position to south of notable ditch suggests natural constraint to root development in northerly direction.	Cut ivy and review in respect of retention context.	L	B2
93	Ash *(Fraxinus excelsior)*	M	G/F	14.00	1.50	5.00	5.50	5.00	4.50	1	592	7.10	Arises wholly on eastern bank of adjoining ditch that will divided physiologically from the subject site. Vigour and vitality appears fair though much of crown is obscured by dense ivy cover.	Cut ivy and review.	M	B2

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural Condition	PMR	Yrs	Cat
94	Silver Birch *(Betula pendula)*	M	F	6.00	2.00	3.00	2.50	2.00	2.00	1	204	2.44	Young and vigorous though slightly distorted.		L	B2
95	Wild Cherry *(Prunus avium)*	S/M	F	5.50	0.75	3.00	2.50	2.00	2.00	1	229	2.75	Young and still vigorous but heavily encroached upon by recent works. Is likely to be unsustainable.		N/A	U
96	Domestic Plum *(Prunus Sp.)*	E/M	F	4.50	1.00	2.00	2.00	1.00	2.00	1	207	2.48	Still vigorous but heavily encroached upon by substantive ground works. Is unlikely to be sustainable.	Consider early removal.	N/A	U
Groups and Alignments																
TG1	Tree Group 1 Leyland Cypress *(Cuppressocyparis leylandii)*	E/M	G/F	11.00-13.00	0.00	Spread 8.00-10.00m				1	1.15		A contiguous a continuous and intact alignment with sole exception of position of Aerial passage of high tension cables where decapitation has taken place. Most trees are still vigorous notwithstanding some localised suppression and thus present notable potential for continued growth and size increase over time. Concerns exist regarding sustainability that are associated with broadly understood species predispositions and relate primarily to an inability to manage in respect of site control over time. Equally, issues relating to mechanical failure at maturity cannot readily be managed. Accordingly, these trees should be regarded as providing limited sustainability.	Review regarding retention context.	S	C2

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural Condition	PMR	Yrs	Cat
TG2	Tree Group 2 Leyland Cypress *(Cuppressocyparis leylandii)*	E/M	F	10.00-14.00	0.00	Spread 8.00-10.00m				1	1.15		Apparently planted to create a drive/access/garden area defining alignment. These trees and now substantially outgrown and beyond hedge status. Though healthy species predispositions and issues relating to management will substantially undermine sustainability over time.		S	C2
TG3	Tree Group 3 Norway Maple *(Acer platanoides)*	S/M	G	6.00	1.50	Spread 7.00m				1	0.82		A close-knit and almost continuous alignment of trees planted within domiciliary plot and inside of adjoining hedge. Trees currently afford visible overhang of site boundary.		L	B2
H1	Hedge 1 Hawthorn *(Crataegus monogyna)* Bramble *(Rubus fruticosus)* Ivy *(Hedera helix)* Ash *(Fraxinus excelsior)*	M	G/F	6.00-7.50	0.00	Spread 6.00-9.00m				m/s	0.60		A broadly continuous Hawthorne hedge heavily infested by Ivy cover that often obscures 75% plus of canopy form. Continuity is contributed to by an emergent Ash population that where existing, tends to suppress the underlying original hedge. General vigour and vitality appears good thus suggesting some potential for tolerance of pruning. Note is made that pruning has already occurred in positions beneath high tension cables and presumably in relation to the maintenance of necessary clearances. Note is made that many of the emergent Ash are of poor quality, particularly the smaller and more suppressed elements. Such material, whilst offering some degree of sustainability within the short-term may prove ill-suited to longer term retention.		L	B2

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural Condition	PMR	Yrs	Cat
H2	Hedge 2 Hawthorn *(Crataegus monogyna)* Bramble *(Rubus fruticosus)* Ivy *(Hedera helix)* Wych Elm *(Ulmus glabra)* Elder *(Sambucus nigra)*	M	P	2.00-7.00	0.00	Spread 5.00-8.00m				m/s	0.60		Review suggests hedge once comprised a continuous Hawthorn-based alignment however, loss of individuals and suppression by larger, emergent which Elm has suppressed this alignment with only limited Thorn retention remaining. Overall alignment is now provided for by a combination of all species as well as a general low-level thicket development. The hedge appears to exist in conjunction with a distinctly raised embankment, to the north of which there was a ditch, much of which appears now to have been coveted. The hedge is of poor quality and if retained would require substantive additional planting.		M	C2

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural Condition	PMR	Yrs	Cat
H3	Hedge 3 Hawthorn *(Crataegus monogyna)* Bramble *(Rubus fruticosus)* Ivy *(Hedera helix)* Blackthorn *(Prunus spinosa)* Elder *(Sambucus nigra)* Wych Elm *(Ulmus glabra)* Goat Willow *(Salix caprea)*	M	P	4.00-7.00	0.00	Spread 6.00-12.00m				m/s	0.60		A substantially dilapidated hedge exhibiting evidence of once having comprised a continuous Hawthorn-based alignment. The alignment appears to exist in conjunction with a shallow and substantially eroded embankment. At present, the Hawthorne element of the alignment is vestigial with the original alignment being substantially intermittent. Continuity at present is best provided for by a broader thicket development, typically dominated by elder as a proportion of the overall hedge alignment. Removal of historically unintended species and thicket development would effectively destroy any existing degree of continuity. Any requirement for a vegetative alignment in this position will be heavily reliant upon replacement planting.		S	C2

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural Condition	PMR	Yrs	Cat
H4	Hedge 4 Hawthorn *(Crataegus monogyna)* Bramble *(Rubus fruticosus)* Ivy *(Hedera helix)* Ash *(Fraxinus excelsior)* Elder *(Sambucus nigra)* Wych Elm *(Ulmus glabra)*	M	P	4.00-6.00	0.00	Spread 3.00-7.00m				m/s	0.60		A particularly poor and dilapidated hedge where vestigial remnants of the Thorn alignment are now wholly dominated by an emergent ash and which Elm population. Accordingly, the original hedge is effectively non-existent with the vegetative alignment best provided for by a scrub thicket development in conjunction with dumped debris. Should a vegetative alignment be required in this position then substantial replacement planting will be necessary.		S	C2
H5	Hedge 5 Elder *(Sambucus nigra)* Bramble *(Rubus fruticosus)* Ivy *(Hedera helix)* Wych Elm *(Ulmus glabra)*	M	P	6.00-7.00	0.00	Spread 6.00-7.00m				m/s	0.60		This alignment appears not to comprise a true hedge but moreover, natural vegetative redevelopment, typically dominated by Bramble and Elder in conjunction with what appears to be a planted alignment of trees including Cypress and Rowan. The material encountered is particularly poor and would be unsuitable retention.	Remove.	N/A	U

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural Condition	PMR	Yrs	Cat
H6	Hedge 6 Hawthorn *(Crataegus monogyna)* Bramble *(Rubus fruticosus)* Ivy *(Hedera helix)* Elder *(Sambucus nigra)* Ash *(Fraxinus excelsior)* Sycamore *(Acer pseudoplatanus)*	M	P	6.00-8.00	0.00	Spread 6.00-8.00m				m/s	0.60		This alignment exhibits evidence of once having comprised a continuous Thorn alignment in conjunction with an earthen embankment. At present, the original Thorn alignment is dilapidated and discontinuous with the alignment continuity being best afforded by naturally arising thicket development typically dominated by elder and Ivy. Eradication of invasive species would greatly denude the alignment. Accordingly, and dependent upon management requirements and should a vegetative alignment be required in this position then substantial replacement planting would be necessary.		S	C2
H7	Hedge 7 Hawthorn *(Crataegus monogyna)* Bramble *(Rubus fruticosus)* Ivy *(Hedera helix)* Ash *(Fraxinus excelsior)* Wych Elm *(Ulmus glabra)*	M	P	4.00-6.00	0.00	Spread 4.00-7.00m				m/s	0.60		Enough evidence exists to suggest there once having been a continuous Thorn alignment in conjunction with the southern edge of a ditch bank. At present, few of the original Hawthorn is remain and the scrub thicket exists as a combination of broader more spurious thicket development. Many of the individual Hawthorn is that remain might be regarded as healthy however, many are becoming suppressed by extensive Ivy cover. Retention of lower level hedge beneath the tree alignment would require substantive replacement planting.		S	C2

No.	Species	Age	Con	Ht	CH	N	E	S	W	Stm	Dia	RPA	Structural Condition	PMR	Yrs	Cat
H8	Hedge 8 Hawthorn *(Crataegus monogyna)* Bramble *(Rubus fruticosus)* Ivy *(Hedera helix)* Ash *(Fraxinus excelsior)* Elder *(Sambucus nigra)* Dog Rose *(Rosa canina)*	M	P	2.00-6.00	0.00	Spread 4.00-5.00m				m/s	0.60		Exhibits evidence of once having comprised a Thorn based hedge that appears to be mechanically cut including the decapitation of numerous young ash, the majority of which have now re-socket. The entire alignment is becoming dominated by Ivy thicket that is serving to smother much of the supporting plants. There will be considered as being of poor quality in respect of a Thorn hedge however, in respect of a vegetative alignment, and notwithstanding the fact that the high proportion of Ivy incorporated into that alignment then continuity is at present relatively good.		S	C2
H9	Hedge 9 Cherry Laurel *(Prunus laurocerasus)*	E/M	F	1.75	0.00	Spread 1.00m				1	0.30		A continuous alignment arising from position immediately inside of post and rail fence. Is likely to prove to be outside of site jurisdiction.		L	B2
H10	Hedge 10 Beech *(Fagus sylvatica)*	S/M	G	2.00	0.00	Spread 1.50m				1	0.38		Young and vigorous, arising wholly from within the fenced area of adjoining property and thus considered to be outside of site jurisdiction.		L	B2


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Guidelines Representation of Tree and Protection Zone
Client : KFLA Landscape Architecture
Scale : 1:1000 Date :March 2018
Project Tree Survey, Grange Castle South, Phase 22
Description Tree Constraints Plan
Drawing Title:D1-Grange Castle-TCP-03-18
This is a colour coded drawing that will by difficult or impossible to interpret if reproduced in black and white
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CHAPTER 13 CULTURAL HERITAGE

Appendix 13.1 Inventory of identified sites of cultural heritage significance and/or potential within study area

CH No.	Category	Legal status	Baseline Value	Description	Townland	Approximate distance to site	ITM_E	ITM_N
CH001	RMP	DU021-108----	Very High	Concentric enclosure. 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. Geophysical survey, test trenching and initial archaeological excavation (Enclosure AH1) have revealed the presence of a double – ditched enclosure and numerous associated features. The outer ditch measured approximately 90 m in internal diameter and and was on average 4 m in width and 1.20 m deep. In the western part of the site, the townland boundary ditch that divides Ballybane and Milltown townlands utilised the line of outer ditch for a length of approximately 63 m. The inner enclosure ditch enclosed an area measuring approximately 48 m in diameter and it measured 4.40 m in width, with an average depth of 1.45 m. This site has been fully archaeologically excavated.	Ballybane	275 m	703060	730985
CH002	RMP	DU021-109----	Very High	Enclosure. 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. Geophysical survey, test trenching and initial archaeological excavation (Enclosure AH5) have revealed the presence of a penannular enclosure. It is defined by a ditch (c. 44m diameter) with an entrance causeway at the east. Potential pits and postholes are located in the interior. This site has been fully archaeologically excavated.	Ballybane	150 m	702937	730716
CH003	PS/ NIAH	PS180 NIAH 11208010	Very High	Castle Bagot House. Detached five-bay three-storey former country house, c.1800, with full-height canted entrance bay. Now in use as offices. Coursed rubble stone walls, originally rendered, with ashlar quoins. Timber casement windows with flat brick or stone arches and stone sills. Panelled timber doors with cut stone doric pilasters, fanlight and pediment. Hipped artificial slate roofs with two stone chimney stacks. Cast-iron gates with late twentieth-century	Kilmactalway	480 m	702806.939	730214.5299

CH No.	Category	Legal status	Baseline Value	Description	Townland	Approximate distance to site	ITM_E	ITM_N
				cut stone piers having reused original frieze blocks with swags.				
CH004	UCH1		Very High	Enclosure AH6. Geophysical survey, test trenching and initial archaeological excavation have revealed a multivallate enclosure comprising an inner circular ditch with an outer kidney-shaped ditch, and an arc of a third ditch between them. A dense concentration of archaeological features was noted towards the centre of the site, largely within the inner enclosing ditch, with others between the inner and outer enclosure, and sporadic additional features outside the outer enclosure. A baluster headed pin was recovered which is provisionally dated to the 10th century suggesting a general early medieval date for the site. This site has been fully archaeologically excavated.	Ballybane	80 m	703014.67	730713.74
CH005	UCH1		Very High	Enclosure AH2. Geophysical survey, test trenching and initial archaeological excavation have revealed a roughly circular ring ditch (27.5 m N/S and 26 m E/W) with two internal features. This site has been fully archaeologically excavated.	Ballybane	100 m	703109.4	730827.42
CH006	UCH1		Very High	Linear Ditches AH9-10: Geophysical survey, test trenching and initial archaeological excavation have revealed two main roughly parallel linear ditches present in both south (AH9) and north (AH10), a further boundary ditch in the southern area, an area of possible cereal-processing activity, a deposit with a high concentration of medieval pottery and several linear features. One of the ditches originally formed part of the townland boundary between Milltown and Ballybane and this boundary was a live ditch or tributary of the Griffeen River. The southern section of the site was archaeologically excavated in 2018 (18E0484) and preliminary analysis of the results indicates activity of medieval date. The remainder of the site is the subject of a separate programme of archaeological excavation.	Ballybane	200 m	703113	730916.66
CH007	TB		Medium /Low	Townland boundary between Ballybane and Aungierstown & Ballybane	Ballybane/ Aungierstown & Ballybane	0 m	703050	730644

CH No.	Category	Legal status	Baseline Value	Description	Townland	Approximate distance to site	ITM_E	ITM_N
CH008	UCH2		Medium / High	Historic roadway or trackway joining Baldonnell Road to Old Nangor Road west of Kilbride and east of Milltown. Shown on Rocque's map (1756) but not present on later OS mapping. It's likely that the double-ditch demarcating townland boundary CH007 on historic mapping and confirmed through archaeological investigation during monitoring of topsoil removal (Hession 2020b) corresponds to this roadway or trackway.	Ballybane/ Aungierstown & Ballybane	0 m	702923	730488
CH009	AAP		High	Two intercutting pits filled by heat shattered stone were identified in Trench 44 during test trenching in November 2019.	Ballybane/ Aungierstown & Ballybane	170 m	702961.115	730500.085
CH010	AAP		Very High	Burnt Mound identified during archaeological monitoring in 2019 consisted of one large pit/ trough (102), one curvilinear feature (100), and three deposits (104), (105) and (106) of burnt mound material (heat shattered stone within a matric of charcoal rich silty clay). All these features were preserved in-situ under a large berm of topsoil (landscaping design purpose) which will act as a protective buffer zone for the underlying archaeology.	Ballybane/ Aungierstown & Ballybane	25 m	703114.182	730575.076
CH011	AAP		Very High	Burnt Mound identified during archaeological monitoring in 2019 consisted of two large troughs, a large well and the remnants of a heavily ploughed out deposit of burnt mound material. In addition, three stake-holes were identified along the edge of one of the large troughs, while a shallow pit flanked another of the troughs. Site fully archaeologically excavated	Ballybane/ Aungierstown & Ballybane	45 m	703053.905	730589.315

Note: The abbreviations that have been used for the 'Category' section are as follows:

RMP: Recorded archaeological monument
PS: Protected Structure
NIAH: Site recorded in NIAH
ACA: Architectural Conservation Area
UBH: Unregistered built heritage site
UCH (1): Unregistered cultural heritage site that comprises extant remains
UCH (2): Unregistered cultural heritage site that does not comprise extant remains
TB: Townland boundary
AAP: Area/feature of archaeological potential

Appendix 13.2 Previous archaeological investigations

An examination of previous excavations carried out within and around the area proposed for development provides a useful framework for assessment of the study area in terms of its archaeological significance as well as its archaeological potential. The Archaeological Excavations Bulletin is an annual fieldwork gazetteer for Irish Archaeology; it was checked for a record of any licensed archaeological investigations carried out in the vicinity of the development area between 1970 and 2017.

County: Dublin Site name: Adamstown Road (R120) and Nangor Road (R134) Improvement Scheme, Ballybane and Milltown townlands
Sites and Monuments Record No.: N/A Licence number: 16E0520 Extension
Author: Dermot Nelis
Site type: No archaeology found
ITM: E 702620m, N 731140m
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.

County: Dublin Site name: Ballybane and Aungierstown, Dublin (South County)
Sites and Monuments Record No.: 250m from 'the zones of notification' for RMP's DU021-108 & DU021-109 a concentric enclosure and an enclosure Licence number: 15E0551
Author: Billy Quinn
Site type: No archaeology found
ITM: E 703357m, N 730445m
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.

County: Dublin Site name: Adamstown Road (R120) and Nangor Road (R134) Improvement Scheme, Ballybane, Ballymakaily, Clutterland, Grange and Milltown townlands
Sites and Monuments Record No.: N/A Licence number: 16E0520
Author: Dermot Nelis
Site type: Post-medieval structure
ITM: E 702670m, N 731650m
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.

County: Dublin Site name: Gollierstown, Aungierstown, Ballybane
Sites and Monuments Record No.: DU021-108---Vicinity of Licence number: 15E0551
Author: Billy Quinn
Site type: No archaeology found
ITM: E 763222m, N 730681m

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.

County: Dublin Site name: DSF, Grange Castle Business Park, Dublin 22
Sites and Monuments Record No.: N/A Licence number: 14E0453
Author: Neil O'Flanagan
Site type: Bronze Age cremation pits & medieval corn-drying kiln
ITM: E 704096m, N 731046m
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.

County: Dublin Site name: Dub06 Data Centre, Grange Castle Business Park, Ballybane, Dublin 22
Sites and Monuments Record No.: N/A Licence number: 13E0471
Author: Neil O'Flanagan
Site type: Bronze Age - Early Medieval
ITM: E 703709m, N 731334m
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.

County: Dublin Site name: Grange/Ballybane/Nangor, Co. Dublin
Sites and Monuments Record No.: N/A Licence number: 13E0435
Author: Gill McLoughlin
Site type: Iron Age smelting pit & Early medieval charcoal clamp
ITM: E 703873m, N 731566m

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.

County: Dublin Site name: Grange/Ballybane/Nangor
Sites and Monuments Record No.: N/A Licence number: 13E0435
Author: Gill McLoughlin
Site type: Furnace pit (monitoring)
ITM: E 703978m, N 703391m
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.

County: Dublin Site name: Profile Park, Nangor Road, Clondalkin
Sites and Monuments Record No.: N/A Licence number: 12E067
Author: Neil O’Flanagan
Site type: No archaeological significance
ITM: E 704448m, N 731067m
Monitoring was carried out in advance of a Digital Data Centre on behalf of Digital Netherland VIII BV Ltd. The site was situated close to Kilbride church and cemetery (DU021-005), and Kilbride castle DU021-004). There were no archaeological features observed.

County: Dublin Site name: New IAWS HQ, Grange Castle Business Park, Clondalkin
Sites and Monuments Record No.: - Licence number: 06E1161
Author: Eoin Sullivan, for Margaret Gowen & Co. Ltd, 27 Merrion Square, Dublin 2.
Site type: No archaeological significance.
ITM: E 706999m, N 731291m
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.

Site name: Ballybane/Aungierstown and Ballybane/Clondalkin
Sites and Monuments Record No.: DU021-109 Licence number: 18E0292
Author: Jean O'Dowd
Site type: No archaeological significance
ITM: E 703105m, N 730807m
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

Site name: Aungierstown, Ballybane and Milltown, Clondalkin
Sites and Monuments Record No.: N/A Licence number: 18E0484
Author: Dermot Nelis
Site type: Medieval linear features
ITM: E 703050m, N 730780m
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.

Site name: Grange Castle South Business Park, Ballybane/Aungierstown & Ballybane, Clondalkin, Dublin 22
Sites and Monuments Record No.: DU021-109 Licence number: 18E0292 Ext
Author: James Hession
Site type: Burnt mounds and medieval ditch and pits
ITM: E 703105m, N 730807m
Archaeological monitoring and excavation was undertaken at the site of a proposed development in the townlands of Ballybane/Aungierstown and Ballybane in Grange Castle South Business Park, Dublin 22, during 2019.

The proposed development site was divided into two phases. Monitoring of topsoil stripping across the majority of the Phase 1 lands was carried out from 1 to 19 July 2019 under an extension to licence 18E0292 (2018:458).

Eight features of archaeological significance were identified consisting of three pits of uncertain date, a stake-hole, two medieval ditches, a post-medieval field drain and the remnants/gateposts of a post-medieval field boundary gate/entrance. These features were fully excavated between 15 and 19 July 2019.

Test trenching and the remaining topsoil stripping of the Phase 1 and Phase 2 lands took place from 4 to 13 December 2019. 18 features of archaeological significance were identified consisting of two isolated prehistoric pits and the ploughed-out remnants of three burnt mounds/fulachtaí fia and their associated features.

The first burnt mound consisted of three deposits of burnt mound material, one trough, one pit, one curvilinear feature and a former field boundary ditch. This site was preserved in situ. The second burnt mound site consisted of a small deposit of burnt mound material, three pits, three stake-holes, two troughs and one possible well. These archaeological features were fully resolved from the 16 to 20 December 2019. The third burnt mound consisting of a deposit of burnt mound material and a possible trough was also preserved in situ.

The two isolated pits consisted of a tree-throw hole that was subsequently altered to accommodate a later sub-oval shaped pit. The main fill of the later pit suggested it may have been used as an earth oven.

Post-excavation work is ongoing.

Site name: Corkagh Demesne, Deansrath, Kilcarbery and Nangor, Clondalkin
Sites and Monuments Record No.: N/A Licence number: 17E0367
Author: Dermot Nelis
Site type: Nine undated features
ITM: E 705100m, N 730800m
South Dublin County Council proposes to build approximately 1,000 dwellings over a 5–7 year period on a site measuring 87.37 acres.

A geophysical survey was carried out by Joanna Leigh (Licence Number 17R0016) in April 2017. The survey showed the site to be littered with modern ferrous debris, including areas of burnt-out cars, prams, mattresses etc. The modern material resulted in a data set comprising of mostly modern ferrous responses. Although modern disturbance dominated the data some responses of interest were recorded, and testing revealed one of the geophysical features to be of archaeological significance.

Approximately 15,000 linear metres of test trenches were excavated by Dermot Nelis and Colm Flynn. Fieldwork was carried out by two machines fitted with 1.8m wide flat buckets, and under archaeological supervision.

Test trenching revealed nine previously unrecorded discrete archaeological features, and these consisted of an area with slag and burning, pits and a possible hearth. It is anticipated that these features will fully excavated, but excavation has not commenced at the time of writing.

Site name: Corkagh Demesne, Deansrath, Kilcarbery and Nangor townlands, Clondalkin
Sites and Monuments Record No.: N/A Licence number: 17E0367 Extension
Author: Dermot Nelis
Site type: Isolated features
ITM: E 705100m, N 730800m
South Dublin County Council proposes to build approximately 1,000 dwellings over a 5–7 year period on a site measuring 87.37 acres.

Test trenching carried out in 2017 revealed a number of previously unrecorded discrete archaeological features within the development area. These features were excavated in 2018.

A pit/hearth and a possible screen were identified towards the southern end of the development area. These features contained no diagnostic artefacts or suitable dating material.

A hearth and post-hole were identified towards the eastern end of the development area. These features contained no diagnostic artefacts or suitable dating material. A shallow post-medieval pit was also identified in this area.

A group of three pits with heat-fractured stone were revealed towards the middle of the development area. A radiocarbon determination from a charcoal sample from one of the pits returned a Middle/Late Bronze Age date. A separate location contained an articulated sheep burial of unknown date.

All known archaeological features within the development were fully excavated. No additional archaeological features or artefacts were revealed.

Appendix 13.3 National Museum of Ireland (NMI) topographical files

The topographical files of the National Museum of Ireland (NMI) contain a record of stray artefacts found in Ireland. Each artefact has an individual file where it gives locational information, description of the artefact and relevant references.

There are no topographic files with locations within the study area.

Appendix 13.4 Legislative Framework

EIA Legislation

EIA Directive 85/337/EEC as amended by 97/11/EC, 2003/35/EC and 2009/31/EC requires that certain developments be assessed for likely environmental effects before planning permission can be granted. This original directive and its amendments were consolidated informally in EIA Directive 2011/92/EU and further amended 2014/52/EU.

Directive 2014/52/EU that among other factors, information is to be provided on:

'cultural heritage, including architectural and archaeological aspects' (Annex IV, Section 3)

Each of these assets is addressed within this assessment report.

Cultural Heritage Legislation

Archaeological Monuments/Sites
Archaeological heritage is protected primarily under the National Monuments Acts 1930-2004. Section 2 of the 1930 National Monuments Act defines the word 'monument' as including:

'any artificial or partly artificial building, structure, or erection whether above or below the surface of the ground and whether affixed or not affixed to the ground and any cave, stone, or other natural product whether forming part of or attached to or not attached to the ground which has been artificially carved, sculptured or worked upon or which (where it does not form part of the ground) appears to have been purposely put or arranged in position and any prehistoric or ancient tomb, grave or burial deposit, but does not include any building which is for the time being habitually used for ecclesiastical purposes'

Under the 1994 Act, provision was made for a Record of Monuments & Places (RMP). The RMP is a revised set of SMR (Sites and Monuments Record) maps, on which newly-discovered sites have been added and locations which proved not to be of antiquity have been de-listed by the National Monuments Service.

In effect, the National Monuments Acts 1930-2004 provide a statutory basis for:

- Protection of sites and monuments (RMPs)
- Sites with Preservation Orders
- Ownership and Guardianship of National Monuments
- Register of Historic Monuments (pre-dating 1700AD)
- Licensing of archaeological excavations
- Licensing of Detection Devices
- Protection of archaeological objects
- Protection of wrecks and underwater heritage (more than 100 years old)

In relation to proposed works at or in the vicinity of a recorded archaeological monument, Section 12 (3) of the National Monuments (Amendment) Act 1994 states:

'When the owner or occupier (not being the Commissioners) of a monument or place which has been recorded [in the Record of Monuments and Places] or any person proposes to carry out, or to cause or permit the carrying out of any work at or in relation to such monument or place, he shall give notice in writing of his proposal to carry out the work to the Commissioners and shall not, except in the case of urgent necessity and with the consent of the Commissioners, commence the work for a period of two months after having given the notice.'

Archaeological artefacts
Section 2 of the 1930 National Monuments Act (amended) defines an archaeological object as (in summary) any chattel in a manufactured or partly manufactured state or an unmanufactured state but with an archaeological or historical association. This includes ancient human, animal or plant remains.

Section 9 (1) of the National Monuments (Amendment) Act 1994 states that any such artefact recovered during archaeological investigations should be taken into possession by the licensed archaeological director

and held on behalf of the state until such a time as they are deposited accordingly subsequent to consultation with the National Museum of Ireland.

Architectural Sites
In 1997 Ireland ratified the Granada Convention on architectural heritage. This provided the basis for a national commitment to the protection of the architectural heritage throughout the country. The Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act 1999 and Local Government (Planning and Development) Act 2000 made the legislative changes necessary to provide for a strengthening of the protection of architectural heritage. The former Act has helped to provide for a forum for the strengthening of architectural heritage protection as it called for the creation of a National Inventory of Architectural Heritage which is used by local authorities for compiling the Record of Protected Structures (RPS). The Record of Protected Structures (RPS) is set out in each respective county's Development Plan and provides statutory protection for these monuments.

Section 1 (1) of the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act, 1999 states:

'architectural heritage means all—
(a) structures and buildings together with their settings and attendant grounds, fixtures and fittings,
(b) groups of such structures and buildings, and
(c) sites, which are of architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest"

The 1999 Act was replaced by the Local Government (Planning and Development) Act 2000 where the conditions relating to the protection of architectural heritage are set out in Part IV of the Act. Section 57 (1) of the 2000 Act states that:

'…the carrying out of works to a protected structure, or a proposed protected structure, shall be exempted development only if those works would not materially affect the character of –
(a) the structure, or
(b) any element of the structure which contributes to its special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest'

Policy Framework

South Dublin County Development Plan 2016–2022
HCL1: It is the policy of the Council to protect, conserve and enhance natural, built and cultural heritage features, and to support the objectives and actions of the County Heritage Plan.

HCL2: It is the policy of the Council to manage development in a manner that protects and conserves the Archaeological Heritage of the County and avoids adverse impacts on sites, monuments, features or objects of significant historical or archaeological interest.

HCL3: It is the policy of the Council to conserve and protect buildings, structures and sites contained in the Record of Protected Structures and to carefully consider any proposals for development that would affect the special character or appearance of a Protected Structure including its historic curtilage, both directly and indirectly.

HCL4: It is the policy of the Council to preserve and enhance the historic character and visual setting of Architectural Conservation Areas and to carefully consider any proposals for development that would affect the special value of such areas.

HCL5: It is the policy of the Council to encourage the preservation of older features, buildings, and groups of structures that are of historic character including 19th Century and early to mid 20th Century houses, housing estates and streetscapes.

HCL6: It is the policy of the Council to secure the identification, protection and conservation of historic items and features of interest throughout the County including street furniture, surface finishes, roadside installations, items of industrial heritage and other stand alone features of interest.

HCL18: It is the policy of the Council to promote the County's cultural heritage.

Appendix 13.5 Cultural heritage graphics

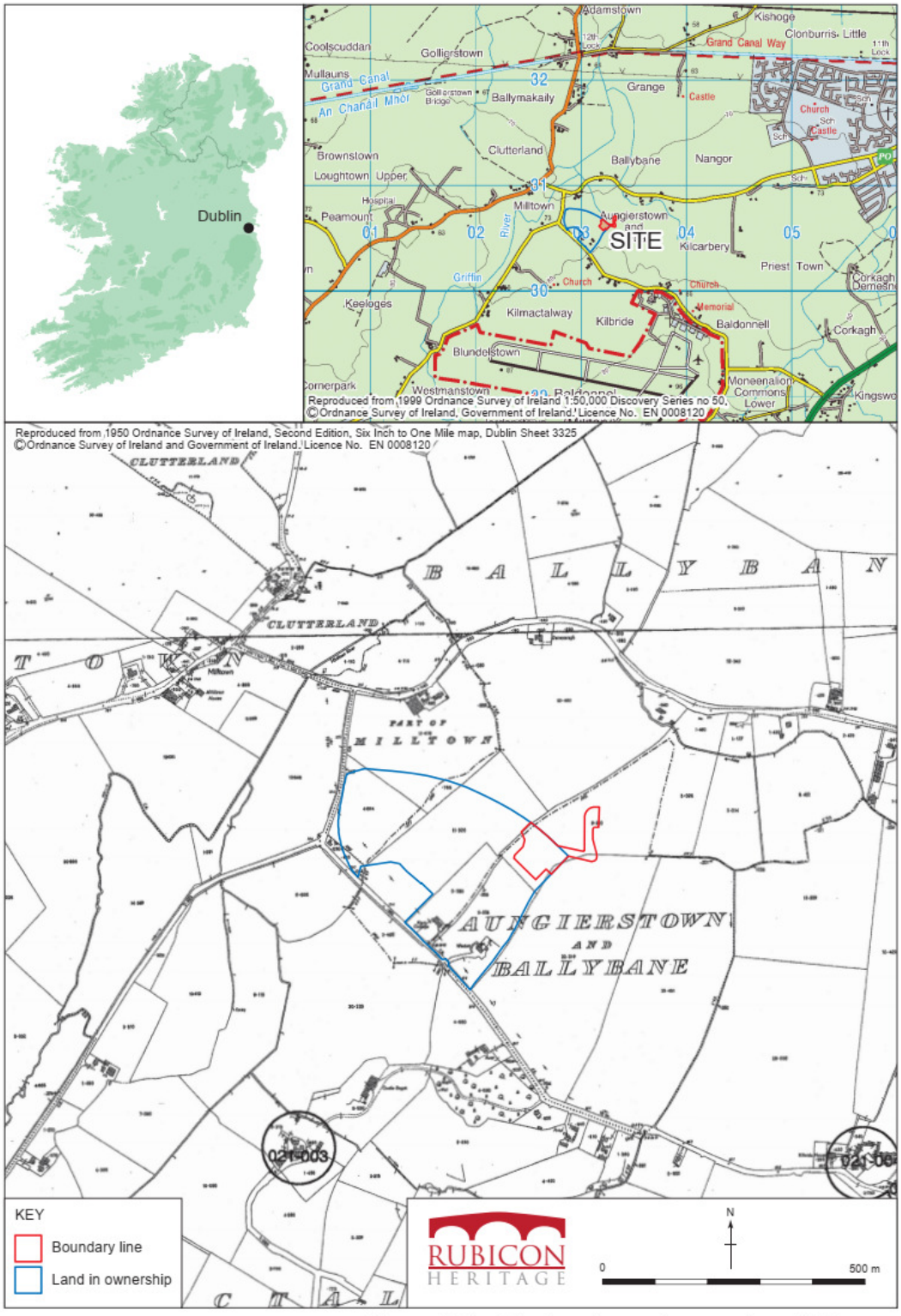

Figure 13.1 - Site location and extract from RMP map.

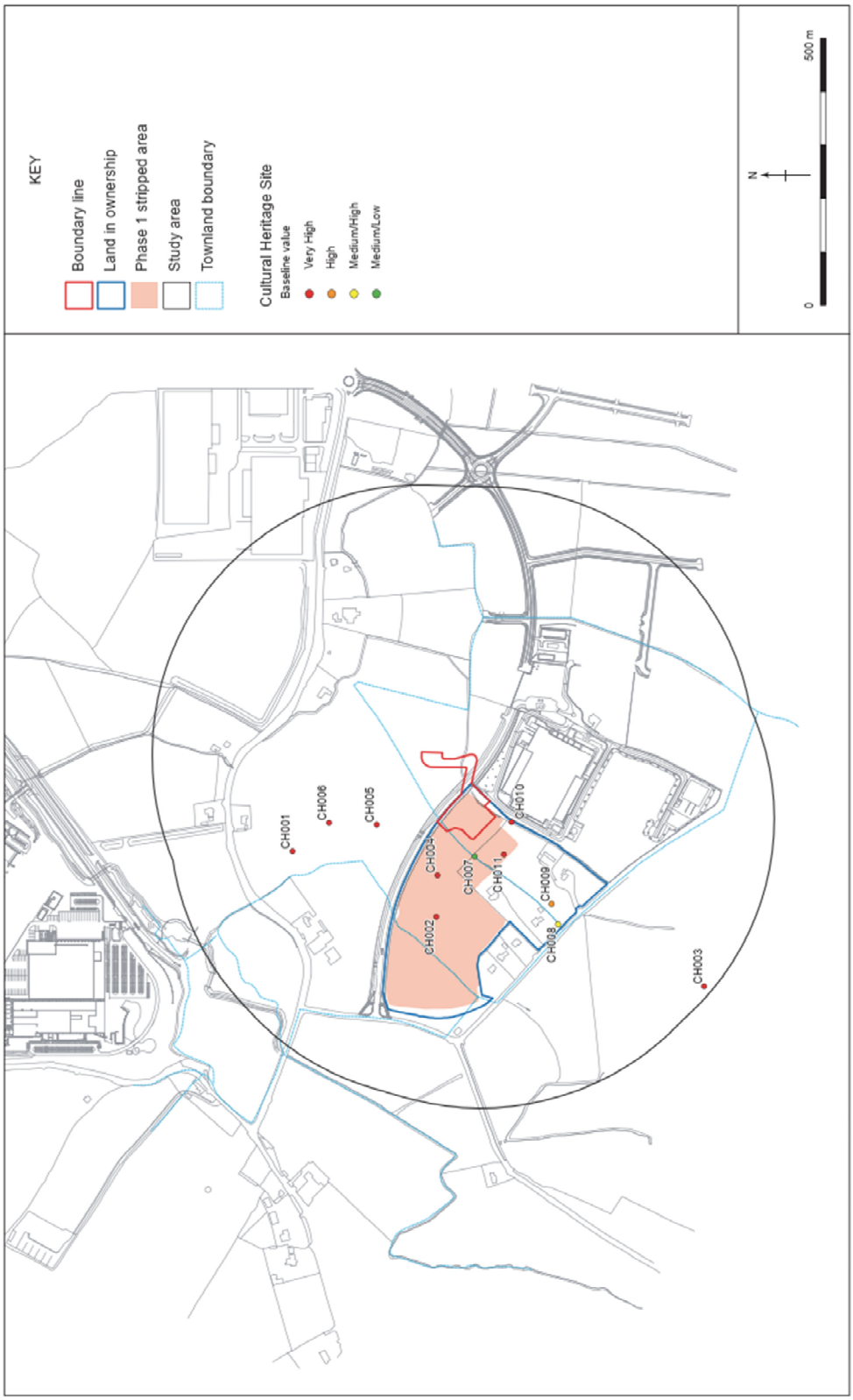

Figure 13.2 - Identified sites of cultural heritage significance and/or potential within study area.

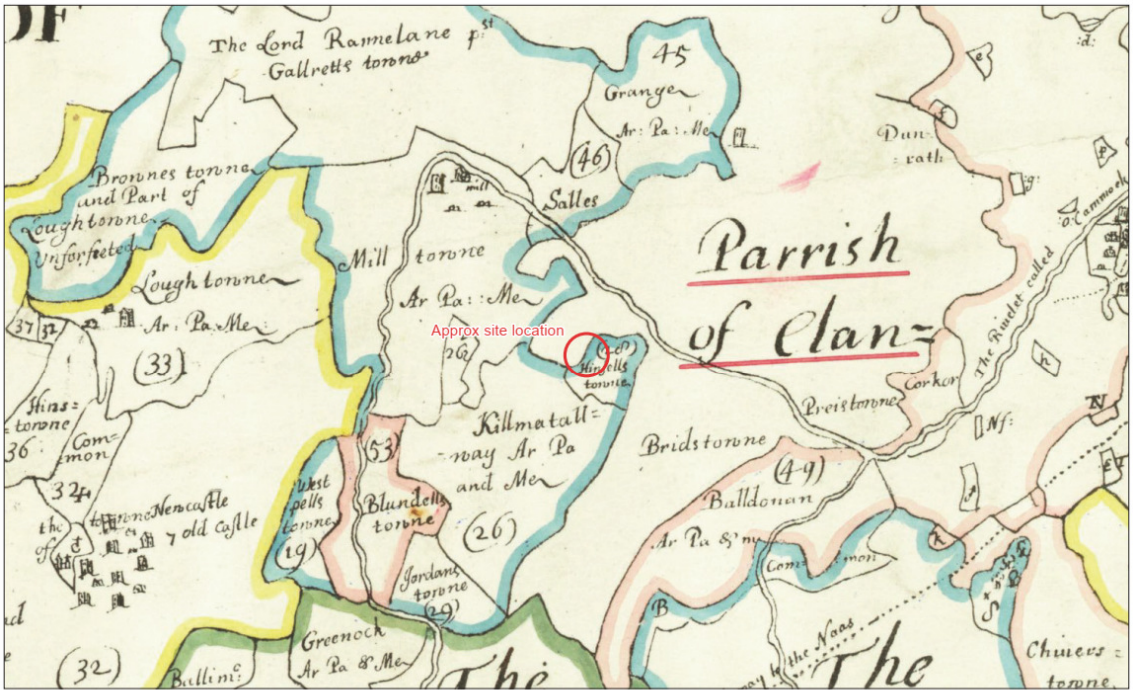

Figure 13.3 - Extract from Down Survey map of Barony of Newcastle.

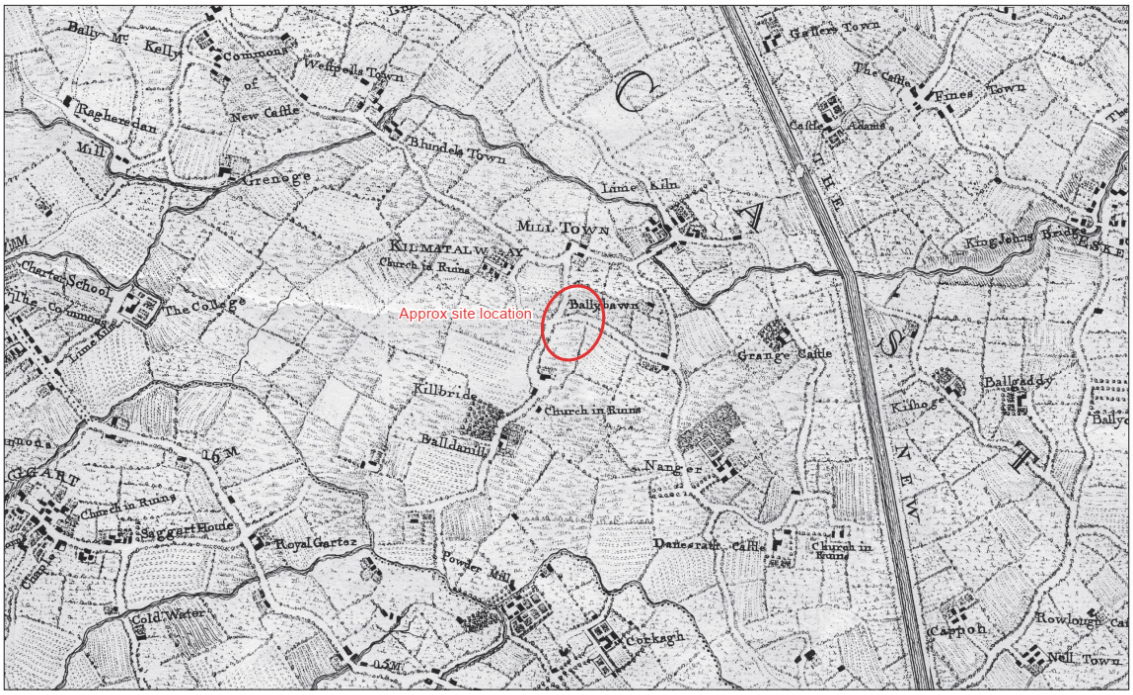

Figure 13.4 - Extract of Rocque's Map of County Dublin.

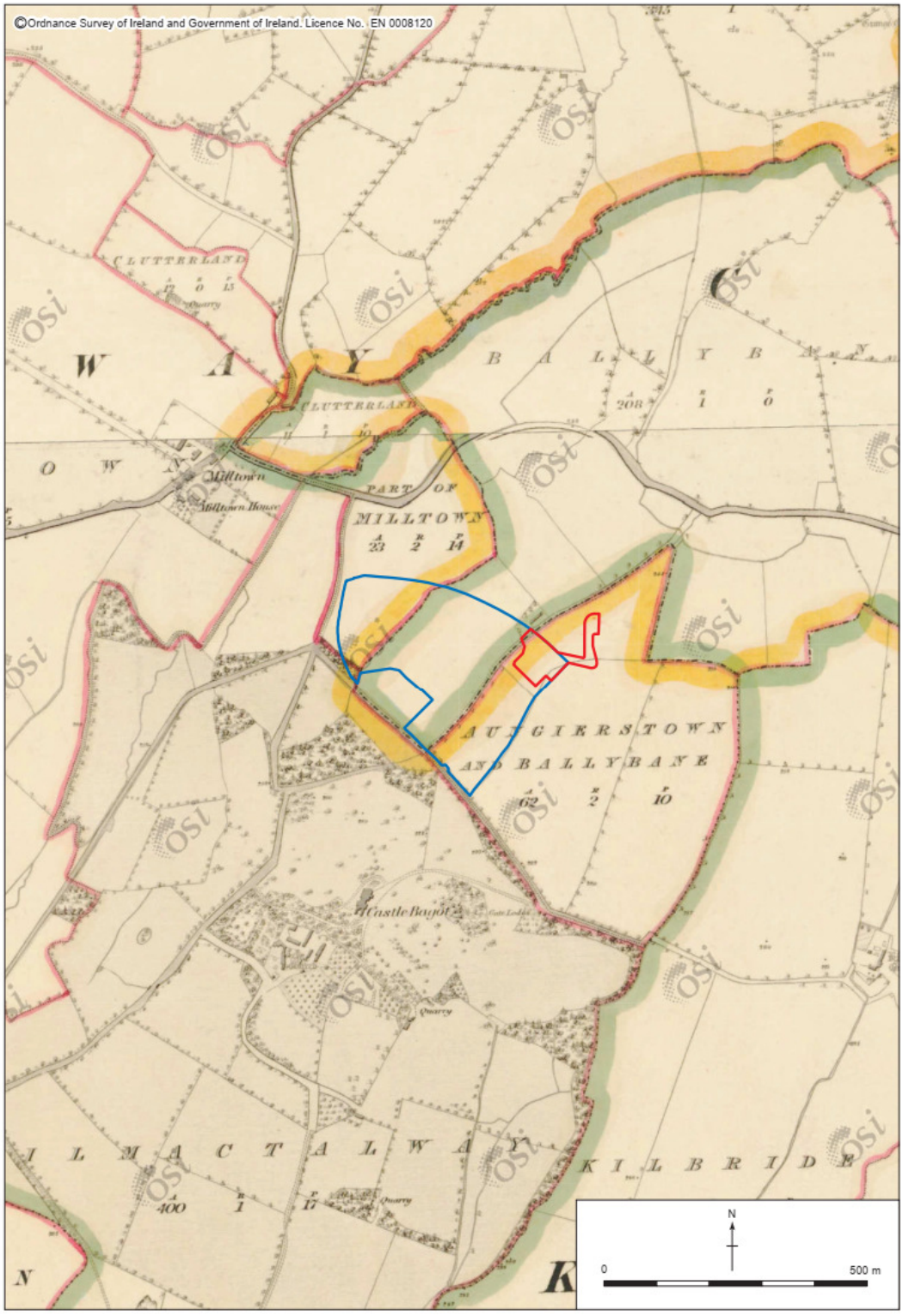

Figure 13.5 - First edition 6-inch Ordnance Survey map with proposed development site.

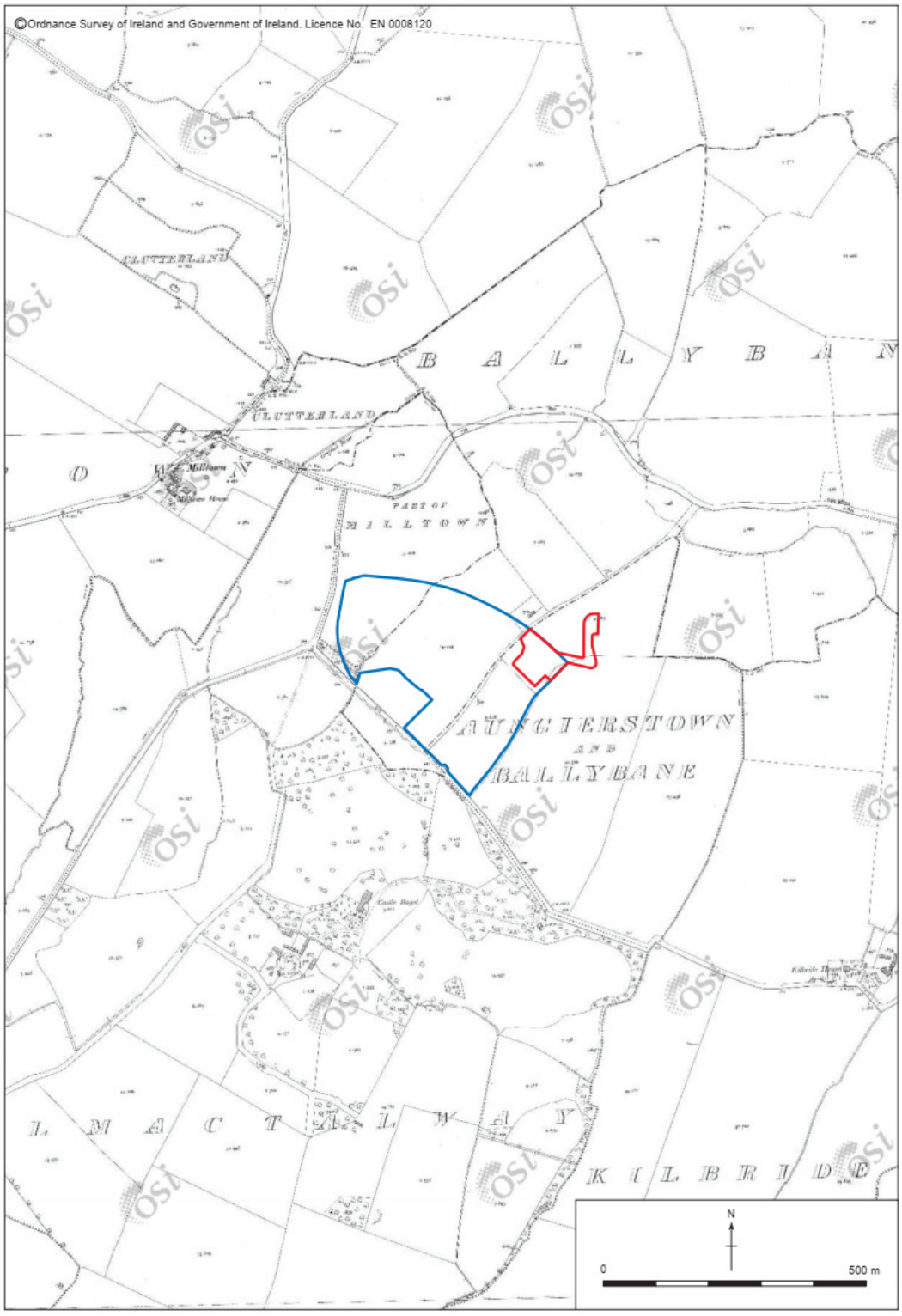

Figure 13.6 - First edition 25-inch Ordnance Survey map with proposed development site.

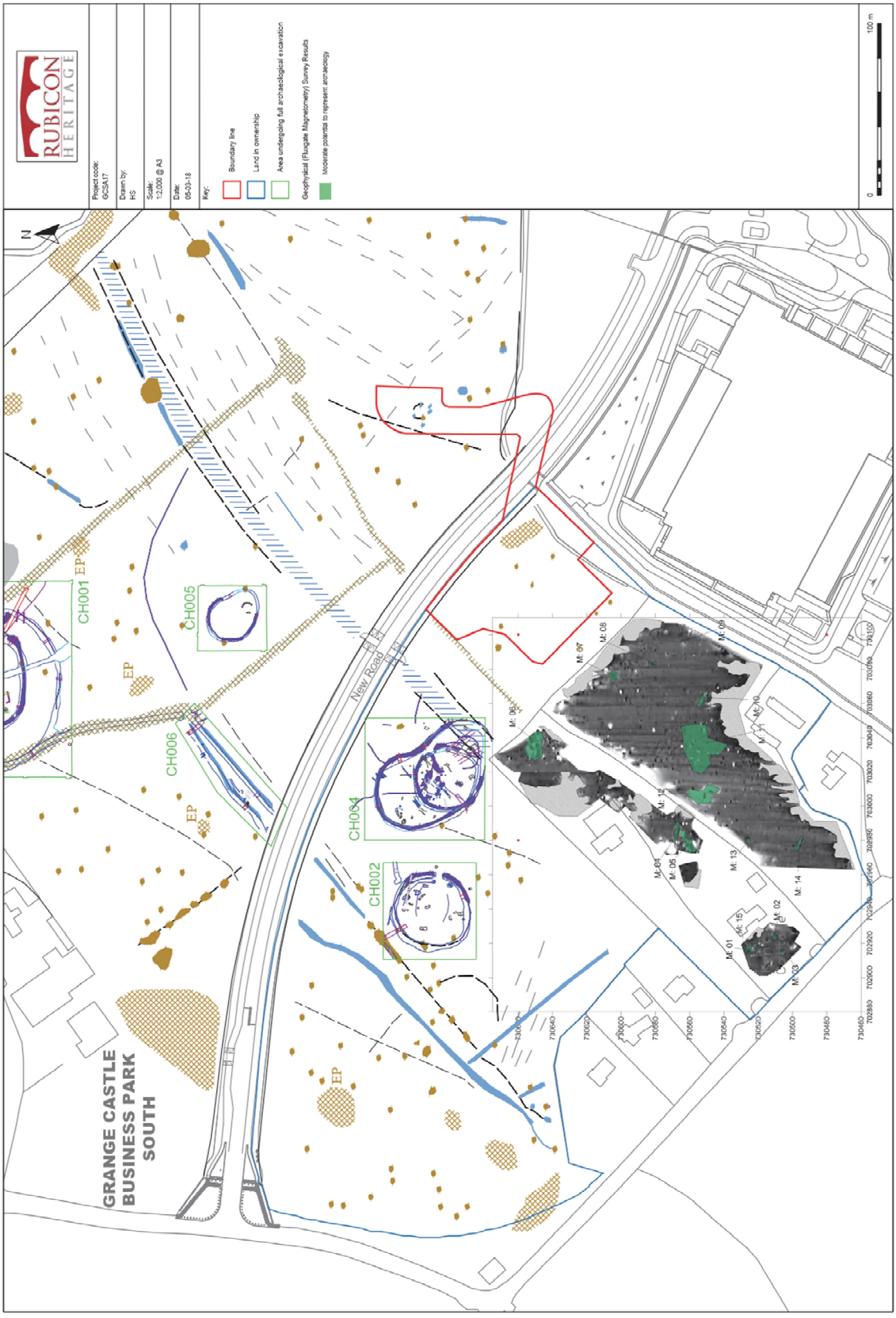

Figure 13.7 - Results of both previous geophysical surveys.

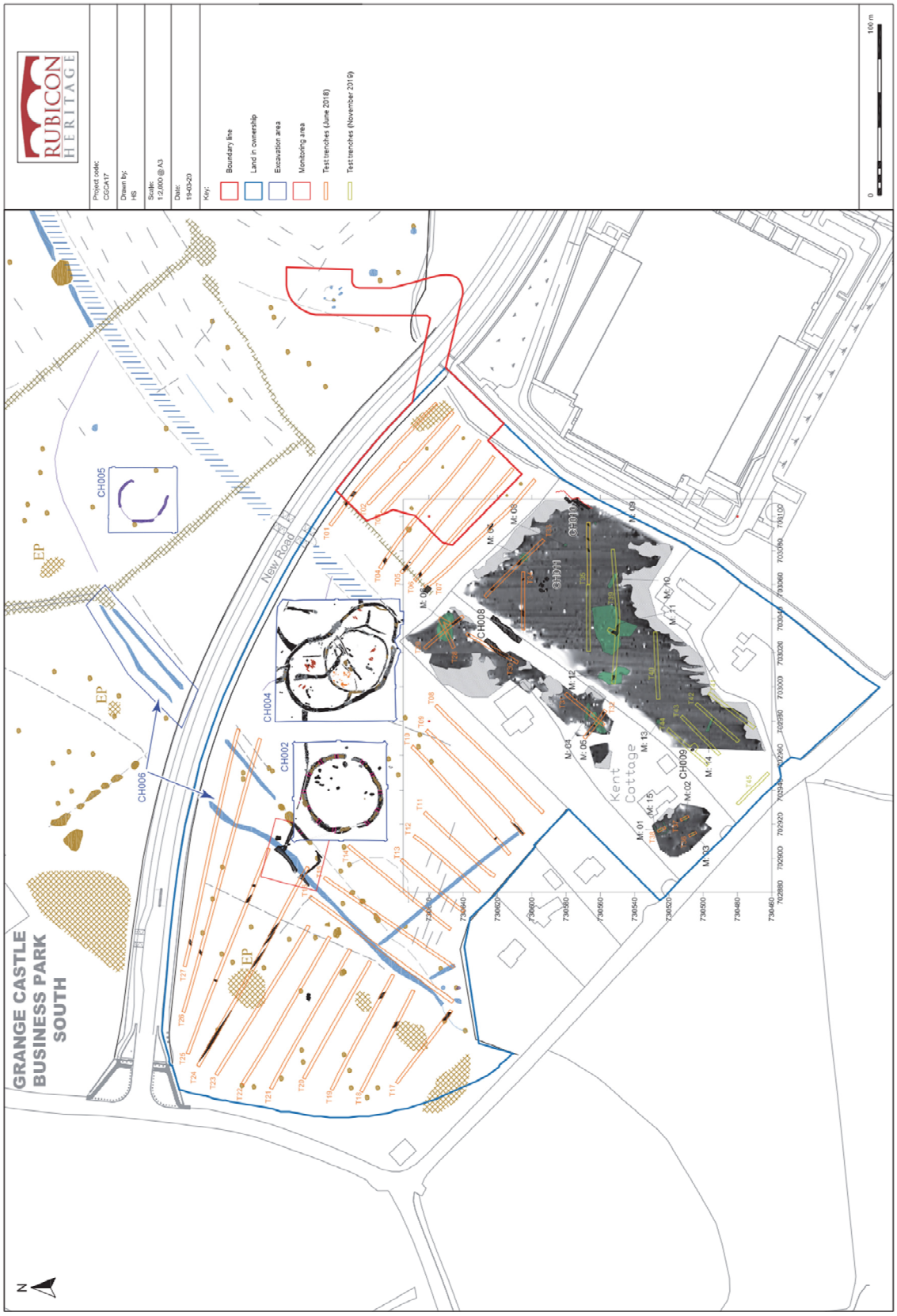

Figure 13.8 - Plan of excavation findings overlaid on results of 2016 geophysical survey, 2018 excavation and subsequent test trenching and monitoring programmes.

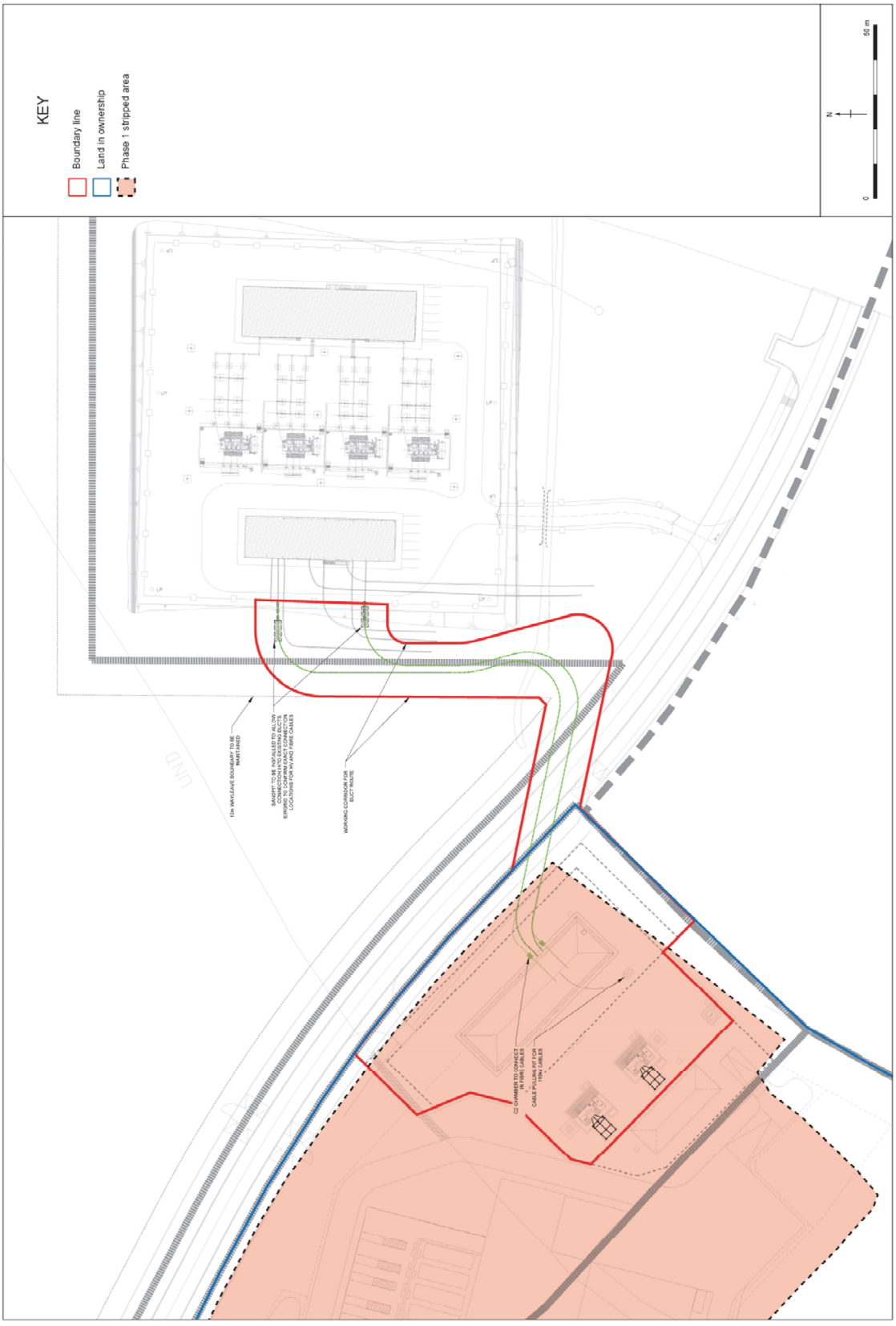

Figure 13.9 - Extent of area stripped to subsoil during archaeological monitoring for Phase 1 of the data centre construction.

CHAPTER 14 – WASTE MANAGEMENT

Appendix14.1 Outline Construction and Demolition Waste Management Plan

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APPENDIX 14.1

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT PLAN

PROPOSED GIS SUBSTATION, 110KV TRANSMISSION LINE, GRANGE CASTLE, DUBLIN 22

Technical Report Prepared By

Jonathan Gauntlett, Environmental Consultant

Our Reference

JG/20/11659WMR01

Date of Issue

2 December 2020

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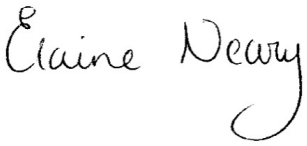
Revision Level	Revision Date	Description	Sections Affected
a	2 December 2020	Revised grid route	All Sections.

Record of Approval

Details	Written by	Approved by
Signature		
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Date	2 December 2020	2 December 2020

CONTENTS

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 planning application to An Bord Pleanála (ABP).

The purpose of this C&D WMP 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 C&D WMP 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 the C&D WMP 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].

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.

2.0 OVERVIEW OF WASTE MANAGEMENT IN IRELAND

2.1 National Level

The 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 [7]. 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 82% over fifteen years (by 2013) [7].

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.

A number of additional National and Regional Waste Policies, Strategies and Reports have been issued in previous years including:

- Department of the Environment, Heritage and Local Government (DoEHLG), *Preventing and Recycling Waste - Delivering Change* (2002);
- DoEHLG, *Making Ireland's Development Sustainable – Review, Assessment and Future Action, World Summit on Sustainable Development* (2002);
- DoEHLG, *Taking Stock and Moving Forward* (2004);
- DoEHLG, *National Strategy on Biodegradable* Waste (2006); and
- DoEHLG, *A Resource Opportunity* (2012).

The most recent national policy document was published in July 2012, entitled *A Resource Opportunity - Waste Management Policy in Ireland* [9]. This document stresses the environmental and economic benefits of better waste management, particularly in relation to waste prevention. The document sets out a number of actions in relation to C&D waste - it commits to undertake a review of specific producer responsibility requirements for C&D projects over a certain threshold.

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, South Dublin County Council, etc.

2.2 Regional Level

The proposed development is located in the Local Authority area of South Dublin County Council (SDCC).

The Eastern-Midlands Region (EMR) Waste Management Plan 2015 – 2021 is the current regional waste management plan for the DCC area. The plan does not set specific targets for construction and demolition (C&D) waste, however, the Waste Framework Directive (WFD) sets a target for Member States of "70% preparing for reuse, recycling and other recovery of construction and demolition waste (excluding natural soils and stones and hazardous wastes)" to be achieved by 2020, which is highlighted in the regional plan. Other mandatory targets set in the Plan include:

- A 1% reduction per annum in the quantity of household waste generated over the period of the plan;
- Achieve a reuse/recycling rate of 50% of municipal waste by 2020; and

- Reduce to 0% the direct disposal of 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. Landfill charges in the region are approximately €130-150 per tonne of waste which includes a €75 per tonne landfill levy introduced under the *Waste Management (Landfill Levy) (Amendment) Regulations 2012*.

The *South Dublin County Council Development Plan 2016 – 2022*[10] sets out a number of objectives and actions for the South Dublin area in line with the objectives of the waste management plan.

Waste objectives and actions with a particular relevance to the proposed development are as follows:

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.

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. Sub-ordinate legislation includes:
    - European Communities (Waste Directive) Regulations 2011 (SI 126 of 2011) as amended

  - Waste Management (Collection Permit) Regulations (S.I No. 820 of 2007) as amended
  - Waste Management (Facility Permit and Registration) Regulations 2007, (S.I No. 821 of 2007) as amended
  - Waste Management (Licensing) Regulations 2004 (S.I. No. 395 of 2004) as amended
  - Waste Management (Packaging) Regulations 2014 (S.I. 282 of 2014) as amended
  - Waste Management (Planning) Regulations 1997 (S.I. No. 137 of 1997)
  - Waste Management (Landfill Levy) Regulations 2015 (S.I. No. 189 of 2015)
  - European Union (Waste Electrical and Electronic Equipment) Regulations 2014 (S.I. No. 149 of 2014)
  - European Union (Batteries and Accumulators) Regulations 2014 (S.I. No. 283 of 2014) as amended
  - Waste Management (Food Waste) Regulations 2009 (S.I. 508 of 2009), as amended
  - European Union (Household Food Waste and Bio-waste) Regulation 2015 (S.I. No. 191 of 2015)
  - Waste Management (Hazardous Waste) Regulations, 1998 (S.I. No. 163 of 1998) as amended
  - Waste Management (Shipments of Waste) Regulations, 2007 (S.I. No. 419 of 2007) as amended
  - Waste Management (Movement of Hazardous Waste) Regulations, 1998 (S.I. No. 147 of 1998)
  - European Communities (Transfrontier Shipment of Waste) Regulations 1994 (SI 121 of 1994)
  - European Union (Properties of Waste which Render it Hazardous) Regulations 2015 (S.I. No. 233 of 2015) as amended.
- Environmental Protection 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 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

The Proposed Development will consist of:

- The proposed development primarily comprises the provision of two no. 110kV transmission lines and a 110kV Gas Insulated Switchgear (GIS) substation compound along with associated and ancillary works and is described as follows:
- The proposed 110kV GIS Substation Compound is to be located on lands to the north-east of the two storey data centre facility and associated three storey office block that was permitted under SDCC Reg. Ref. SD18A/0134 / An Bord Pleanála Ref. ABP-302813-18, and within an overall landholding bound to the north by the Grange Castle South Business Park access road; to the west by the Baldonnel Road and to the south by 3 no. residential properties and the Baldonnel Road; and to the east by the Google data centre facility within Baldonnel, Dublin 22. The site of the proposed development has an area of c. 0.9163 hectares.
- The proposed 110kV Gas Insulated Switchgear (GIS) Substation Compound includes the provision of a two storey GIS Substation building (with a gross floor area of 1,307.2sqm) (known as the Aungierstown Substation), two transformers, lighting masts, car parking, associated underground services and roads within a 3.5m high fenced compound and all associated construction and ancillary works.
- Two proposed underground single circuit 110kV transmission lines will connect the proposed Aungierstown 110kV GIS Substation to the existing 220kV / 110kV Castlebaggot Substation to the immediate north-east. The proposed transmission line covers a distance of approximately 150m within the townlands of Ballybane, and Aungierstown and Ballybane.
- The development includes the connections to the two substations (existing and proposed), changes to landscaping permitted under SDCC Reg. Ref. SD18A/0134 / An Bord Pleanála Ref. ABP-302813-18 and all associated construction and ancillary works.

A detailed description of the development is provided in Chapter 2 (Description of the Proposed Development) of the EIA Report. A description of the characteristics of the development relevant to waste are described in Section 14.20 – 14.35 of Chapter 14 (Waste Management).

3.2 Overview of the Non-Hazardous Wastes to be produced

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, topsoil, subsoil and possibly bedrock (if encountered).

The project engineers have estimated that c. 1,050m3 of excavated material will be generated, of made ground, soils/stones. Suitable soils and stones will be reused on site as backfill in the grassed areas, where possible. However, it is currently envisaged that majority of the excavated material will require removal offsite. The importation of fill materials will be required for construction of foundations and to reinstate the trenches.

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 in the site compound for the permitted development Reg. Ref. SD18A/0134 / An Bord Pleanála Ref. ABP-302813-18.

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 Potentially Hazardous Waste

3.3.1 Contaminated Soil

Any surplus material that requires removal from site for offsite reuse, recovery and/or disposal as a waste and any potentially contaminated material (in the unlikely event that it is encountered), should be segregated, 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'* using the *HazWasteOnline* application (or similar approved classification method). If the material is to be disposed of to landfill, it will then need to be classified as clean, inert, non-hazardous or hazardous in accordance with the *EC Council Decision 2003/33/EC* and landfill specific criteria. This legislation sets limit values on landfills for acceptance of waste material based on properties of the waste including potential pollutant concentrations and leachability.

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.

A geotechnical site investigation was conducted at the site in November 2017 and March 2018 by IGSL Limited on behalf of Cyrus One. The ground investigation report shows there was no evidence of subsurface contamination encountered during the site investigation works. It is not anticipated that subsurface contamination will be encountered along the proposed services routes.

Further details on the soil quality at the site is provided in Chapter 7 (Land, Soils, Geology and Hydrogeology).

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 Other Known Hazardous Substances

Paints, glues, adhesives and other known hazardous substances will be stored in designated areas, if generated. They will generally be present in small volumes only or may not arise at all. If these wastes are generated, storage of these waste types 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 and batteries (Lead, Ni-Cd or Mercury) may be generated from the temporary site office 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 3.1. 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 List of Waste Codes (* individual waste type may contain hazardous materials)

Main Waste Material Types	**List of Waste Code**
Soil and stones	17 05
Biodegradable/Green Waste	20 02 01
Bituminous mixtures*	17 03 01/02
Other Waste Types (*which may be generated*)	**List of Waste Code**
Electrical and electronic components	20 01 35 & 36
Paper and cardboard	20 01 01
Mixed municipal waste	23 03 01
Mixed C&D waste	17 09 04
Batteries and accumulators*	20 01 33 & 34
Liquid fuels*	13 07 01, 02 & 03

4.0 ESTIMATED WASTE ARISINGS

4.1 Demolition Waste Generation

No demolition will be required to facilitate the construction of the proposed development.

4.2 Construction Waste Generation

The quantity of excavated material that will be generated has been estimated by the project engineers, to be c. 1,050m^3. It anticipated that the majority of the material will be removed off site for reuse and recycle/recovery, with some being reused as backfill in the grassed areas, where possible.

It is expected that wastes generated (other than excavated material and trees/shrubbery) from other construction activities will be negligible and will generally comprise waste generated from 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 the site office.

The welfare facilities and site office for the proposed development will be located in the site compound for the concurrent development.

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

An outline Construction Environmental Management Plan (CEMP) has been prepared to accompany the planning application. The appointed main contractor will be required to prepare a detailed CEMP prior to commencement of construction which may refine the above waste estimates.

4.3 Proposed Waste Management Options

Waste materials generated will be segregated on-site, where it is practical. Where the on-site segregation of certain wastes types is not practical, off-site segregation will be carried out. There will be skips and receptacles provided to facilitate segregation at source. 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.

Mixed C&D waste (classified under the List of Waste code 17 09 04) is permitted for acceptance at a number of waste facilities in the region including Integrated Material Solutions landfill in north Dublin and a number of waste transfer stations.

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:

Soil and Stone
The Waste Management Hierarchy states that the preferred option for waste management is prevention and minimisation of waste, followed by preparing for reuse and recycling/recovery, energy recovery (i.e. incineration) and, least favoured of all, disposal. The volume of soil and stone to be excavated is estimated to be 1,050m^3. It is currently anticipated that majority of the excavated material will be require removal off site, with some being used as backfill in the grassed areas, where possible.

The majority of soil & stone will need to be removed off-site either as a waste or, where appropriate, as a by-product. Where the material is to be reused on another site as a by-product (and not as a waste), this will be done in accordance with Article 27 of the European Communities (Waste Directive) Regulations 2011. EPA agreement will be obtained before re-using the material as a by-product.

The next option (beneficial reuse) may be appropriate for the excavated material, subject to environmental testing to classify the material as hazardous or non-hazardous in accordance with the EPA Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous publication. Clean material may be used as fill material in other construction projects or engineering fill for waste licensed sites. Beneficial reuse of surplus excavation material as engineering fill may be subject to further testing to determine if materials meet the specific engineering standards for their proposed end-use.

Any nearby sites requiring clean fill/capping material could be contacted to investigate reuse opportunities for clean and inert material. If any soils/stones are imported onto the site from another construction site as a by-product (and not as a waste), this will also be done in accordance with Article 27. However, it is not expected that this will be necessary.

If the material 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 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 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 inert/non-hazardous material. It will require off-site treatment at a suitable facility or disposal abroad via Transfrontier Shipment of Wastes (TFS).

Tarmacadam
Tarmacadam excavated will be segregated and transferred off site for appropriate reuse, recycling, recovery and/or disposal.

Concrete
Concrete will be segregated and transferred off site for appropriate reuse, recycling, recovery and/or disposal.

Biodegradable/Green Waste
Trees and shrubbery removed will be transferred off site for appropriate reuse and/or recovery.

Waste Electrical and Electronic Equipment (WEEE)
Any WEEE generated in the site office will be stored in a dedicated container in the site office pending collection for recycling.

Batteries
Any waste batteries generated in the site office will be stored in a dedicated container in the site office pending collection for recycling.

Other Recyclables
Where any other recyclable wastes such as cardboard and soft plastic are generated at the site compound, these will be segregated at source into dedicated receptacles and removed off-site.

Non-Recyclable Waste
C&D waste which is not suitable for reuse or recovery, such as polystyrene, some plastics and some cardboards, will be placed in separate receptacles in the site compound. Prior to removal from site, the non-recyclable waste receptacle will be examined by a member of the waste team (see Section 7.0) to determine if recyclable materials have been placed in there by mistake. If this is the case, efforts will be made to determine the cause of the waste not being segregated correctly and recyclable waste will be removed and placed into the appropriate receptacle.

Other Hazardous Wastes
On-site storage of any hazardous wastes produced e.g. contaminated soil during excavations or waste fuels at the site compound will be kept to a minimum, with removal off-site organised on a regular basis. Storage of all hazardous wastes 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 it is not possible to provide information on the specific destinations of each waste stream at this stage of the project. Prior to commencement of construction and removal of any construction waste offsite, details of the proposed destination of each waste stream will be provided to SDCC for approval.

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 (see Section 6.0) will maintain a copy of all waste collection permits on-site.

If the waste is being transported to another site, a copy of the Local Authority 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*.

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.

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&DWMP 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 Waste Regulation Unit on a monthly basis.

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 auditing the site during the construction and demolition phases of the project.

8.2 Review of Records and Identification of Corrective Actions

A review of all the records for the waste generated and transported on or 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 reuse/recovery/recycling/disposal 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. Waste management costs will also be reviewed.

Upon completion of the construction phase, a final report will be prepared, summarising the outcomes of waste management processes adopted and the total reuse, recycling, recovery and disposal 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 SDCC for their approval.

SDCC 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) ○ 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 Environment, Communities and Local Government (DoECLG), *A Resource Opportunity - Waste Management Policy in Ireland* (2012).
10. South Dublin County Council, *South Dublin County Development Plan 2016 – 2022* (2016)
11. Environmental Protection Agency (EPA), *Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous* (2015).
12. EPA, *National Waste Database Reports 1998 – 2012*.