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ATTACHMENT-4-8-3

COMPLETE BASELINE REPORT

Technical report prepared for

Amazon Data Services Ireland Limited

Technical Report Prepared By

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Our Reference

LB/21/12146WR01

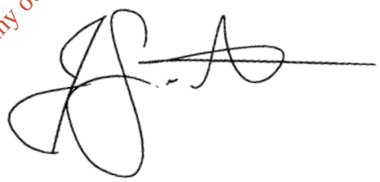
Date of Issue

21st May 2021

Document History

Document Reference		Original Issue Date	
LB/21/12146WR01		12 January 2021	
Revision Level	Revision Date	Description	Sections Affected

Record of Approval

Details	Written by	Approved by
Signature		
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Date	12 January 2021	12 January 2021

EXECUTIVE SUMMARY

This soil and groundwater quality baseline report has been completed as part of the Amazon Data Services Ireland Limited IED licence application. The report has been prepared in compliance with *European Commission Guidance concerning baseline reports under Article 22(2) of Directive 2010/75/EU on industrial emissions.*

The only relevant bulk hazardous substances (substances stored or used onsite and which are classified as hazardous by the EPA under the Groundwater Regulations and contained in bulk storage) is diesel for backup generators. The diesel store was of sufficient volume to be identified as a hazard present at the site which has the potential to impact soil and groundwater if not adequately mitigated during storage and operation at the plant.

A review of containment and mitigation measures at the facility confirms that the risk of a contamination event resulting in soil or ground water contamination is low. These measures include hard standing, adequate bunding, tank level alarms, double lined transfer lines, spill management procedures and oil interceptors on stormwater lines.

The site is within an a commercial/industrial area situated in the Grange Castle South Business Park. A review of the site history confirmed that the subject site has been in mostly agricultural land use with no previous IE or IPC licences developments.

The nearest illegal landfill in this area is Nangor Road, Ballybane. It is understood that SDCC carried out a walkover survey in February 2010 and noted that the site is very unsightly with waste deposited around its boundaries. The potential sources of contamination are from the different types of waste such as tyres, metals, textiles and commercial waste which could be seen on the ridge acting as a fence. It is understood that no intrusive investigation has been carried out on the site as per EPA code of practice for environmental Risk Assessment of illegal landfills.

Much of the site will be hard paved reducing the potential for vertical migration to ground during operation. In the unlikely event of a leakage outside of the storage bunds, the primary pathway would be through the stormwater drainage system which ultimately discharges through oil interceptors and an attenuation pond with a hydrobrake.

In the event of a fire, run-off would be to the site attenuation pond where water would be held until tested and removed off site if required.

A conceptual site model (CSM) has been presented for the site which includes assessment of site investigation data collected in 2019. The source pathway qualitative risk assessment concludes that the risk of an impact to soil or water is low.

CONTENTS

1.0 INTRODUCTION

The following Baseline Report relates to the Amazon Data Services Ireland Ltd. ("ADSIL" or ('the applicant') data centre development located within the townlands of Milltown; Ballybane; Aungierstown and Ballybane; and bounding Baldonnel Road to the west; both the Old and New Nangor Road to the north; and Grange Castle South Access Road to the south, Baldonnel, Dublin 22.

ADSIL are applying to the Environmental Protection Agency (EPA) for an Industrial Emissions (IE) Licence to operate Buildings A, B and C on the site. As with the majority of the data storage facilities in Ireland, all buildings will be equipped with diesel powered emergency back-up generators for the provision of emergency power supply.

The report relates to the development site located at Grange Castle South Business Park, Dublin, D22 as described in the Operational Report Attachment 4.8.2.

It is necessary form the outset of a licence application that the operator of a facility has a record of the existing conditions of the site prior to development. This allows for a comparison of contamination at the beginning and end of a site's operational history.

1.1 DISCLAIMER

The conclusions presented in this report are professional opinions based solely on the tasks outlined herein and the information made available to AWN. They are intended for the purpose outlined herein and for the indicated site and project. Furthermore, this report is produced solely for the benefit of ADSIL to address the EPA requirement for a licence application.

This report may not be relied upon by any other party without explicit agreement from AWN. Opinions and recommendations presented herein apply to the site conditions existing at the time of the completed field work and subsequent assessment.

They cannot apply to changes at the site of which AWN is not aware and has not had the opportunity to evaluate. This report is intended for use in its entirety; no excerpt may be taken to be representative of this baseline assessment. All work carried out in preparing this report has utilised and is based on AWN professional knowledge and understanding of the current relevant Irish and European Community standards, codes, and legislation.

1.2 LEGISLATIVE CONTEXT AND GUIDANCE

Under the Industrial Emissions Directive[1] it necessary to prepare a Baseline Report in conjunction with an Industrial Emissions Licence Application, as stated in Article 22(2) Chapter 2 of the directive:

> *"Where the activity involves the use, production or release of relevant hazardous substances and having regard to the possibility of soil and groundwater contamination at the site of the installation, the operator shall prepare and submit to the competent authority a baseline report before starting operation of an installation…."*

[1]European Union. Directive 2010/75/EE of the European Parliament and of the Council on industrial emissions (integrated pollution prevention and control). EU: November 2010.

Article 22(2) specifies that the Baseline Report should contain at least the following information:

a) Information on the present use and, where available on past uses of the site,
b) Where available, existing information on soil and groundwater measurements that reflect the state at the time the report is drawn up or, alternatively, new soil and groundwater measurements having regard to the possibility of soil and groundwater contamination by those hazardous substances to be used, produced or released by the installation concerned.

The Industrial Emissions Directive was transposed into Irish law under the European Union (Industrial Emissions) Regulations 2013[2]. The Environmental Protection Agency Act 1992 was subsequently amended to include aspects of the conditions outlined in Article 22(2); this included the requirement for an applicant for a license to furnish to the Agency a baseline report. T*he applicant in preparing the baseline report shall include any information prescribed in regulations under section 89 which includes:*

a) The current use and, where available, the past use of the site,
b) Any available information.
   i. On soil or groundwater measurements that reflect the state of the site at the time that the baseline report is drawn up, or
   ii. On new soil and groundwater measurements, having regard to the possibility of soil and groundwater contamination by the hazardous substances proposed to be used, produced or released by the installation concerned.

This report has been completed in to address the requirements of legislation and in accordance with the EU Guidance[3] for baseline reports. The EU Guidance outlines a number of key tasks that should be undertaken to both determine whether a baseline report needs to be produced for a particular situation and in order to produce the baseline report itself. The EU Guidance sets out 8 individual Stages to be considered; this report addresses the elements in accordance with Stages 1 to 8.

- Stage 1: Identifying the potential hazardous substances that are currently used, produced, or released at the site.
- Stage 2: Identifying the relevant hazardous substances i.e. those which have the potential to cause soil and groundwater contamination.
- Stage 3: Assessment of the site-specific pollution risk.
- Stage 4: Site History.
- Stage 5: Environmental Setting.
- Stage 6: Conceptual Site Model.
- Stage 7: Site Investigation – Soil & Water Quality Assessment.
- Stage 8: Production of the Baseline Report.

2Ireland. European Union (Industrial Emissions) Regulations 2013 (S.I. No. 138 of 2013).

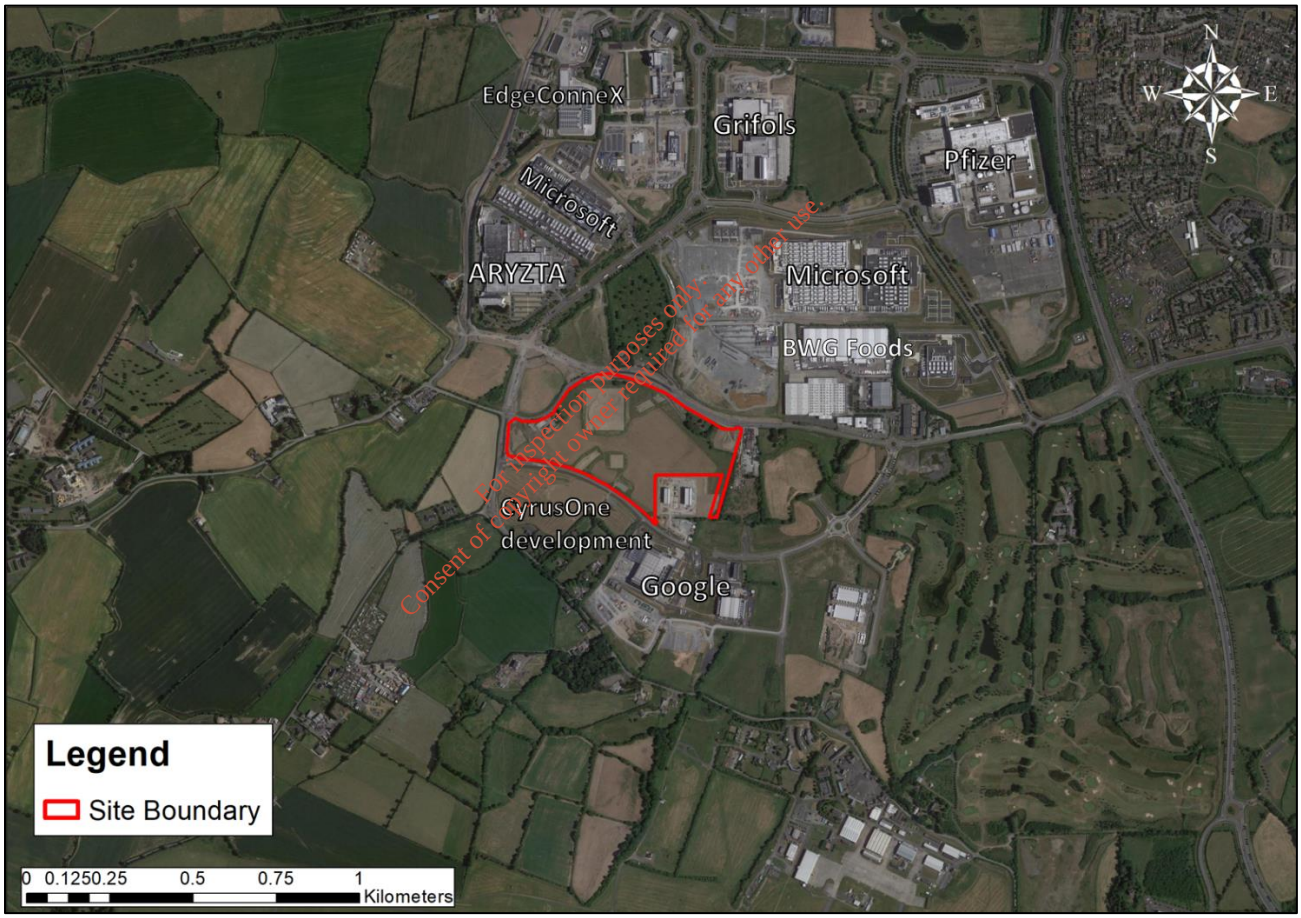
3European Guidance concerning baseline reports under Article 22(2) of Directive 2010/75/EU on Industrial Emissions. EU: 2014/C 136/03

1.3 SITE LOCATION AND CONTEXT

The site is c. 16.5 hectares in extent that consists of a former greenfield site within the Grange Castle South Business Park which will accommodate 3 no. data storage facilities – also known as building A, B and C. The power requirements for the installation are to be provided via a connection to an 110kV GIS substation located to the east of the main buildings. The substation will then provide a 20kV electrical power distribution at medium voltage throughout the site.

1 no. temporary single storey substation and 3 no. single storey Medium Voltage (MV) buildings will manage the supply of electricity from the substation to each data centre and are to be located to the immediate west of the generator compound for buildings A and B, and to the south of the generator compound for building C.

The site boundary is of the licence application is shown in Insert 1.1.



Insert 1.1 Site Location (red line boundary)

The site is located in Grange Castle South Business Park, approximately 18km from Dublin Airport, 13km from Dublin City Centre and 5km from the M50 motorway. The wider context of the site is defined primarily by commercial and industrial development. Large areas of the surrounding lands to the south and north within the Grange Castle Business Park and Profile Park have been developed in the past 10-15 years and are occupied by industrial campuses including pharmaceutical, data centres and food manufacturing uses. The Google data centre campus is located to the south-east of the site and the Cyrus One development is currently being constructed to the immediate south. The closest occupied residential properties are located c. 230m

south of the proposed site boundary along the Baldonnel Road. There are 6 no. of these residential units in a ribbon development layout. The three easternmost of these dwellings (Erganagh, Kent Cottage and Weston Lodge) are included in the Cyrus One planning application notice. The westernmost is operating as a business premises (Comex McKinnon).

The site is bounded by the realigned Baldonnel Road to the west; by the old and new Nangor Road to the north; by agricultural fields and the Grange Castle Motor Company to the east; and by the Grange Castle South Access Road that provides access off the Baldonnel Road into Grange Castle South Business Park to the south.

The overall site is located between the N4 and N7 national primary roads and is served by a good road network that has recently undergone an upgrade as well as the new Business Park road (Grange Castle South Access Road) that provides access into this part of the Grange Castle Business Park from the Baldonnel Road.

It is noted that the only application on the subject site is from South Dublin County Council (SDCC) in relation to infrastructure works (Reg. Ref. SD088/010). O'Connor Sutton Cronin & Associates (OCSC) undertook a Key word search of the planning database for 'Data Centre' and 'Grange Castle'. The search shows that the Council have an established precedent of Granting Permission for Data Centres on EE zoned lands. A number of permissions have issued to the following entities:

- Microsoft Operations Ireland Limited;,
- Google Ireland Limited,
- Digital Realty Trust,
- Cyrus One Irish Data Centre Holdings Limited; and,
- Interxion Ireland DAC.

1.4 SOURCES OF INFORMATION

Reference is made in this report to information from several existing data sources and reports including the following:

- Ordnance Survey Ireland - aerial photographs and historical mapping,
- Environmental Protection Agency (EPA) – website mapping and database information,
- SDCC - illegal landfill information,
- Environmental Protection Agency (EPA) – www.epa.ie on-line mapping and database information,
- Environmental Protection Agency (EPA) – www.epa.ie on-line licence information, and
- Research papers referred to in the text.

Other relevant documentation consulted as part of this assessment included the following:

- Environmental Impact Assessment Report for the Proposed Data Storage Facility Development Grange Castle Business Park, Dublin 22; AWN (2020).
- DUB002 Technical Due Diligence Report dated 16th May 2019; OCSC (2019).
- Environmental Site Assessment Report dated 6th June 2019. Prepared for Amazon Web Services (AWS); OCSC (2019).
- 'Grange Castle Flood Study Report', dated 13th December 2019; RPS Group Ltd (2019).

- Grange Castle Additional Hydraulic Modelling Report, dated 7th February 2020; RPS Group Ltd (2020).
- Engineering Services Report, dated January 2020; CS Consulting Group (2020).

1.5 SCOPE OF WORK UNDERTAKEN

The scope of the work undertaken for this assessment included the following:

- A desktop review of regional and site geology and hydrogeology.
- Review of available soil and groundwater quality data.
- Review of bulk liquid storage at the site and assessment in terms of likely impact to receiving waters.

2.0 STAGE 1: IDENTIFYING THE POTENTIAL HAZARDOUS SUBSTANCES

This section of the report identifies a list of all hazardous substances dealt with inside the installation boundary (either as raw materials, products, intermediaries, by-products, emissions or wastes).

This includes all hazardous substances associated with both the IED Annex I activities and directly associated activities which have a technical connection to the activities carried out and which could have an effect on soil or groundwater pollution.

Where hazardous substances are listed under trade names the chemical constituents have also been identified. For mixtures or compounds the relative proportion of the largest constituent chemicals are identified.

Table 2.1 *Substances stored on site*

Substance	Area Served/Purpose	Expected Volume of storage
Diesel Fuel Oil	Emergency Generator Fuel source	1,240m^3

There are no other raw materials held onsite other than domestic cleaning chemicals for cleaning of the staff facilities. These are managed by the cleaning company.

All oils, paints, adhesives or other materials required are brought onsite and removed from site by the relevant contractors.

Refrigerant is held within the VRF system for the offices. No refrigerants are stored onsite. R410A and R32 is held within these systems on a continuous basis and would only be removed during decommissioning.

The small amounts of hazardous waste generated are stored in a fully paved designated storage area in each building. The waste is covered, and a mobile retention bund is in place to contain any liquid waste that requires storage. The waste is collected from this area by an authorised waste contractor for disposal off-site.

Waste oil, coolant and filters and waste batteries are not stored onsite and are removed by the maintenance companies during maintenance operations and oil and coolant change outs.

3.0 STAGE 2: IDENTIFYING THE RELEVANT HAZARDOUS SUBSTANCES

This section identifies which of the hazardous substances from Stage 1 are 'relevant hazardous substances' as defined by European Commission Guidance concerning baseline reports under Article 22(2) of Directive 2010/75/EU on industrial emissions.

'Relevant hazardous substances' are those substances or mixtures defined within Article 3 of Regulation (EC) No 1272/2008 on the classification, labelling and packaging of substances and mixtures (CLP Regulation) which, as a result of their hazardousness, mobility, persistence and biodegradability (as well as other characteristics), are capable of contaminating soil or groundwater and are used, produced and/or released by the installation.

Table 3.1 *Hazard statements for substances on site*

Substance	Hazard Statement(s)	Hazard Statement Description
Diesel Fuel Oil	H400, H411	Very toxic to aquatic life, Toxic to aquatic life with long lasting effects

The table above summarise the Hazard Statement and description of the hazards for the identified chemicals identified, these statements identify the ability of these substances to contaminate soil or groundwater.

The only bulk liquids to be stored on site is diesel which is stored for emergency back-up operation of generators. Diesel fuel oil is considered to be capable of contaminating soil and/or groundwater.

4.0 STAGE 3 – ASSESSMENT OF SITE-SPECIFIC POLLUTION RISK

This section addresses the actual possibility in the context of the site for soil or groundwater contamination, including the probability of releases and their consequences. Taking account of:

- The quantity of each hazardous substance handled, produced, or emitted in relation to its environmental effects.
- The location of each hazardous substance on the site e.g., where it is or will be delivered, stored, used, moved around the site, emitted etc., in view of the characteristics of the soil and groundwater at that part of the site.
- The method of storage, handling and use of relevant hazardous substances and containment mechanisms to prevent emissions occurring, e.g. bunds, hard-standing, handling procedures.

As with every site there is the risk of accidents and incident due to tanker overturning on site road; vessel rupturing; leaking underground tank; seal breaking; accidental discharge; leaks from drain ruptures; or fire. As well as identified risks during routine operations such as spills during delivery or from pipe joints, small spills during decanting/transfer of product, leaks from blocked or broken drains, cracks in concrete hard standing.

The only planned emissions from the site that hold a risk of including these relevant substances is the discharge to stormwater network. There are no planned discharges to land or ground water.

4.1 DIESEL FUEL OIL STORGAGE

A diesel unloading bay will be built onsite adjacent to Buildings A, B and C. Fuel delivery to the bulk storage tanks will take place within designated bunded unloading areas. Diesel will be piped from the bulk storage tanks to an internal double-skinned belly tanks at each of the back-up generator units.

1240 m^3 of diesel is stored in multiple locations across the site. Each building will have a 40 m^3 Fill Tank (i.e., 3 no. tanks of 40 m^3).

Each of the 70 generators will have a 16 m^3 belly tank (i.e., 70 no. tanks of 16 m^3). Admin/house generators have smaller integral tanks. Fire pumps have individual tanks and a bulk tank.

Building A and Building C will each have 26 no. and Building B will have 18 no. generators (total of 70 no Diesel Generators). Bulk diesel is supplied to generators from three no. 40,000 litre bulk storage tanks located adjacent to each data centre. Each of the fill tanks will be bunded in a concrete bund and the belly tanks will be double lined.

Buildings A, B and C

Bulk diesel is supplied to generators at Buildings A, B and C from 3 no. steel bulk storage tanks (40,000 litre tanks) located in their respective bunded area adjacent to each building. They are bunded to a volume of 110% of the capacity of the tank within the bund (plus an allowance of 30 mm for rainwater ingress). Drainage from the bunds is diverted for collection and safe disposal.

The bulk fuel tanks will be fitted with automated level gauges and the online readings from these gauges are fed back into the facility's BMS. There are drip trays at the diesel fill point for the bulk tank. The bulk tanks also have high/low level alarms (90% high, 30% low) and a high-level switch at 95% which alarms to the BMS/EPMS critical alarm.

The bunds will be constructed of suitable concrete and have undergone testing for their integrity during the commissioning phase. All pipelines are integrity tested following installation by vendor and follow up integrity testing of both bunding and pipelines will be completed every three years in accordance with the IE Licence.

The generators are housed within a container with various designed control measures in place includes acoustic attenuation, exhaust silences, and diesel stored locally within each containerised generator. The individual belly tanks are double skinned tanks, with level gauges (high and low) within the fuel tanks connected to an onboard controller which will alarm to prevent overfilling and identify a sudden loss of fuel within the tank.

4.2 SURFACE WATER DRAINAGE

SDCC require all storm water generated on site to be retained, on site and released at a controlled rate of 2l/sec/Ha or the natural greenfield runoff rate, (Q-bar), whichever is the greater in accordance with the requirements of the *Greater Dublin Strategic Drainage Study*. Taking Met Éireann rainfall data for the site and *soil type* from the soil maps produced as part of the Flood Studies Report, the greenfield run off rate for the site was calculated to be 2.01l/sec/Ha.

Rainwater runoff from impermeable areas of the site will be collected via the onsite storm water drainage network. This network will convey the stormwater to one of three stormwater attenuation ponds to be constructed on site.

The proposed development will require 3No. attenuation storage areas, due to the proposed phasing of the development. The proposed storage areas have been designed as retention basins to not only allow for rainwater retention to enhance local ecology, but also to provide sufficient storm water storage for the predicated 1-in-100-year extreme storm event, increased by 10% for the predicated effects of climate change.

It is proposed to gather storm water in the new drainage network and direct it to attenuation areas, as noted in above. Prior to storm water entering the attenuation retention ponds, storm water is directed into 'forebays'. The forebays allow small intensity rainfall events to be stored separated from the main water body. This allows for any detritus material to be removed from the water and aids in particulate removal, increasing overall storm water quality prior to disposal.

All storm water generated on site from roof areas, hardstanding, & roads will pass through a suitably sized oil separator prior to disposal.

4.3 WASTEWATER DRAINAGE

Domestic Effluent

All internal foul drainage networks were designed in accordance with;

- Irish Waters Code of Practice for wastewater Infrastructure,
- National Building Regulations Technical Guidance Document H – Drainage & Waste Disposal.

When constructed a gravity piped foul drainage network of 225 mm uPVC pipes will take effluent from internal sanitary locations and outfall into the proposed external foul network. When constructed the outfall into the existing foul network will be at two location, one to the west (SE1) and the second to the east (SE2). The proposed western outfall will cater for foul flows from Blocks A, B & 50% of Block C. while the second outfall to the east will cater for 50% of Block C & the welfare facilities associated with the Substation.

The foul network ultimately discharges into a regional pumping station before final treatment and disposal at Ringsend Wastewater Treatment Plant (WWTP) in Dublin.

Cooling Water Drain down

In additional to domestic effluent generated on site, there is a requirement to have the capability to discharge run-off from coolant effluent into the foul network. The coolant effluent is a biproduct of potable water used, when atmospheric temperatures are in excess of 25 degrees C to cool components within the facility.

5.0 CONCLUSION - STAGES 1 TO 3

Stages 1 to 3 of the Baseline Assessment have concluded that the development includes the storage of relevant hazardous substance that are capable of contaminating soil or groundwater.

The potential pollution risk is low based on the likelihood of releases of such substances occurring. However, due to the volume of the diesel fuel oil, which is a relevant hazardous substance, 'used, stored and transported' to the site it is considered that a Complete Baseline Assessment is required.

6.0 STAGE 4 – SITE HISTORY

The purpose of this section is to determine which of the relevant hazardous substances identified by Stage 3 have the potential to be present on site in the soil and groundwater already as a result of activities to date and to determine whether they are coincident with potential future emission points.

The EU Commission guidance requires the following activity to be undertaken for Stage 4:

- Provide a site history. Consider available data and information.
- In relation to the present use of the site, and on emissions of hazardous substances which have occurred, and which may give rise to pollution. In particular, consider accidents or incidents, drips or spills from routine operations, changes in operational practice, site surfacing, changes in the hazardous substances used.
- Previous uses of the site that may have resulted in the release of hazardous substances, be they the same as those used, produced or released by the existing installation, or different ones.
- Review of previous investigation reports may assist in compiling this data.

6.1 SUMMARY OF PRIOR USE

This section includes an evaluation of the likelihood of the presence of any historic contamination of soil/ groundwater at the site and an overview of the site history.

The historic mapping below indicates the prior use of the site from the earliest mapping available 1837-1842 through to present day.

The site was historically of agricultural use which is representative of the surrounding land use at the time c.1837-1842 visible in Insert 6.1, below. A 25-inch (c. 1888-1913) is shown in Insert 6.2. Currently a greenfield site, the land to the west of the R120 and South of the Grand canal is predominantly used for livestock grazing. The site can be seen to contain part of the Historic Milltown estate (1837-1842) on the western side of the site visible in Insert 6.3, below from which no original buildings remain. Several historic industries are present in the surroundings from this period, such as a flour mill to the north of the Grand Canal and two quarries also located along the banks of the Grand Canal. Surrounded by agricultural lands of various plot sizes, barns, mills, tree lined boundaries and other watercourses, typical of the rural setting at the time.

The nearest illegal landfill in this area is Nangor Road, Ballybane. It is understood that SDCC carried out a walkover survey in February 2010 and noted that the site is very unsightly with waste deposited around its boundaries. The potential sources of contamination are from the different types of waste such as tyres, metals, textiles and commercial waste which could be seen on the ridge acting as a fence. It is understood that no intrusive investigation has been carried out on the site as per EPA code of practice for environmental Risk Assessment of illegal landfills.

Development of the Grange castle Business Park to the North of the Site began in 2000 with the construction of the Pfizer Ireland Pharmaceuticals biotechnology plant and ancillary infrastructure. The site was licenced and officially opened in 2005.

Followed by the Takeda Pharma Ireland Ltd. Bulk Pharmaceutical plant which received planning permission in Dec 2002, the facility and accompanying ancillary infrastructure was completed by late 2005 and is visible directly north of the site in Insert 6.5 (2005-2012).

Four Data Centre facilities have been built by Microsoft within the Grange Castle Business Park, the first of which was constructed in 2008 and can be seen Northwest of the site in Insert 6.6, below.

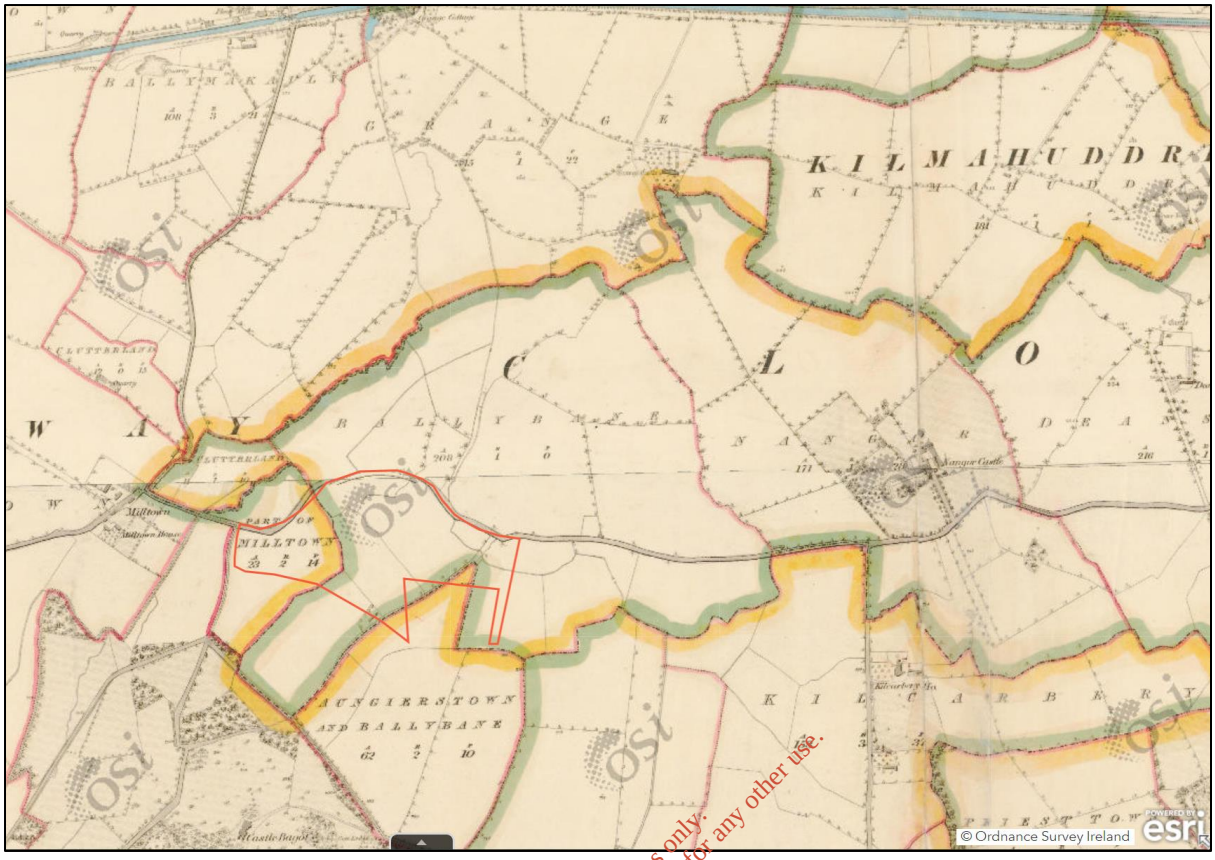
6.2 HISTORIC MAPPING

Historical Ordnance Survey maps were examined for the purpose of this report to identify any historical sources of contamination. The available OSI mapping from the 1830s through to the 1930s (Insert 6.1 – 6.3) shows no indication of historic land usage that might have caused residual negative environmental impacts.

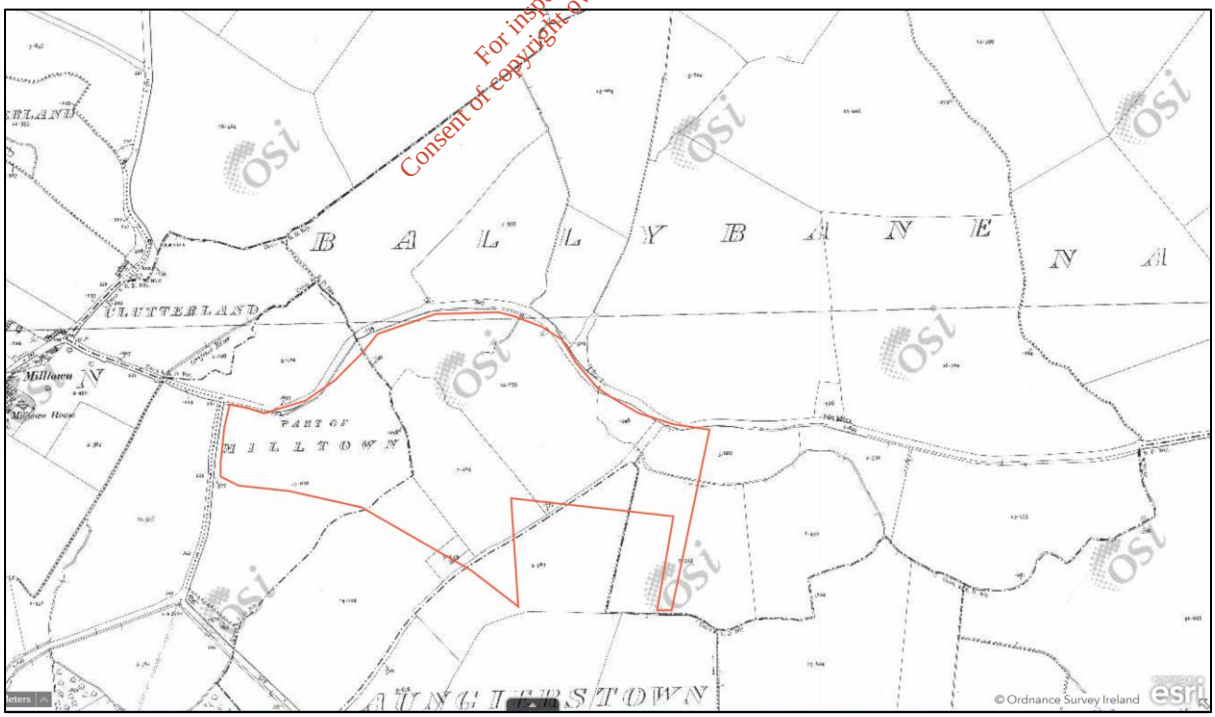
The overall site extends to over 16.5 ha. of lands within the Grange Castle South Business Park extending over the townlands of Milltown, Ballybane and Aungierstown & Ballybane; and bounded by the New Nangor Road (R134) to the north, the realigned Baldonnell Road to the west, the Grange Castle South Road to the south and the new Castlebaggot sub-station, agricultural lands and the Bolands Car Centre to the east. It is a green site of tillage and pasture land reclaimed as part of the business park. Similar developments have been recently completed or are currently under construction both to the north and to the south of the subject site.

The subject site is greenfield and has historically been exclusively in agricultural use, with the exception of shallow archaeological excavations conducted on the site in 2017-2018.

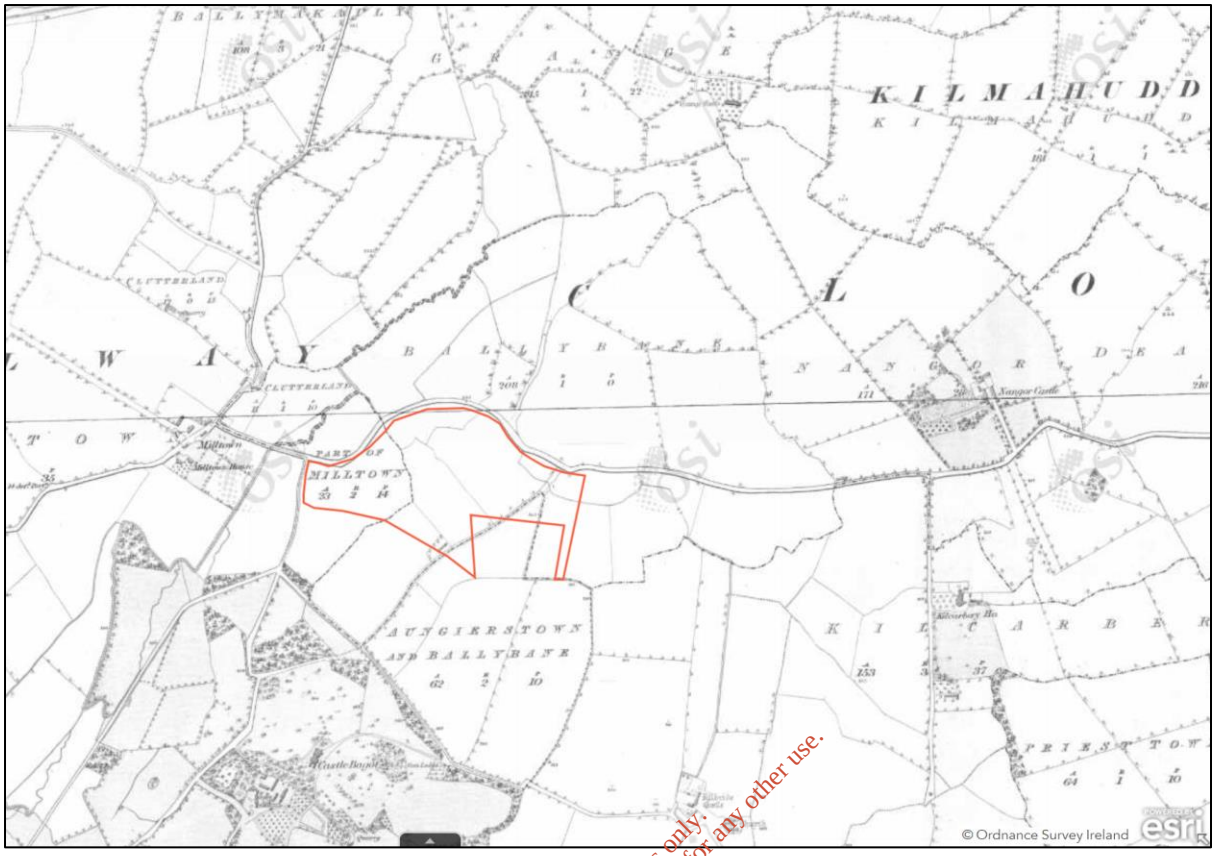
The lands surrounding the site were presumably agricultural Greenfields of various plot sizes, barns, dwellings, tree lined lanes/boundaries and Water Courses, typical of the semi-rural setting at the time. Baldonnell airfield and barracks (currently known as Casement Aerodrome) is located c. 900m southeast of the site which began construction in 1917 and is visible in the Cassini imagery from 1830s-1930s Insert 6.3, below.



Insert 6.1 Historic Map 6 inch Colour, site boundary in red (c. 1837-1842) (source www.osi.ie). (Red line shown as indicative only)



Insert 6.2 *Historic Map* 25-inch, *site represented by red star (c. 1888-1913)* (source www.osi. (Red line shown as indicative only)

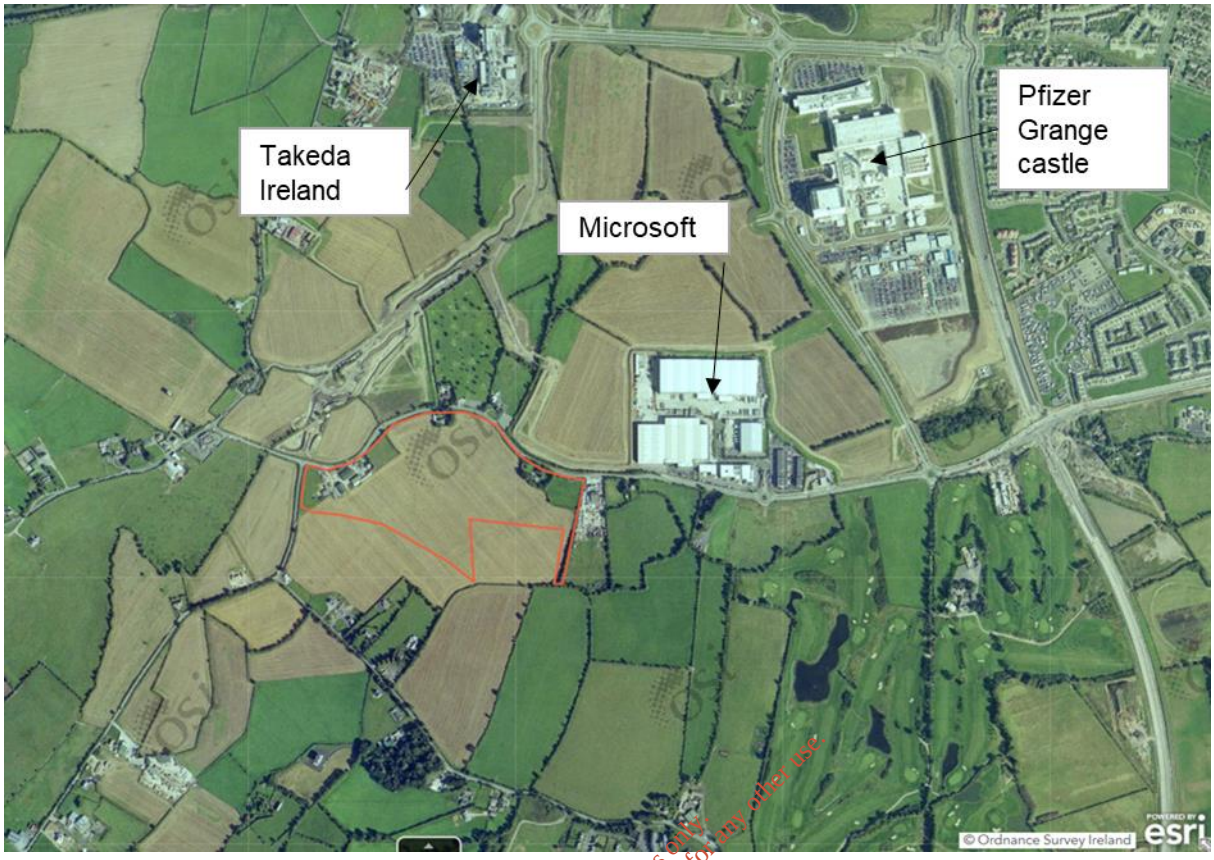


Insert 6.3 *6-inch Cassini (c. 1830s – 1930s)* (source www.osi.ie) (Red line shown as indicative only)

The most notable changes that occurred between the 1930s Cassini map and 1995 aerial imagery (Insert 6.4) with the addition of a small cluster of residential farmhouses to the north of the site. Housing developments in the Oldcastle park area begin to emerge c. 1.3km northeast of the site. While the lands to the West and Southwest have remained mostly undeveloped. The development of the Peamount Hospital campus c. 1.2km to the West of the Site also took place during this period.

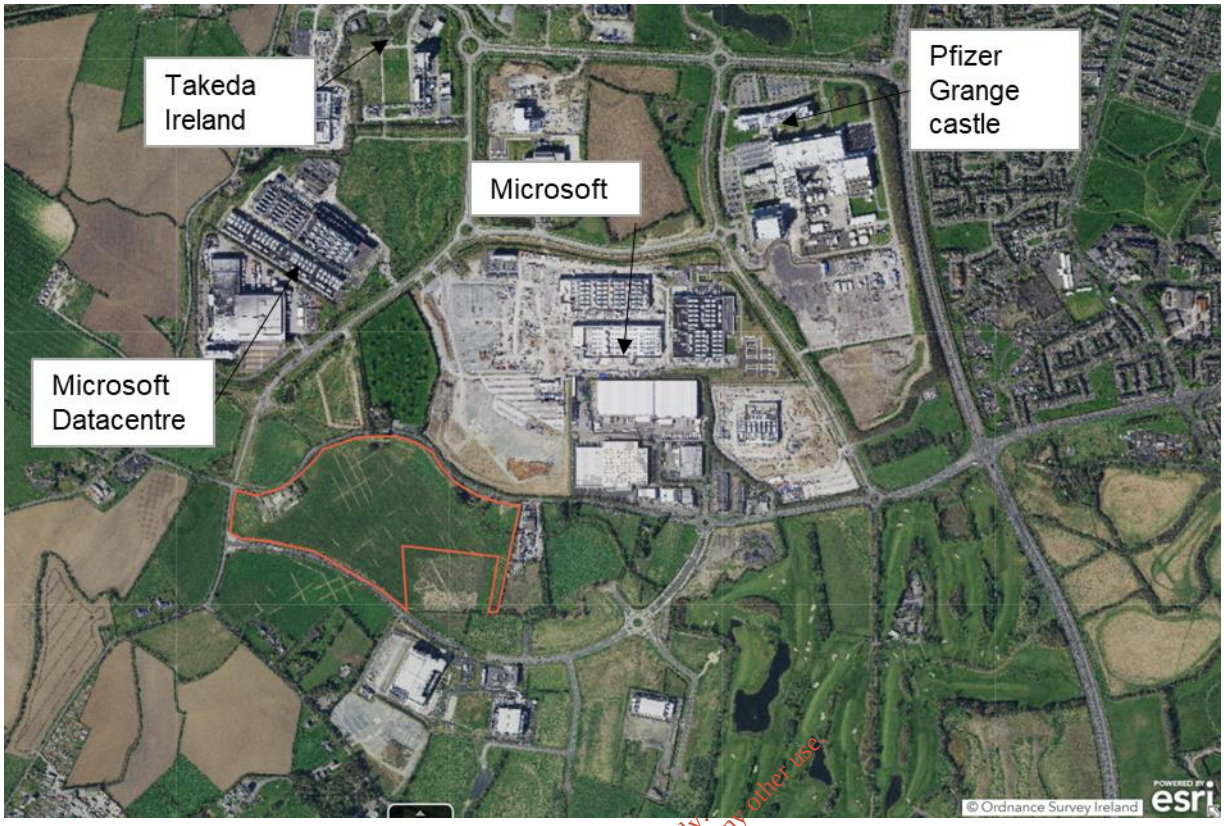
Insert 6.4 Aerial Image (1995) (source www.osi.ie) (Red line shown as indicative only)

The most notable change between the 1995 image above and the 2005-2012 image (Insert 6.5) below is the completion of the Pfizer Biotechnology Plant, Microsoft data Centre and the Takeda Pharmaceutical Facility. All of which are served by combined auxiliary infrastructure i.e., an electrical substation, access roads, sewage network etc.

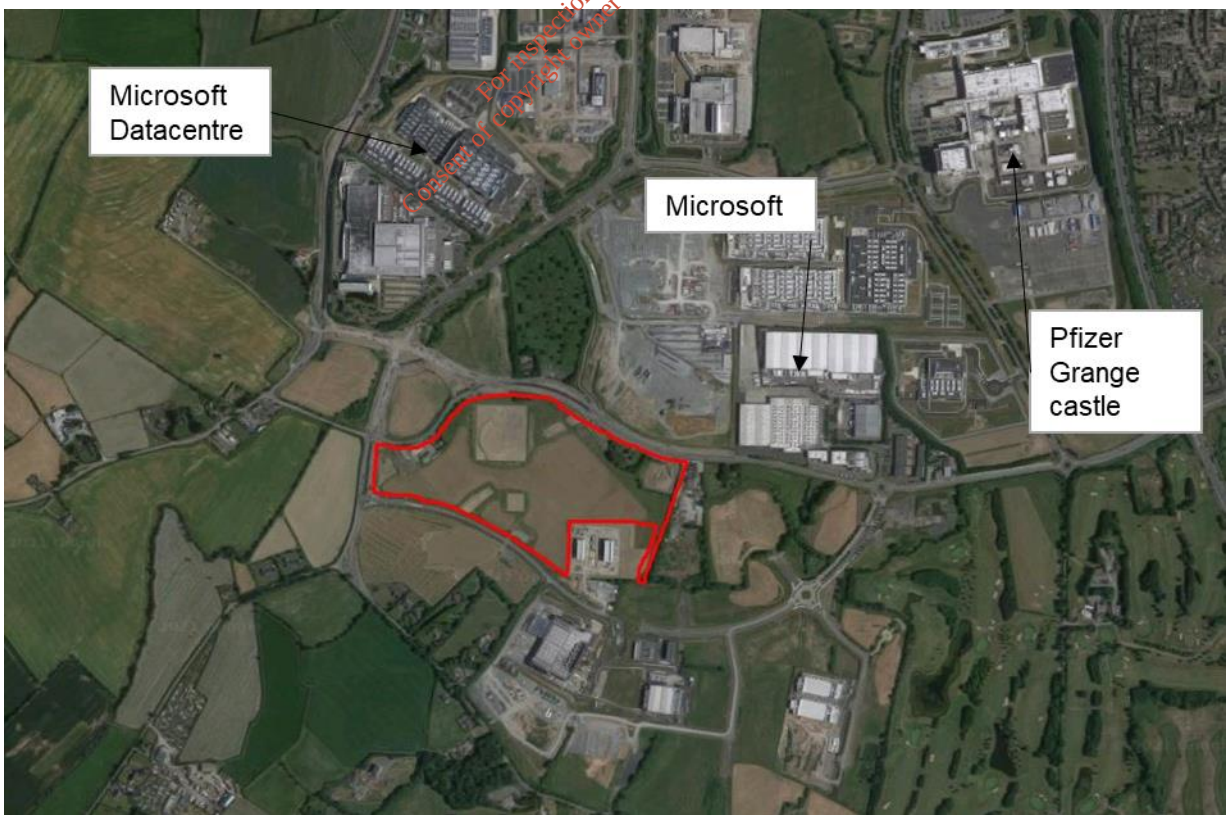


Insert 6.5 *OSi Aerial Map (2005-2012) (source www.osi.ie)* (Red line shown as indicative only)

The imagery dated 2012-2018, (Insert 6.6) shows the beginnings of the present-day site, it shows the completion of the Takeda Bulk pharmaceutical plant directly North, as well as Microsoft's first Data centre northwest of the site constructed in 2008. The Site is mostly undisturbed and continues to be a greenfield site up to 2018. Infrastructure developed to support the Grange Castle business park during this period is evident in the completion of an electrical substation on the south-eastern boundary of the site visible in Insert 6.6 as well as a second ancillary road built along the southern boundary of the site.



Insert 6.6 OSi Aerial Map (2012-2018) (source www.osi.ie) (Red line shown as indicative only)



Insert 6.7 Aerial Map 2021 (source Google Maps) (Red line shown as indicative only)

The most recent imagery, (Insert 6.7 above) dated 2021 shows the Expansion of the Takeda Bulk Pharmaceutical facility, three additional Microsoft Data centre have been built since 2008, the 'ARYZTA Food Solutions' headquarters as well as 'Grifols' Pharmaceutical Headquarters were also constructed during this period.

6.2.1 Planning History

A planning search was carried out for the subject site via SDCC website for planning enforcement.

No planning enforcements were assigned to the subject site on the SDCC website.

Review of Environmental data and Previous reports.

Report(s)	Year(s)	Main Findings
RPS Group- ***Grangecastle Flood Study 2019*** ***Additional Hydraulic Modelling Report 2020***	**2019** **2020**	The results of the ***2019 Grangecastle Flood Study*** indicated that the proposed development site is within 1% AEP floodplains. As a mitigation measure, it is recommended to incorporate a compensatory flood storage within the proposed development site with a safe discharge route to the unnamed stream located along the northern boundary. The proposed compensatory storage volume of 750m^3 plus freeboard is required to be designed to accommodate the 1% AEP event taking into account climate change as per the OPW guidelines for new developments. The results of the hydraulic analysis indicated that proposed compensatory storage with a limited peak discharge rate of 75l/s to the unnamed stream will not increase the flood risk to the stream and at other locations. The ***Additional Hydraulic Modelling 2020*** exercise was completed to establish whether the proposed solutions in the Grangecastle Flood Study report were adequate to alleviate out-of-bank flooding from the development site without increasing flood risk elsewhere. The proposed solutions were simulated using Infoworks ICM for the 1% and 0.1% AEP events including climate change effects. The results indicated that the proposed measures were adequate to alleviate flooding from the proposed development site for the 1% AEP. The hydraulic model was also run for the 0.1% AEP event to assess the impact of the proposed development site on flood levels within the Baldonnell River. There was a maximum increase of 3mm in the 0.1% AEP water levels at locations upstream of the New Nangor Box Culvert within the Baldonnell Stream. Further hydraulic modelling was carried out to including a compensatory flood storage upstream of the proposed development site. A storage volume of approximately 2,680m^3 over an area of 5,500m^2storage resulted in a maximum decrease of 4mm in peak 0.1% AEP water levels within the Baldonnell Stream downstream of the proposed flood compensatory storage area. The potential for further reduction was severely limited by the surcharging condition of the New Nangor Road Culverts. Hence additional compensatory flood storage volume is required to provide adequate reduction in the 0.1% AEP peak water levels within the Baldonnell River adjacent to the proposed development site.
IGSL Limited- ***Ground Investigation Report 2019***		The investigation showed the surface soils to comprise mainly Topsoil and sandy subsoil. Towards the north-western corner of the site (BH01), approximately 300mm of granular fill was present at ground level. Towards the north of the site (TP03), some brick fragments within the upper 0.6 metres were indicative of Made Ground. Below the topsoil / subsoil layers, the sandy gravelly clay soils were in a predominately firm or stiff condition. The firm layer was generally limited to the upper 1.0 to 1.2 metres and predominately within the eastern portion

		of the site, but persisted to approximately 2.2 m BGL in BH13 (north-east of the site). The underlying main body of soil comprised stiff and very stiff deposits of brown / black gravelly clay with cobbles and boulders. This is glacial till, commonly referred to as the Dublin “boulder clay”. The high strength of these deposits is due to the over-consolidation during the glaciation period of the ice age. The upper brown deposits of glacial till were in a predominately stiff condition, while the lower dark brown / black deposits were generally very stiff or hard in consistency. Rotary coring has confirmed the presence of medium strong to very strong limestone bedrock at depths of between 2.5 and 3.6 m BGL. Laboratory strength tests have confirmed a predominately “Strong” condition for the rock core samples. Groundwater was observed in the form of slow to rapid inflow at depths of between 2.0 and 2.8 m BGL in the boreholes and coreholes, possibly in association with the weathered bedrock horizon. Some shallower inflows were noted in the trial pits. Most recent monitoring of standpipes has shown water to be present at depths of between 1.4 and 1.9 m BGL in the standpipes, with the exception of RC14 (eastern boundary), Where the water level was 0.6 m BGL. The trial pits remained generally stable. However, some instability occurred in two locations in association with the groundwater ingress. While groundwater ingress was generally confined to depths in excess of 2 metres, inflows at 1.7 and 1.3 m BGL occurred in trial pits TP02 and TP05 respectively. Deeper water strikes in the boreholes and coreholes appear to be related to the weathered bedrock horizon (highly fractured angular gravel, cobbles and boulders). Groundwater monitoring has revealed water levels in the range 1.4 to 1.9 m BGL in the standpipes. However, in one standpipe (BH14), the water level was notable shallower at 0.6 m BGL. This should be borne in mind when assessing the dewatering requirements for the foundation trenches. It is also noted that groundwater ingress can cause destabilisation of foundation trenches, as observed at trial pits TP02 and TP05. It is noted that while the majority of trial pits remained stable during the excavation (typically 45 minutes), instability was observed in association with groundwater ingress. Therefore, provision should be made for temporary trench control measures when excavating for foundations. Where groundwater ingress occurs in gravelly clay soils, it is recommended that foundation excavations are blinded immediately in order to minimise water-softening of the base. Foundation trenches that contain water should be pumped dry and any water-softened material over-excavated prior to pouring foundations or lean mix concrete.

7.0 STAGE 5 - ENVIRONMENTAL SETTING

This section includes an assessment of the likely fate of any spill/leak event based on the topography, soil, and groundwater characteristics at the location. Based on the findings of Stages 1 to 4 above, the location where hazardous substances are stored has also been assessed with regard to confirming source-pathway-receptor linkages i.e., in the unlikely event of a leakage/spillage.

7.1 TOPOGRAPHY

The site is relatively flat, there is a fall of approximately 5.5-6m from the south eastern boundary of the site north-west (from c. 68.5m AOD to c. 74.5m AOD).

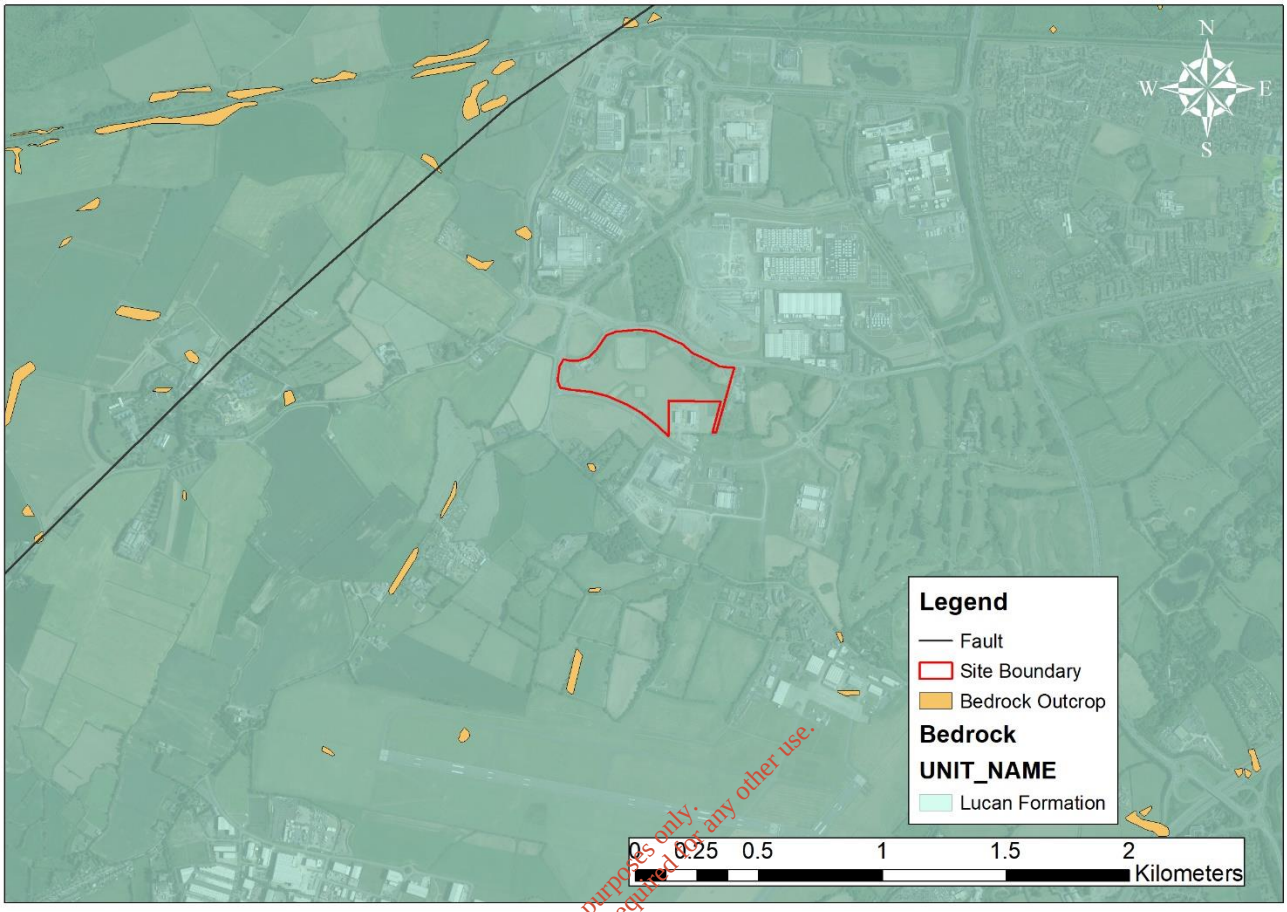
7.2 SOILS, GEOLOGY & HYDROGEOLOGY

7.2.1 Regional Geology

The bedrock of the greater Dublin region consists of Dinantian Upper Impure Limestone which is part of the Lucan Formation. Refer to Insert 7.1 below. The limestone is colloquially known as Calp and is estimated to be up to 800m thick. The homogeneous sequence consists of dark grey massive limestones, shaley limestones and massive mudstones. The average bed thickness is less than 1m, but these normally thin-bedded lithologies can reach thicknesses of 2m or more.

The Calp is almost completely obscured across central Dublin under the Dublin Boulder Clay. The depth to bedrock is mapped as <3mbgl on the GSI GeoUrban viewer however the depth to bedrock throughout the site was confirmed as 2.1 - 3.3mbgl (based on 2019s IGSL Ltd investigation of the site). The site investigation also confirms identification of the bedrock as dark grey and black limestone.

There are no bedrock outcrops identified on the site. In terms of the structural relationship of the area, the GSI database (refer also to Insert 7.1 below) shows a fault to the Northwest c. 950m away at its closest point.



Insert 7.1 Bedrock Geology Map (Source www.gsi.ie). Red line shown as indicative only.

7.2.2 Regional Hydrogeology

7.2.2.1 Aquifer Classification

Aquifers are generally classified as rocks or other matrices that contain sufficient void spaces and which are permeable enough to allow water to flow through them in significant quantities. The GSI classifies the principal aquifer types in Ireland as:

Bedrock Aquifer

- Rkc – Regionally Important Aquifer – Karstified (conduit).
- Rkd – Regionally Important Aquifer – Karstified (diffuse).
- RK – Regionally Important Aquifer – Karstified.
- Rf – Regionally Important Aquifer – Fissured bedrock.
- Lm – Locally Important Aquifer – Bedrock which is Generally Moderately Productive.
- Lk – Locally Important Aquifer – Karstified.
- Ll – Locally Important Aquifer – Bedrock which is Moderately Productive only in Local Zones.
- Pl – Poor Aquifer – Bedrock which is Generally Unproductive except for Local Zones.
- PU – Poor Aquifer – Bedrock which is Generally Unproductive.

Gravel Aquifer

- Lg - Locally Important Aquifer - Sand & Gravel.
- Rg - Regionally Important Aquifer - Sand & Gravel.

The bedrock aquifer underlying the site according to the GSI (www.gsi.ie/mapping) National Draft Bedrock Aquifer Map is classified as a Locally Important Aquifer (Ll) which is described as *Bedrock which is Moderately Productive only in Local Zones*. According to the GSI, the aquifer is not considered to have any primary porosity and flow will be primarily fracture controlled.

The site is underlain by the Dublin Groundwater Body (EU code: IE_EA_G_008) which has been investigated by the GSI and is described as having a groundwater flow regime of PP which is poorly productive bedrock aquifer.

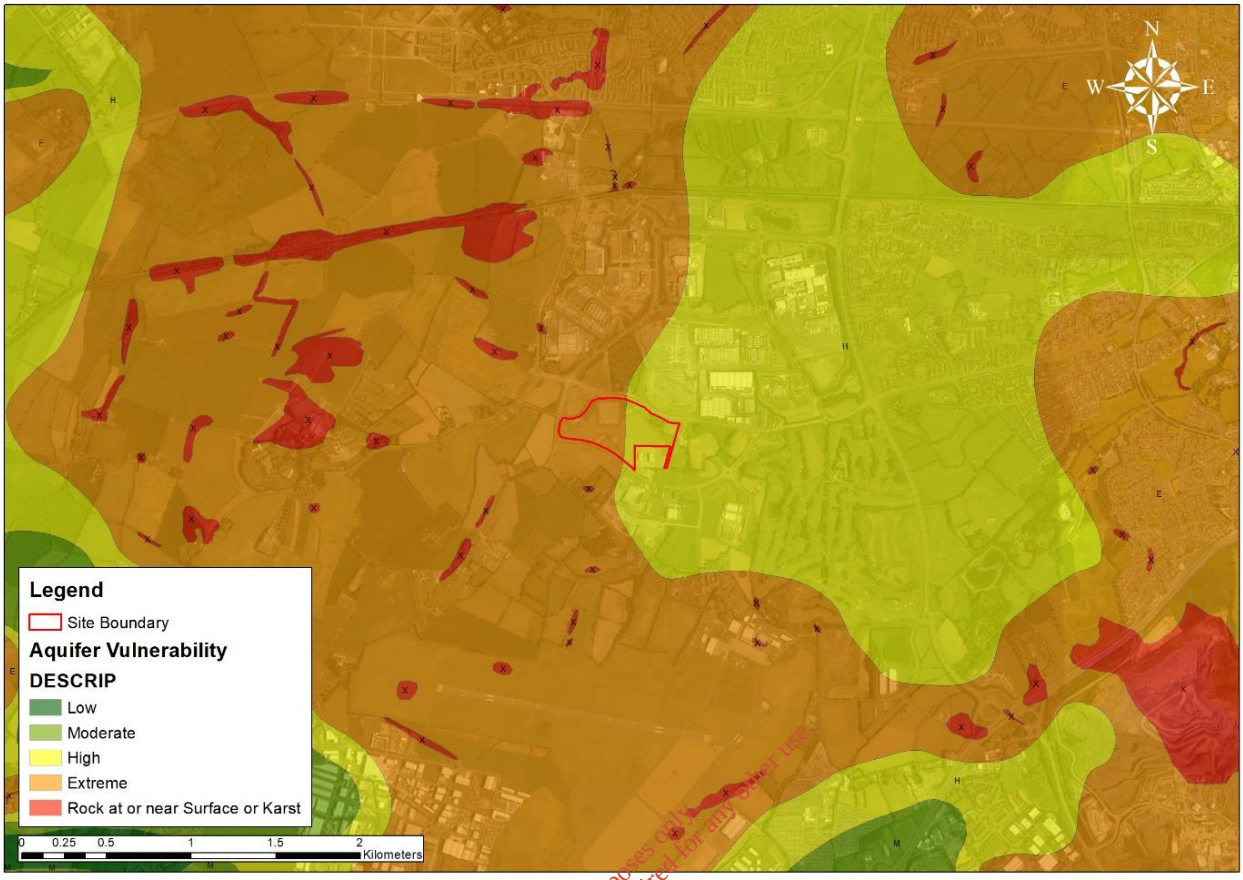
7.2.2.2 Aquifer vulnerability

Aquifer vulnerability is a term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated generally by human activities. Due to the nature of the flow of groundwater through bedrock in Ireland, which is almost completely through fissures, the main feature that protects groundwater from contamination, and therefore the most important feature in protection of groundwater, is the subsoil (which can consist solely/ or of mixtures of peat, sand, gravel, glacial till, clays, or silts).

Site Specific Data

The GSI presently classifies the aquifer within the site as between Extreme (E) which indicates an overburden depth of 0-3m and High (H) which indicates an overburden depth of 3-5m. This is consistent with site investigation data and the site is considered to have Extreme to High Vulnerability. The GSI classifies the eastern side of the proposed site with a score of Extreme and the Western side as High. Rotary coring carried out in 8 different locations confirmed the presence of limestone bedrock at depths that were typically in the range of 2.0 to 2.8 m BGL. The exception to this occurred at RC07 (north of the site), where bedrock was encountered at a depth of 3.6 m BGL. No bedrock outcrops were identified in the IGSL Limited Ground investigation Report of July 2019.

The GSI currently classifies the aquifer vulnerability in the region surrounding the site between (E) - Extreme Vulnerability status (indicating <3 m of low permeability soil) and (H) High Vulnerability Status (indicating 3-5m of low permeability soil) (Insert 7.2).



Insert 7.2 Aquifer vulnerability. Red line shown as indicative only.

7.2.2.3 Groundwater Wells and Flow Direction

There are no source protection areas relating to group water schemes or public water supplies within 2km of the site, i.e. zones surrounding a groundwater abstraction area.

The GSI Well Card Index is a record of wells drilled in Ireland, water supply and site investigation boreholes. It is noted that this record is not comprehensive as licensing of wells is not currently a requirement in the Republic of Ireland. This current index does not show any wells drilled or springs at the site or surrounding area with the nearest recorded wells located over 3km to the west and east of the site. The area is serviced by public mains therefore it is unlikely that any wells are used for potable supply. The site is not located near any public groundwater supplies or group schemes. There are no groundwater source protection zones in the immediate vicinity of the site.

Insert 7.3 presents the GSI well search for the area surrounding the site. (Note this source does not include all wells)

Insert 7.3 GSI Well Search (GSI, 2021). Red line shown as indicative only.

The regional flow direction in the overburden generally follows no fixed pattern or trend. Flows of this nature are typical of low permeability clay strata with intermittent fill areas, where often the water level measures represent pore water seepages into the overburden monitoring well (opposed to bedrock wells) or perched groundwater conditions (not bedrock aquifer water).

Based on a review of available information, local groundwater flow is expected to be to the north. Information taken from the due diligence states that groundwater ingress occurred in most boreholes at depths of between 2.0 and 2.5m BGL i.e., the weathered surface. Groundwater levels during a later monitoring event were in the range 0.5 to 1.4m BGL. Moderate groundwater ingress was also observed in several trial pits. However, when the rotary core holes were drilled, there was no groundwater inflows in the bedrock. This would suggest that the water strikes found in the boreholes and trial pits were from perched water at the weathered interface of the overburden and bedrock.

7.2.2.4 Groundwater Quality

The European Communities Directive 2000/60/EC established a framework for community action in the field of water policy (commonly known as the Water Framework Directive [WFD]). The WFD required '*Good Water Status'* for all European water by 2015, to be achieved through a system of river basin management planning and extensive monitoring. 'Good status' means both *'Good Ecological Status'* and *'Good Chemical Status'*.

The Groundwater Body (GWB) underlying the site is the Dublin GWB (EU Groundwater Body Code: IE_EA_G_008). The current EPA data (2013-2018) classifies the Dublin GWB as having 'Good Status', with a WFD risk score of 'under review'.

7.2.3 Regional Soils

On the GSI regional mapping the site and overburden geology comprise Quaternary Glacial Til (TLs). The Glacial Till is derived from limestone and is a common soil cover in this region. There are no areas of made Ground located on the proposed site

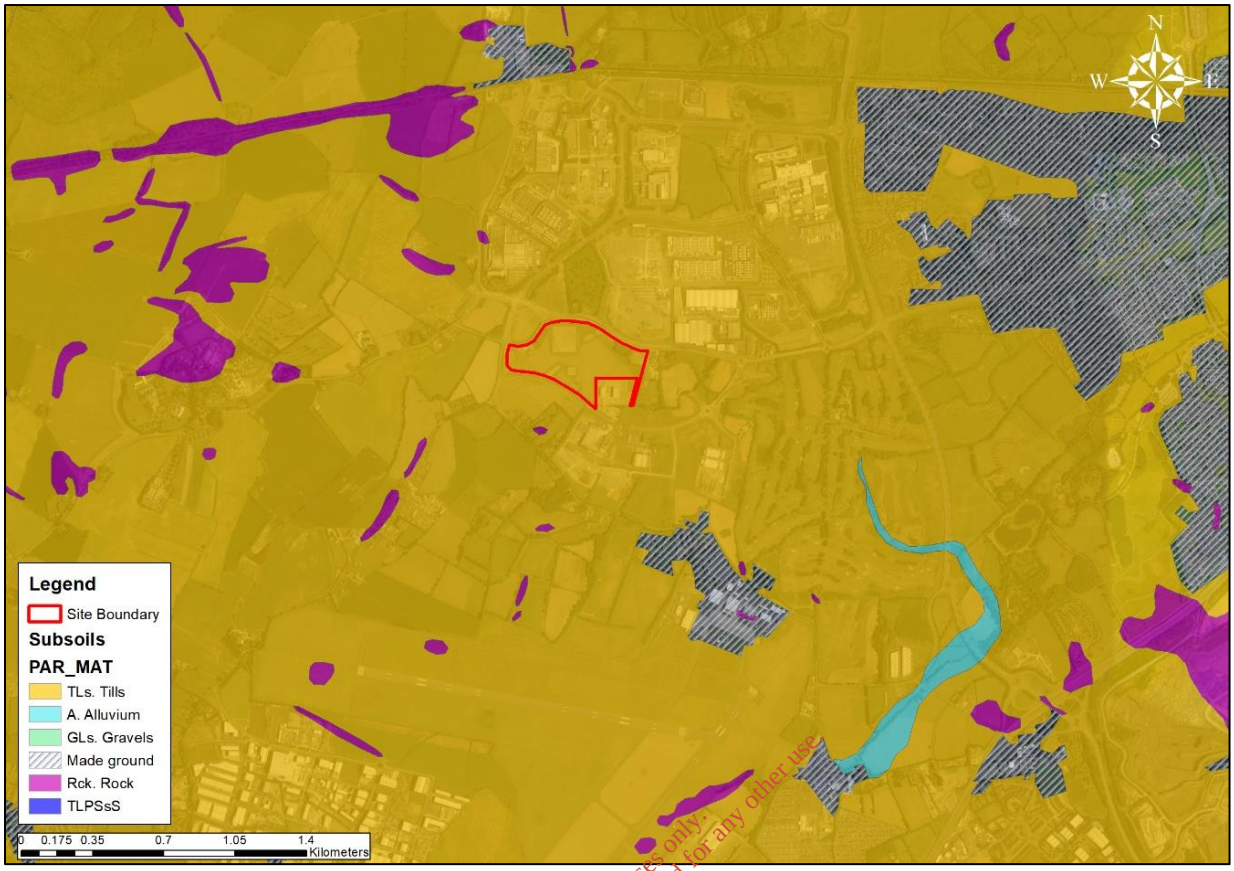
The following ground conditions were encountered during the investigation process; 0-0.4 metres below ground level (mbgl) topsoil is present. A thin covering of made ground was encountered in Boreholes BH01 and BH02 comprising granular fill and gravely clay.

Firm brown gravely clay underlays the topsoil within the eastern portion of the site. These upper clays were present to depths of between 1.1 and 2.2 m BGL.

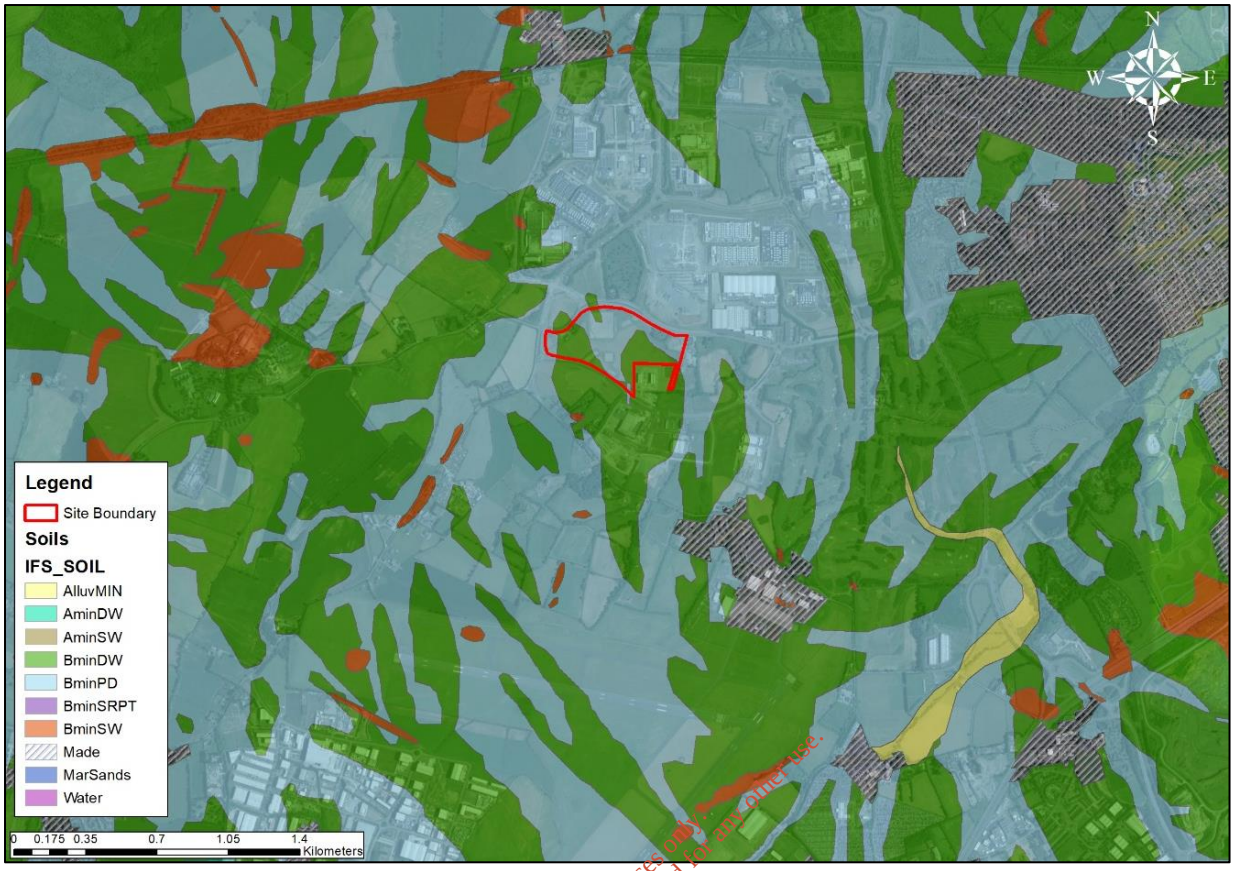
Towards the north end of the site, stiff deposits of brown sandy gravelly were present within the upper metre. Very stiff deposits of sandy gravelly clay were encountered in all boreholes, and underlay the upper firm or stiff gravelly clay soils, where present. Towards the north end of the site these deposits were encountered at depths of between 1.7 and 1.9m BGL. Further south, these deposits were typically present within the upper metre.

The subsoil has been classified as limestone till (Carboniferous). This is the dominant subsoil type in the region and is a glacial deposit which is known as Dublin Boulder Clay. The soils and subsoils map for the installation is illustrated in Insert 7.4 and 7.5.

The boulder clays generally exhibit very low permeability in the order of $1x10^{-7}$ to $1x10^{-9}$ m/s or lower. The glacial boulder clay will tend to act as an aquitard or aquiclude (a confining layer with low permeability) between the other more permeable formations including the limestone bedrock (fracture dominated flow).



Insert 7.4 Soils map (boundary indicated in red) (Source: www.gsi.ie). *Red line shown as indicative only.*



Insert 7.5 Sub-Soils map (boundary indicated in red) (Source: www.gsi.ie). Red line shown as indicative only.

Insert 7.5 above shows the regional soil coverage in the area of the Proposed Development site. The soil type beneath the local area is composed of BminPD and BMinDW. BminPD and can be defined as Surface water Gleys / Ground water Gleys Basic and BMinDW soils by Grey Brown Podzolics/Brown earths.

7.3 HYDROLOGY

The existing site is greenfield development where surface water flows via overland drainage ditches and a surface water drain into the Baldonnell Stream and Griffeen River which ultimately outfalls into the River Liffey. Under the Water Framework Directive, the River Liffey has been designated as 'at Risk'.

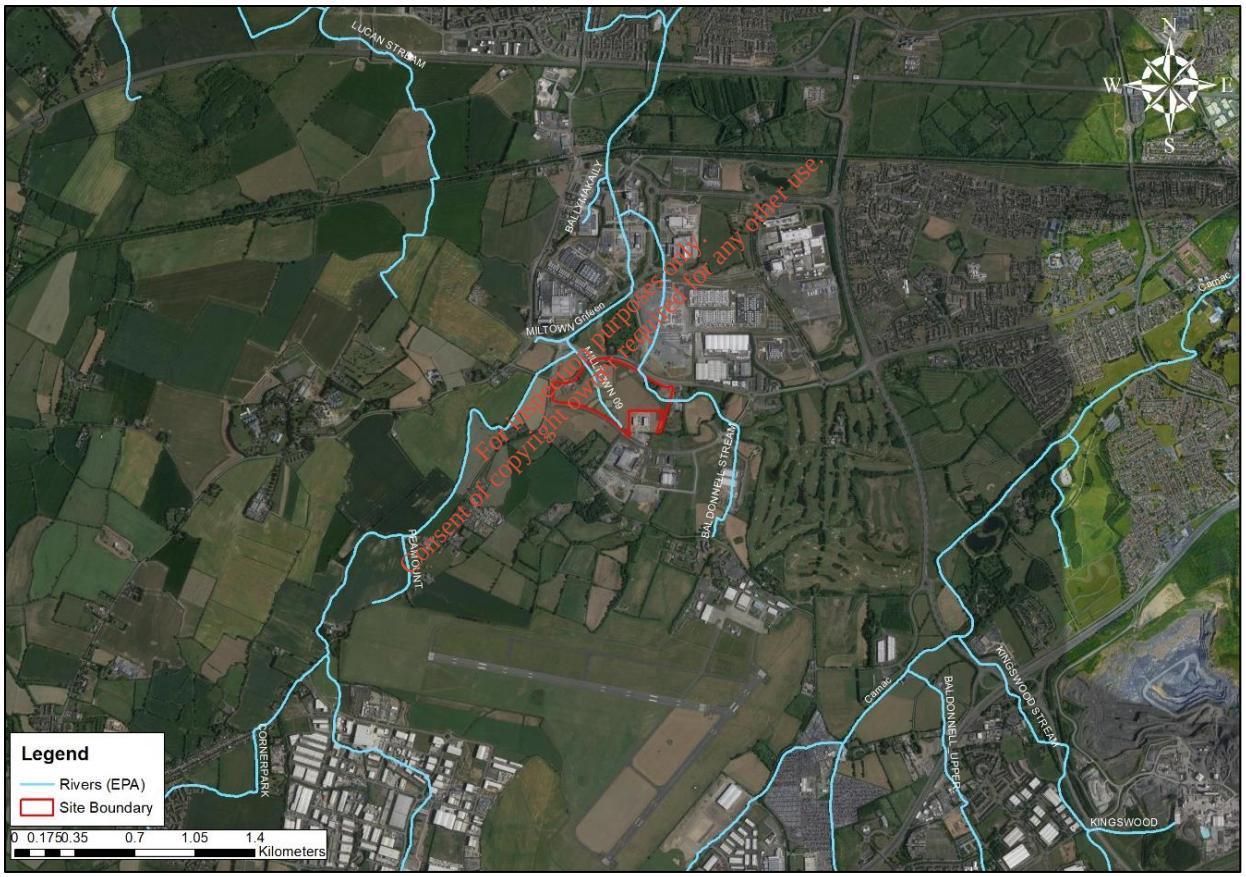
The Baldonnell Stream runs roughly east to west through the northern part of the site. Based on the most recent water quality information 2010-2015 (EPA, 2019) the stream has been designated as having 'Good' chemical and fish status with 'Moderate' status overall.

The topographical survey discovered that two historical streams discharging to the River Griffeen downstream of the proposed development site have been diverted. These streams originated within the proposed development site and the adjacent greenfield. Running from south to north through the Microsoft land to the River Griffeen downstream. The diversion of the two historical streams, referred to in this report as the Baldonnell and unnamed stream, occurs within the proposed development site

which now runs along the southern boundary of the New Nangor Road until it discharges to the River Griffeen approximately 150m to the west.

The eastern reach is in its natural condition and runs at surface, for approximately 200 m, from the boundary with Boland's Grangecastle behind a vacant bungalow in an open ditch. The central 280 m reach has been realigned and runs again on the surface in a newly formed channel parallel to the Nangor Road. The final, western reach is in a 200 m culvert and continues westwards to outfall to the Griffeen River at a point southeast of the junction of the New Nangor and Baldonnell roads (Insert 7.6).

To the south of the subject lands there is two stormwater sewers, 450mm in diameter. They drain from east to west, then combine and turn north ultimately discharging into the Griffeen River. South Dublin drainage records do not indicate any storm water sewers crossing the subject lands.



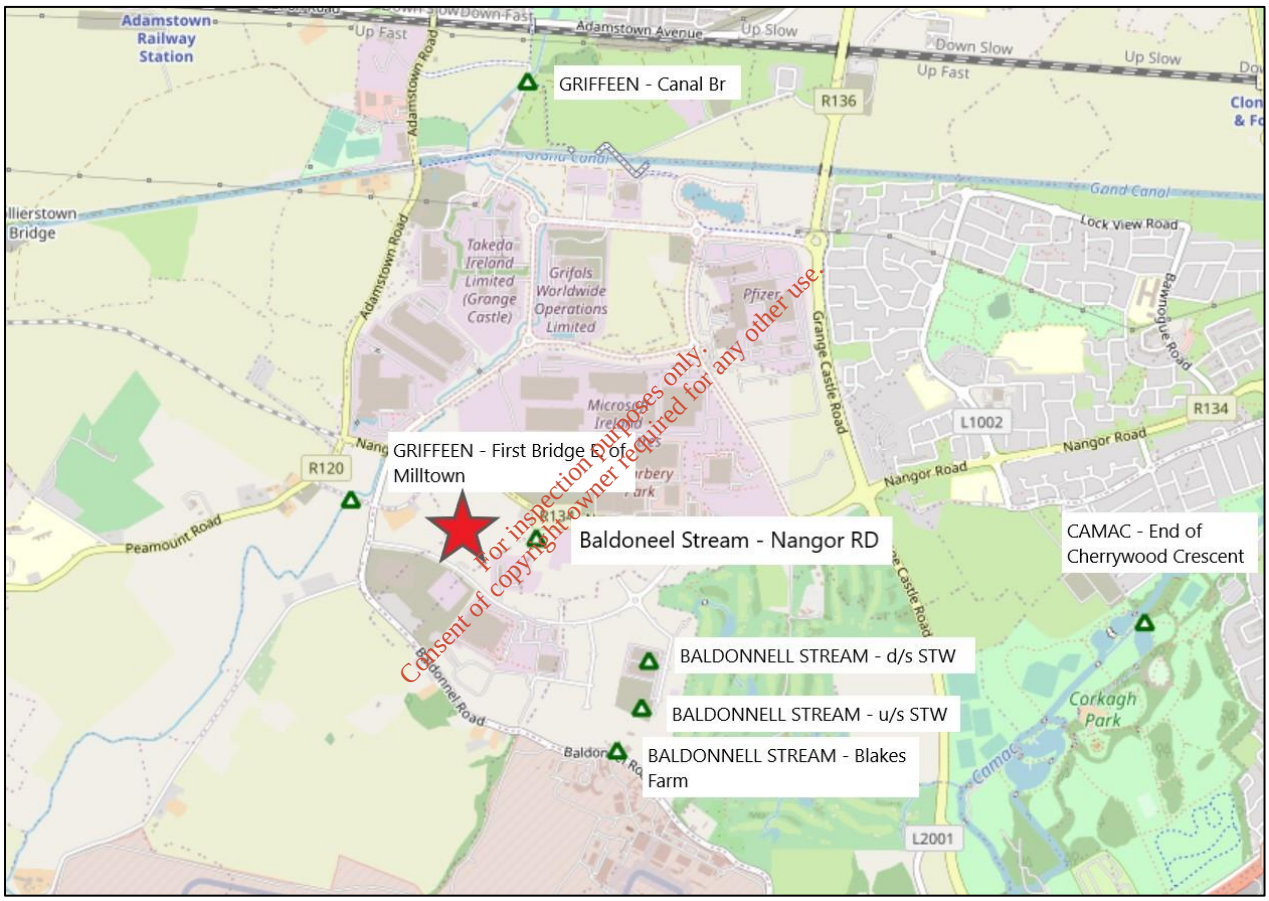
Insert 7.6 Hydrological Environment. Red line shown as indicative only.

7.3.1 Surface Water Quality

The development is located within the Eastern River Basin District (ERBD), as defined under the European Communities Directive 2000/60/EC, establishing a framework for community action in the field of water policy – this is commonly known as the Water Framework Directive (WFD).

The closest EPA surface water quality station downstream to the site is the 'Griffeen in Lucan Village' (EPA Code RS09G010600) which is located in the Griffeen River c. 4 Km to the north (i.e., downstream) of the subject site, just before its junction with the River Liffey. Its most recent data (2019) show records which are consistently below the threshold values defined to achieve 'Good Status' (EU Environmental Objectives Regulations, SI 272/2009 and amendment SI 77/2019). However, a moderate status has been found for nitrogen and nitrate conditions.

Surface water quality is monitored continuously by the EPA at various regional locations along principal and other smaller watercourses. Insert 7.7 below presents the EPA quality monitoring points in the context of the site and other regional drainage setting, together with hydrometric gauges along the respective stage of each river body shown.



Insert 7.7 *Surface Water Quality Monitoring Point (source: www.epa.envision) (Site location indicated with red star with monitoring point locations shown with Green triangles).*

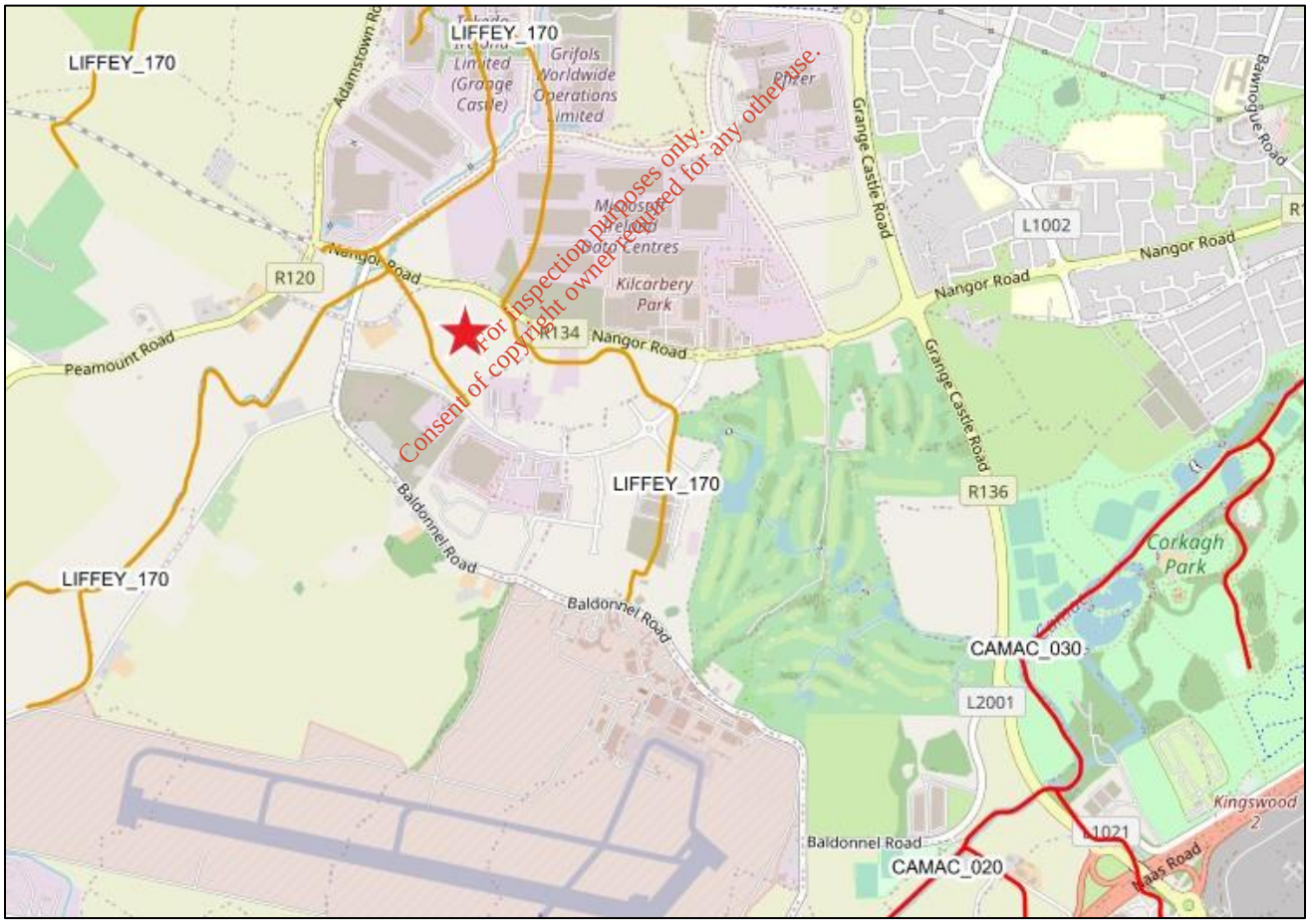
Surface water quality is monitored periodically by the EPA at various regional locations along principal and other smaller watercourses. With reference to the site setting, the nearest downstream EPA monitoring station is situated along the Griffeen River to the North of the site.

The EPA assess the water quality of rivers and streams across Ireland using a biological assessment method, which is regarded as a representative indicator of the status of such waters and reflects the overall trend in conditions of the watercourse.

The biological indicators range from Q5 - Q1. Level Q5 denotes a watercourse with good water quality and high community diversity, whereas Level Q1 denotes very low community diversity and bad water quality.

Several water quality monitoring stations located on the Griffeen River downstream of the proposed site have Water quality ratings available within the last ten years. The monitoring location (GRIFFEEN - In Lucan Village RS09G010600) which is just north of Insert 7.7's scope obtained a Q rating of 3 - Poor Status (in 2019). The station "GRIFFEEN - First Bridge E. of Milltown" (RS09G010200) also has a status of poor and denotes the values at Lucan Village as this station is upstream of the proposed site.

In accordance with the WFD, each river catchment within the former ERBD was assessed by the EPA and a water management plan detailing the programme of measures was put in place for each. Currently, the EPA classifies the WFD Ecological Status for the Griffeen River as having '*Good Status'* (Cycle Status 2013-2018) with a current WFD River Waterbody risk score of 1a, '*At risk of not achieving good status'.* Insert 7.8 presents the river waterbody risk EPA map.



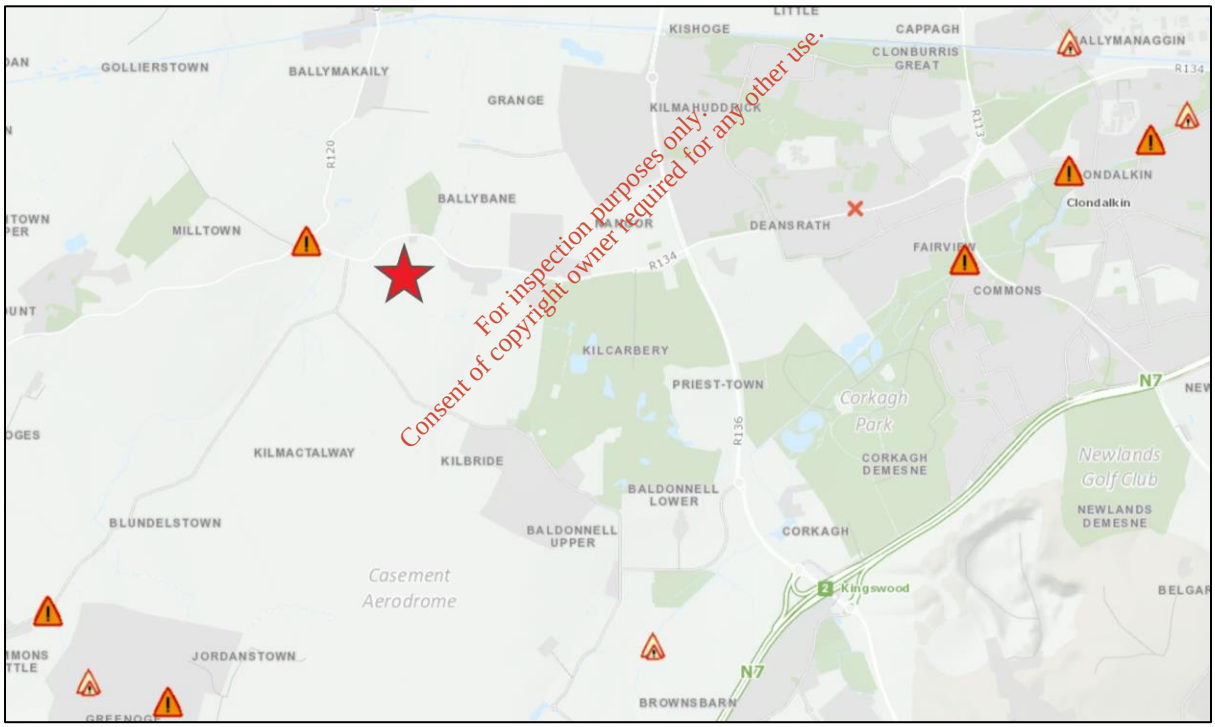
Insert 7.8 *River Waterbody Score – Review/ 1a 'At risk of not achieving good status, WFD Ecological Status: Good. (Site location indicated with red star).*

7.3.2 Flood Risk

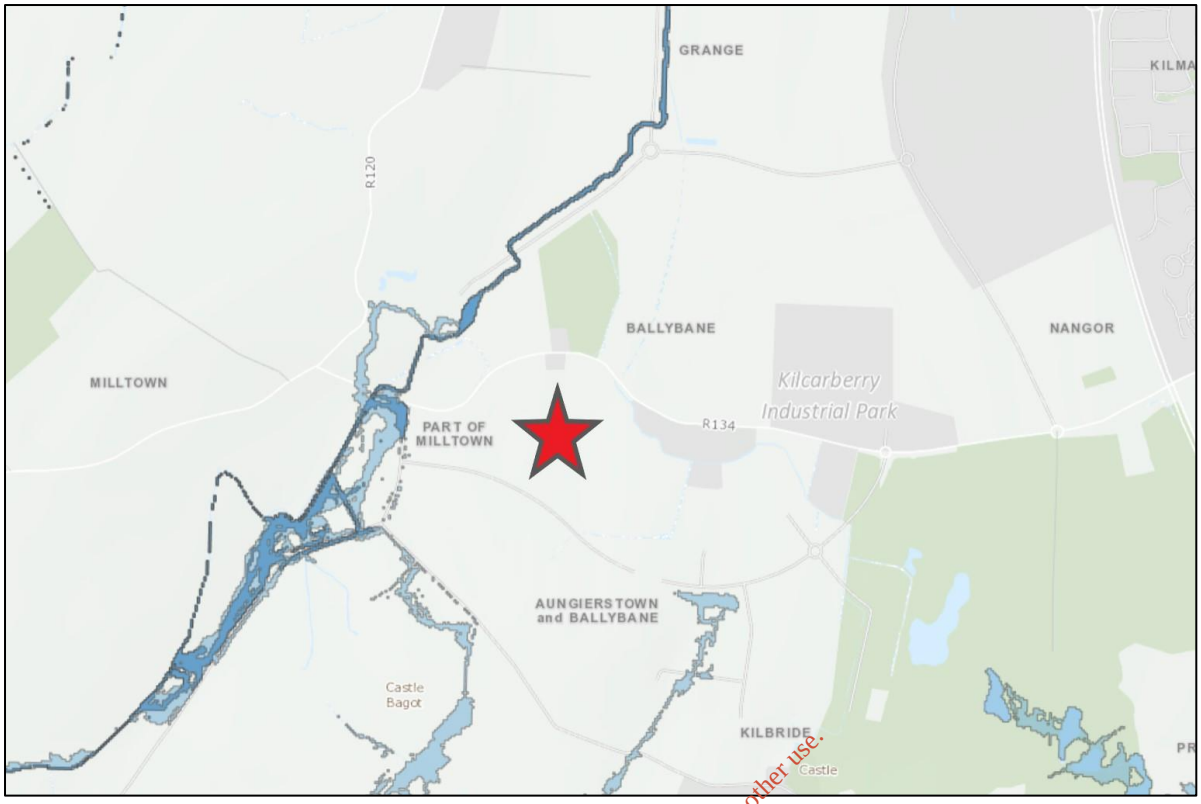
The potential risk of flooding on the subject site was also assessed through a review of the OPW CFRAM mapping for the area; shown in Insert 7.9 and 7.10 below. Based on the CFRAM flood extent mapping from OCSC, it is concluded that the majority of the site is outside the 0.1%AEP flood extent and is therefore within Flood Zone C. Those parts of the site subject to overland flow from flood water arising in the River Camac are within the 0.1%AEP flood extent but outside the 1.0%AEP flood extent and are therefore within Flood Zone B. No part of the site is within Flood Zone A.

Consideration of the above suggests that all the predicted flooding within the subject lands results from overland flow arising from the River Camac and that flood events in the River Griffeen do not contribute to flooding on the subject lands.

The hydraulic model did not show out-of-bank flooding from the unnamed stream in the vicinity of the proposed development site for the 1% AEP event. However, there was out-of-bank flooding from the unnamed stream for the 0.1% AEP event. The construction of new road embankments, river culverts and stream diversion have the potential to impact on the behaviour of the overland flow that traverses the subject lands.



Insert 7.9 OPW Historical Flood Map (source: www.floodmaps.ie). Site is marked with a red star.



Insert 7.10 *floodinfo.ie extract. Note Area of medium probability of flooding (1 in 100 year) to the East and South highlighted i.e. outside of proposed development area. Site is marked with a red star*

7.4 MAN-MADE PATHWAYS

No significant dewatering is anticipated to be required for construction as no basement structures are required. Local minor dewatering may be required during excavation works and groundworks dependent on the weather conditions at the time of works.

Removal of localised overburden material will be required during preparation of the platform for the building, but extensive excavations are not required. Infilling and landscaping will be undertaken, and all soils & subsoils stripped will be reused for infilling, levelling or landscaping with any remainder being retained on site for future use.

There will be no direct discharges to ground required for operation of the facility. Water supply will be supplied from public mains and effluent discharge will be to public sewer. Hard standing areas will reduce local recharge to ground. Diesel storage for the backup generators will be required. Each generator will be installed in an externally rated container with a self-contained belly tank (steel double wall type for leak containment and inner tank leak alarm system) with 48 hours diesel fuel storage capacity at full load. As identified in Stages 1-4 there is bulk storage for hydrocarbons only planned for the facility. Due to the volumes stored and the hazard classifications of these substances they could pose a risk to receiving waters if a source-pathway-receptor linkage existed.

Apart from diesel fuel, there is no other bulk storage of hazardous liquids at the site which minimises the risk to soils and water. Indirect discharges could occur from the following sources:

- Accidental leakages from cars in the car park areas although this will be primarily directed through the surface water drainage through an interceptor.
- Accidental leakage from the bunded diesel storage tanks during refuelling.
- overuse of pesticides and herbicides could impact on groundwater quality.

There are no historic mines on the site, or any existing land drains which may act as a migration route. All appropriate areas of the site will be hard paved reducing the potential for vertical migration to ground during operation. In the unlikely event of a leakage outside of the storage bunds, the primary pathway would be through the stormwater drainage system. The only man-made pathway of concern is the site stormwater network, the stormwater network is described in Section 4.2 above.

As noted in Section 4.2 the fuel tanks are located on hardstanding, appropriately bunded, with leak detection alarm systems, furthermore, prior to discharge stormwater is passed through a Class 1 Bypass Oil Separator (NPBP006 type with an oil capacity of 90 litres) to ensure that the quality of the stormwater discharge is controlled. In the event of a fire, run-off would be to the site attenuation pond where water would be held until tested and removed off site if required.

7.5 SURROUNDING LAND USE AND INTERDEPENDENCIES

The surrounding context of the site has been described in Section 1.3 above. According to the EPA (2021) there is no licensed IPPC facility attached to the subject site.

According to the EPA (2021), there are seven (7) no. IPPC and or IEL facilities are indicated as located in the wider surrounding area. These are referred to as follows:

- Takeda Ireland Limited (P0693-02) located approximately 0.95 Km North of the site.
- Grange BackUp Power Limited (P1033-02) located approximately 1.15 Km North of the site.
- Pfizer Ireland Pharmaceuticals (P0652-01) located approximately 1.2 Km Northeast of the Site.
- Rilta Environmental (W0185) located approximately 2.5 Km Southwest of the site.
- Rilta Environmental (W0192) located approximately 2.8 Km Southwest of the site.
- Starrus Eco Holdings Limited (Greenogue) (W0188) located approximately 2.9 Km south-south-west of the site.
- BBALP Limited (P0275) located approximately 2.7 Km south-south-east of the site.

Out of the seven (7) no. IPPC and/or IEL licenced facilities, there are four (4) no. facilities located upgradient from the subject site. Three (3) no. of these are waste facilities located in the vicinity of the subject site.

There are no geological national heritage areas (NHA) close to the development site. There is however a proposed national heritage area (pNHA) in the Grand Canal, 1.2 km north of the proposed site boundary.

All licenced sites are operated and governed under the EPA and are subject to environmental audits throughout the calendar year to ensure compliance. Therefore,

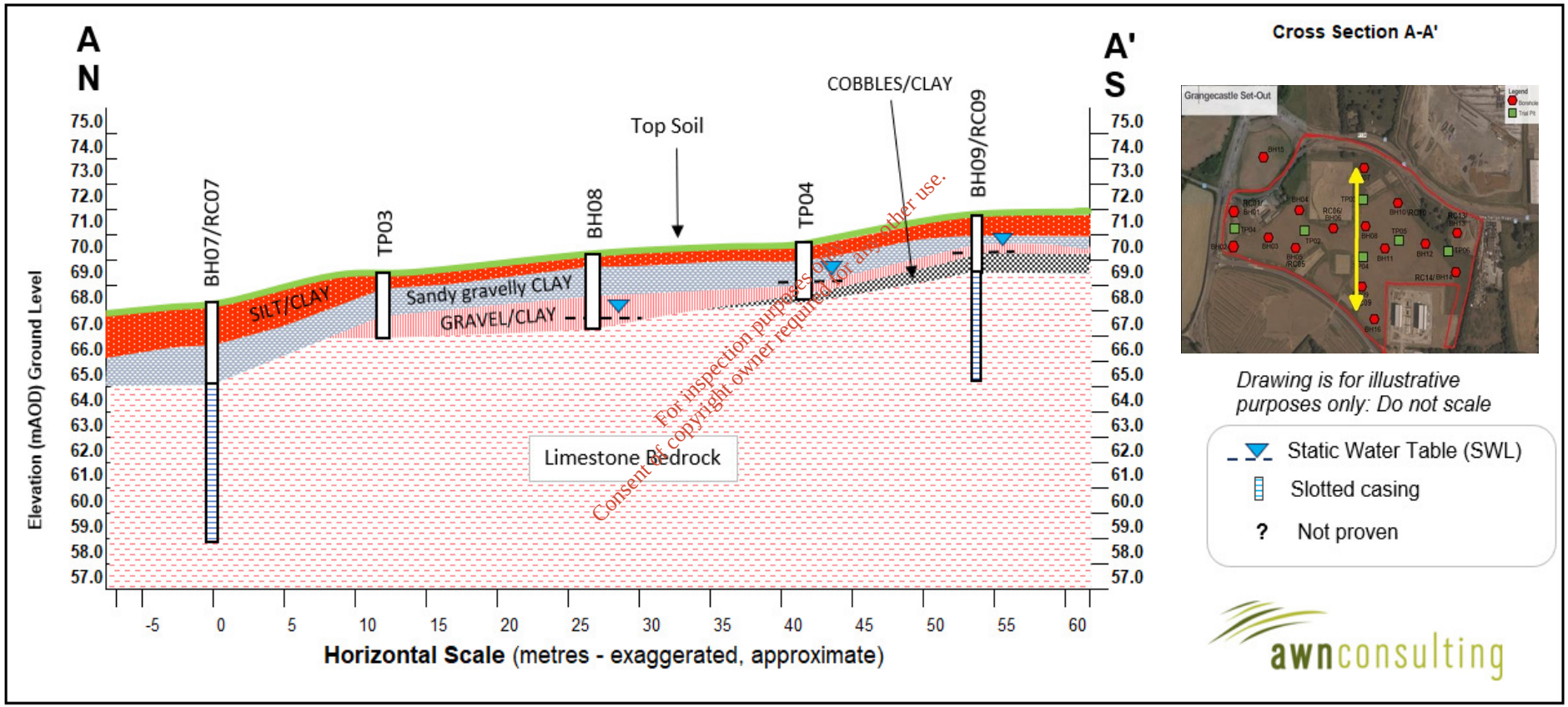
the potential of any contamination migrating from one of these licenced sites to the subject site is very low.

8.0 STAGE 6 – SITE CHARACTERISATION

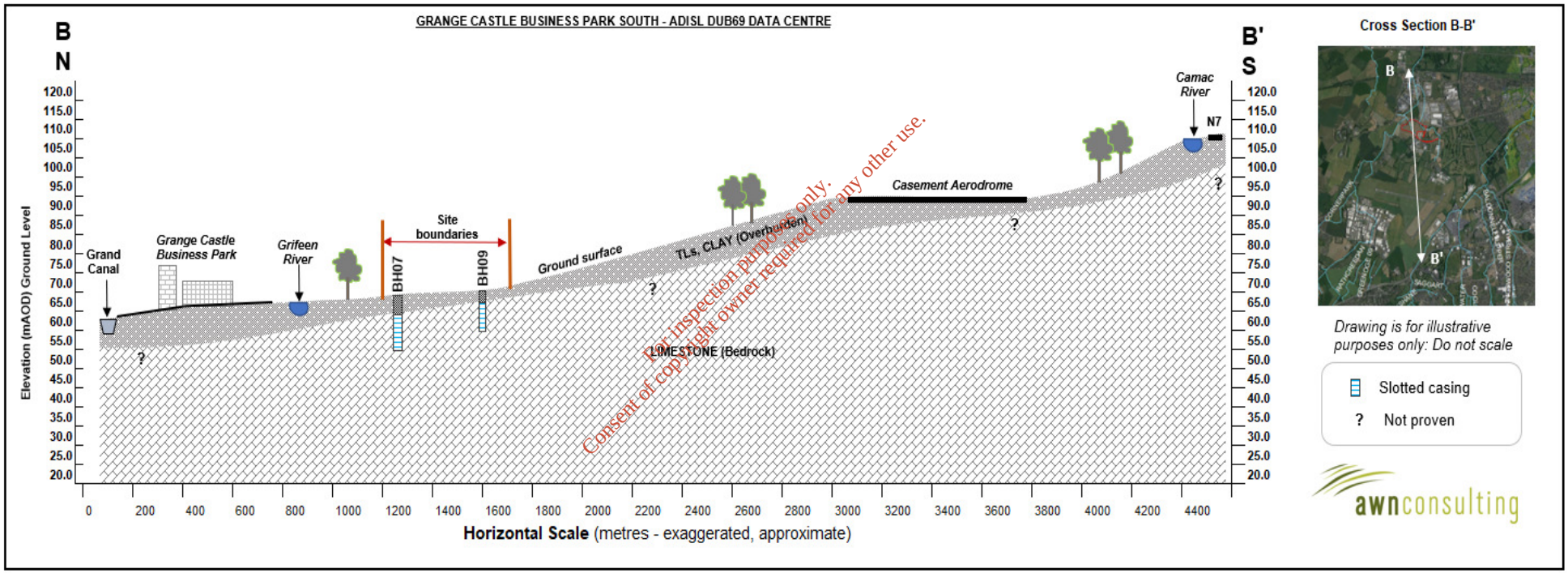
Insert 8.1 below shows the locations used to inform the conceptual site model (CSM) based on the *OCSC preliminary site investigation April and May 2019* and *IGSL Ltd Ground investigation report 2019 – Dub002 Technical Due Diligence Report* (OCSC, 2019). Insert 8.2 and 8.3 present the location of representative cross sections through the Existing site to show the local hydrogeology conceptual site model (CSM) which is as follows:

- The site is situated on relatively flat ground with a ground elevation of approximately +68-75 mAOD (Malin Head datum).
- The site is underlain by glacial till known as Dublin Boulder Clay which is c. 3m thick, has considerable strength and low permeability.
- The site is underlain by the Lucan Formation comprising dark shaley limestone known as Calp.
- The profile on site is relatively consistent overlain by topsoil in most locations with made ground encountered in two boreholes (BH01 & BH02), Made Ground were limited to upper 0.4 metres. Underlying deposits comprise sandy gravelly CLAY (likely Dublin Boulder Clay) with cobbles and boulders, in an initially firm condition in places (predominately eastern portion of site) improves in consistency with depth. Stiff and very stiff deposits generally encountered within 1.0 to 1.5 metres of current ground level.
- Bedrock onsite is most likely calp Limestone. Depth to bedrock typically shallow in the region with multiple outcropping of bedrock evident in the surrounding area. Generally, depth to weathered limestone bedrock is typically 2.0 – 2.6 m BGL, deepening to 3.6m BGL towards the north of the site (RC07) based on onsite investigations.
- Review of the geology and hydrogeology in the surrounding region indicates that there are no sensitive receptors such as groundwater-fed wetlands, significant public water supplies/ Group Water Schemes or geological heritage sites within the immediate vicinity which could be impacted by the proposed development.
- The aquifer is a “Locally Important” (Ll) bedrock aquifer and is moderately productive only in local zones.
- There is no evidence of a continuous water table within the clayey soil and shallow water was encountered within the weathered surface of the limestone bedrock.
- Groundwater flows are in a Northerly direction towards the River Liffey; however, the permeability of soils within the region are generally low as characterised by the Dublin GWB.
- Based on the Institute of Geologists of Ireland (IGI) the criteria for rating the importance of hydrogeological features, the importance of the hydrogeological features at this site is rated as *Medium Importance*. This is based on the assessment that the attribute has a medium quality significance or value on a local scale. The aquifer is a *locally important* (Ll) bedrock aquifer over part of the site, and it is unlikely to be used for public water supply or widely used for potable use. In addition, it does not host any groundwater dependent ecosystems (SACs/NHAs).

Insert 8.1 *Location of cross sections for CSM. Red line shown as indicative only.*



Insert 8.2 A-A' cross section



Insert 8.3 B-B' cross section

8.1 POLLUTANT LINKAGES

The pollutant linkages based on the primary sources of possible contaminants on site are summaries in Table 8.1.

Table 8.1 Pollutant Linkages

Source	Pathways	Receptor	Impact Assessment
Bulk Fuel storage and minor spills from vehicle activities	Vertical and lateral migration via shallow overburden to underlying bedrock. Lateral migration via groundwater within the bedrock aquifer. Lateral migration via drainage system.	Locally Important Aquifer with high to extreme vulnerability. Stormwater system to Baldonnel Stream along the Northern boundary of the site.	Low – Chemicals are stored in tanks in bunded areas or within warehouse areas which have drainage to process wastewater. Low – Materials contained (as above), current control measures mean spill will be contained before reaching the nearby stream.

9.0 STAGE 7 – SITE INVESTIGATION

The most relevant site investigation is found in the OCSC (2019)– Dub002 Technical Due Diligence Report as commissioned by OCSC prior to the development of the existing campus site. The aim of the site investigation was to provide a baseline soil quality assessment prior the commencement of any lease/purchase on the site.

The report was informed by site investigation which included a soil profiling and soil and groundwater sampling undertaken Between April and May 2019. The investigation included;

- Excavation of 6No. Trial Pits and 2No. soakaway pits:
    - TP01-TP06, SA01-SA02;
- Drilling of 16 no. cable percussion boreholes: BH01-BH16;
- Drilling of 8 no. Rotary Core boreholes: RC01, RC05, RC06, RC09, RC07, RC10, RC13 and RC14;
- BH02, BH08, BH11 and BH16 was converted into a groundwater monitoring well with slots across the overburden;
- RC01, RC07 and RC14 were converted into a groundwater monitoring wells with slots across the bedrock;
- Sampling and analysis of soil samples collected from these site investigations;
- Sampling of 3 no. groundwater wells.

Ten (10) no. representative soil samples were collected and submitted for analysis of a full range of parameters including metals, (As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Zn), VOCs & SVOCs, Pesticides, PCBs, Asbestos, Polycyclic Aromatic Hydrocarbons and Petroleum Hydrocarbons C10 – C50 (Extractable Petroleum Hydrocarbons and mineral oil).

The soil analytical data was compared with a set of Generic Assessment Criteria (GAC) derived to be protective of human health and also ecology for Commercial/industrial landuse. At the time of the comparison the soils were assessed against the latest GAC derived from LQM (Land Quality Management) and the CIEH (Chartered Institute of Environmental Health) for Human Health Risk Assessment (2015) in addition to the SP1010 – Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination CL:AIRE (2014) and the EIC/AGS/CL:AIRE Soil Generic Assessment Criteria for Human Health Risk Assessment (2010). As an initial generic assessment this will allow the screening out of significant contaminants of concern. A total of 82 substances including many organic substances had LQM GACs derived, for the standard land uses of residential, commercial/industrial and allotments.

Three (3) No. groundwater samples were collected and submitted to Exova Jones Environmental Laboratory, a UKAS and MCERTS accredited laboratory, for a suite of analysis including;

- VOCs & SVOCs;
- Pesticides;

- PCBs;
- Asbestos;
- Polycyclic Aromatic Hydrocarbons;
- Extractable Petroleum Hydrocarbons C10 – C50
- Metal Elements.

The Environmental Due Diligence Assessment for the existing campus concluded the following;

- The soil sampling results (OSCC, 2019) for GAC criteria found that all soil samples contained concentrations were below the GAC commercial land use values.
- Two parameters, barium and zinc, showed slightly elevated concentrations in groundwater samples however it is not considered that these present a risk to future users nor that they represent a significant plume of contamination. No LNAPL (floating hydrocarbon) or DNAPL (settled/sinking hydrocarbon) layer was observed and/or sampled.
- No other metals were in exceedance of the human health assessment criteria (where available).
- No visual, olfactory, or chemical evidence of the presence of LNAPL or DNAPL during the investigation and/or sampling.
- Made ground represents a thin layer in a small area of the site.
- No evidence of concentrations that could present vapour risk.
- EPH and Mineral Oil were recorded at concentrations below the limit of detection in all soil samples.

9.1 WASTE ACCEPTANCE CRITERIA

Five (5) no. soil samples were submitted for a suite of analysis to facilitate the assessment of material in terms of waste soil classification.

To comply with the European Waste Framework Directive (2008/98/EC), S.I. 233 of 2015 and S.I. 126 of 2011; a hazardous waste assessment was carried out utilising HazWasteOnline software using classification engine WM3.v1.1 (2018). The software enables the user to review the total pollutant content analysis in terms of any Hazardous Properties (as defined in the Regulations) the material may have.

Of the analyses of the five (5) no. samples, all of which were assessed as being non-hazardous. This is as expected given the greenfield nature of the site.

All samples were subjected to asbestos screening and none of the samples contained detectable asbestos fibres.

All excavated soil and wastes requiring export from the site, for recovery or disposal offsite, shall require waste classification. Waste classification shall be carried out by a suitability qualified and experienced person via sampling and analysis following best industry practice and relevant legislation including:

• List of Waste & Determining if Waste is Hazardous or Non-Hazardous (EPA, 2015);

• European Waste Framework Directive (2008/98/EC);

• Guidance on the classification and assessment of waste, Technical Guidance WM3 (EA et al, 2015);

• EU Council Decision 2003/33/EC and 1999/31/EC (2002);

• European Union (Properties of Waste which render it Hazardous) Regulations 2015 –S.I. 233 of 2015; and

• EC Classification, Labelling & Packaging Regulations (No. 1272/2008).

10.0 CONCLUSIONS

On the basis of the soil and groundwater investigations undertaken prior to construction of the ADSIL facility and an assessment of source-pathways-receptors, the following conclusions have been made:

- A review of the available soil and water quality confirms that there is no evidence of any residual contamination beneath the site.
- There is only bulk diesel storage proposed for the facility. However, the risk prevention measures planned at the facility significantly reduce the potential for an environmental impact to soil or water to occur. These measures include bunded and double contained vessels, double lined drainage and containment systems and spill management procedures.
- Source-pathway-receptor linkages were assessed for the bulk storage areas. It was concluded that there are no direct pathways to either the soil or groundwater environment. Interceptors are installed on the surface water drainage. A leakage from a bulk tank would be fully contained in the designated bund or the double skin lining of the tank, with leaks during delivery fully contained within the continuous hard stand delivery area. Any leakage outside of the delivery area would be contained within the drainage system.

11.0 REFERENCES

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