7.0 HYDROLOGY

7.1 INTRODUCTION

This chapter assesses and evaluates the potential impacts of the Proposed Development on the hydrological aspects of the site and surrounding area. In assessing likely potential and predicted effects, account is taken of both the importance of the attributes and the predicted scale and duration of the likely effects.

7.2 METHODOLOGY

7.2.1 Criteria for Rating of Effects

This chapter evaluates the effects, if any, which the Proposed Development will have on Hydrology as defined in the the EPA EIA Report Guidelines 2022. The EPA Draft Advice Notes for EIS 2015 are also followed in this hydrological assessment and classification of environmental effects. Due consideration is also given to the guidelines provided by the Institute of Geologists of Ireland (IGI) in the document entitled Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements' (IGI, 2013). In addition, the document entitled 'Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes' by the Transport Infrastructure Ireland (TII, 2009) is referenced where the methodology for assessment of impact is appropriate.

The rating of potential environmental effects on the hydrological environment is based on the standard EIA Report impact predictions table included in Chapter 1 which takes account of the quality, significance, duration, and type of effect characteristic identified (in accordance with impact assessment criteria provided in the EPA EIA Report Guidelines 2022).

The duration of each effect is considered to be either momentary, brief, temporary, short-term, medium term, long-term, or permanent. Momentary effects are considered to be those that last from seconds to minutes. Brief effects are those that last less than a day. Temporary effects are considered to be those which are construction related and last less than one year. Short term effects are seen as effects lasting one to seven years; medium-term effects lasting seven to fifteen years; long-term effects lasting fifteen to sixty years; and permanent effects lasting over sixty years. The construction of Proposed Development is targeted to be completed within one year, however the contractor's compound will remain in place for a further year for use for maintenance activities for the existing TILGC site. Therefore the duration of effects is considered to be temporary to short term for the construction phase.

The TII criteria for rating the magnitude and significance of impacts on the hydrological related attributes and their importance at the site during the EIA stage are also relevant in assessing the impact and are presented in Tables 1-3 in Appendix 7.1.

The principal attributes (and effects) to be assessed include the following:

- River and stream water quality in the vicinity of the site (where available);
- Surface watercourses near the site and potential impact on surface water quality arising from Proposed Development related works including any discharge of surface water run-off;

- Localised flooding (potential increase or reduction) and floodplains including benefitting lands and drainage districts (if any); and
- Surface water features within the area of the site.

7.2.2 Sources of Information

Desk-based hydrological information in the vicinity of the site was obtained through accessing databases and other archives where available. Data was sourced from the following:

- Environmental Protection Agency (EPA) – website mapping and database information. Water quality monitoring data for watercourses in the area (www.catchments.ie);
- River Basin Management Plan for Ireland 2018-2021 (https://www.gov.ie/en/publication/429a79-river-basin-management-plan-2018-2021/);
- The Planning System and Flood Risk Management, Guidelines for Planning Authorities (Department of the Environment, Heritage and Local Government (DoEHLG) and the Office of Public Works (OPW));
- Office of Public Works (OPW) flood mapping data (www.floodinfo.ie);
- Ordnance Survey Ireland (OSi) – Current and historical mapping and aerial photography;
- The Shannon River Basin District Catchment Flood Risk Assessment and Management Study (CFRAMS);
- South Dublin City Council (2005), Greater Dublin Strategic Drainage Study: Technical Documents of Regional Drainage Policies. Dublin: Dublin City Council;
- 'Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors' (CIRIA 532, 2001); and
- National Parks and Wildlife Services (NPWS) – Protected Site Register.

Site specific data was derived from the following sources:

- Engineering Infrastructure Report. DPS (2022);
- Flood Risk Assessment; Takeda Development Grange Castle Business Park. Malachy Walsh and Partners Consulting Engineers (2017);
- Ground Investigation Report. Takeda DPS. GII (2022);
- Various design site plans and drawings.

7.3 RECEIVING ENVIRONMENT

The receiving environment is discussed in terms of hydrology.

7.3.1 General Description of the Site

The subject site is located within the existing TILGC biopharmaceutical manufacturing facility at its site in Grange Castle Business Park, Clondalkin, Dublin 22. Within the Grange Castle Business Park, immediately adjacent to the TILGC site to the west is an EdgeConnex Data Centre and an emergency power generation installation. To the south and southwest are a series of Microsoft Data Centres ranging from fully operational to under construction. Grifols Worldwide operations, a supplier of plasma products to the bioscience sector is located immediately east of the site with Pfizer Grange Castle located further to the east within the Business Park. Interxion data centre and Grange Castle backup power generation are located

to the northeast of the site. Residential housing makes up the land to the east and north of Grange Castle Business Park. To the west is mainly agricultural land and to the south are Grange Castle Golf Club and Profile Park Industrial Estate, with Baldonnell Aerodrome located further south. The site is not located directly adjacent to any areas of national or local environmental sensitivity/designation.

The majority of the TILGC site is already developed and consists of an office block with reception and administration, 3 no. production buildings (P1, P2 and P3), warehousing and storage, an electrical substation, backup power generation installation utilities and other ancillary buildings.

The specific development site is located within the Grange Castle Business Park, Dublin 22 accessible via the New Nangor Road. The overall TILGC site area is 16.15 Hectares. The Proposed Development area (red line boundary) is 1.49 Hectares (refer to Figure 6.1 below). The area proposed for the new VOC abatement system and utilities workshop is characterised by a flat terrain comprising backfill from previous construction projects on the site, and covered with ruderal vegetation with no trees, shrubs or hedgerows. The area proposed for the contractor's compound is a greenfield area that has predominantly grown wildly for biodiversity with a cut border around the perimeter. The existing wastewater treatment plant (WWTP) is located to the south of the proposed development and there is an existing contractor's compound to the north. Along the east and west boundaries there are established planted berms with trees interspersed among dense hedgerows.

In the immediate vicinity of the subject site there are industrial/commercial units associated with Grange Castle Business Park. The Grand Canal proposed National Heritage Area (pNHA) is located approximately 300 m north of the site. There are no Natura 2000 sites in the vicinity of the subject site. The nearest protected sites is the Rye Water Valley/ Carton Special Area of Conservation (SAC) and pNHA which is located approximately 4.6 km northwest of the site and the Glenasmole Valley SAC c. 9.34 km to the south. However, there are no pathways or connectivity to either of these two sites. These Natura sites are further discussed in detail in Section 6.4 of Chapter 6 (Lands, Soils, Geology and Hydrogeology).

The TILGC site is generally flat with local undulations in level (covered with grass) with ground levels at approximately 63.6mOD in the north rising to 64.5mOD in the south. A section of the Griffeen River which previously ran through the site was realigned during the construction of the Business Park and runs along the eastern boundary of the site on the far side of the road and along part of the southern boundary.

7.3.2 Hydrology

The Proposed Development site lies within the Liffey and Dublin Bay Catchment (Hydrometric Area 09) and River Liffey sub-catchment (WFD name: Liffey_SC_090, Id 09_15) (EPA, 2022).

The surrounding environment can be described as predominantly industrial and commercial. The site is generally flat with local undulations in level (covered with grass) with ground levels at approximately 63.6mOD in the north rising to 64.5mOD in the south.

According to the EPA river network, the Griffeen River flows along the eastern boundary of the overall TILGC site across the Grange Castle Business Park road and along part of the southern boundary (refer to Figure 7.1 below). The Griffeen River rises in the townland of Greenoge, approximately 6 km southwest of the

Proposed Development. It flows in a northerly direction where it is culverted beneath the Grand Canal and from there it flows north through Lucan. The Griffeen River enters the River Liffey just north of Lucan town. A section of the Griffeen River originally ran through the overall TILGC site but it was realigned during the construction of the Grange Castle Business Park and associated access roads and its original route may have been infilled with imported material. It now runs alongside the internal access road of the Business Park in a northerly direction. The Baldonnell Streams flows in a northerly direction and is a tributary to the Griffeen River.

The Griffeen River discharges into the River Liffey c. 3.5km to the north of the site which ultimately discharges into the South Dublin Bay SPA/SAC/pNHA which is c. 15km to the east of the site. There would be an indirect discharge to Dublin Bay waterbody from the Proposed Development site through the stormwater and foul water site drainage, albeit at a huge distance with a large dilution factor in Dublin Bay.

Figure 7.1 Site Location and Local Hydrological Environment

With regard to the local drainage, the TILGC site discharges its surface water run-off from roofs and hardstanding areas currently to one location (EP-WS-01) which is an existing licensed emission point. This discharge point discharges uncontaminated surface water run-off to the public surface water system, which ultimately discharges to the Griffeen River, which is a tributary of the River Liffey.

The overall TILGC site has an existing surface water drainage system which collects surface water runoff from the hardstanding areas (excluding bunded areas) and roof areas of the site, which falls into monitoring chamber at the north of the site. Under normal operating conditions, it is gravity fed through a Class 1 interceptor and continues to the outlet monitoring chamber EP-WS-01 prior to discharge to the

Griffeen River. The surface water quality is continuously monitored for Total Organic Carbon (TOC) and pH in accordance with TILGC's IE Licence P0693-02. The outlet valve is operated electrically and is normally in an open position but will close if the limits for TOC or pH are exceeded, if the fire alarm is activated or if manual closing is required. If the outlet valve is closed for any reason or if the velocity of the surface water is greater than 13 l/s, the hydrobrake flow control devise is initiated, the normal discharge route to the outlet chamber is shut and excess surface water overflows into the firewater retention tank (capacity of 2,230m^3). When situation is resolved (i.e. limit exceedance, fire alarm, or increased flow addressed) water in the firewater retention tank can then be pumped back into the inlet monitoring chamber, whereby it then flows through the Class 1 interceptor and continues to the outlet monitoring chamber prior to discharge to the River Griffeen. Surface water in the firewater retention pond will only be discharged back into the inlet monitoring chamber after it has been confirmed that no contamination has occurred and water quality is within alarm warning and trigger limits which much be approved by TILGC's Environmental Health and Safety (EHS) personnel. The hydrobrake flow control device ensures that discharge flows are controlled and limits the water outflow from the site to a greenfield rate.

The existing surface water drainage system was designed in accordance with SUDs, the Greater Dublin Strategic Drainage Study, and EN standards. There are currently 6 interceptors on the overall site. These retain silt, diesel and oil and prevent them from discharging offsite.

TILGC's have a surface water management programme for monitoring, inspecting, and maintaining the surface water drainage system in accordance with best practice, their IE Licence P0693-02.

As the River Griffeen is a tributary of the River Liffey it is in direct hydraulic connection to a number of national and European protected site. According to the NPWS (2022) online database, the following area of conservations are in hydraulic connection to the Griffeen:

- North Dublin Bay Special Area of Conservation (SAC) (Site Code 000206) – c. 18.2 km east of the site;
- South Dublin Bay Special Area of Conservation (SAC) (Site Code 000210) – c. 15.75 km east of the site;
- North Bull Island Special Protection Area (SPA) (Site Code 004006) – c. 18.19 km east of the site;
- South Dublin Bay and River Tolka Estuary Special Protection Area (SPA) (Site Code 004024) – c. 15.09 km east of the site.

The Proposed Development site location is an unoccupied area along the western boundary of the TILGC site. The area for the proposed VOC abatement system is characterised by a flat terrain comprising of backfill from other construction projects on the site covered with ruderal vegetation. The area for the proposed temporary contractor's compound is a greenfield area that has been planted in grasses predominantly grown wildly with a cut border around the perimeter. There is currently no connection from these areas to the existing surface water or wastewater drainage system for the overall TILGC site.

7.3.3 Surface Water Quality

The development is located within the former ERBD (now the Irish River Basin District), 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). It is situated in Hydrometric Area No. 09 of the Irish River Network and is located within the River Liffey Catchment.

The Water Framework Directive (WFD) Directive 2000/60/EC was adopted in 2000 as a single piece of legislation covering rivers, lakes, groundwater and transitional (estuarine) and coastal waters. In addition to protecting said waters, its objectives include the attainment of 'Good Status' in water bodies that are of lesser status at present and retaining 'Good Status' or better where such status exists at present.

The WFD requires 'Good Water Status' for all European waters to be achieved through a system of river basin management planning and extensive monitoring by 2015 or, at the least, by 2027. 'Good status' means both 'Good Ecological Status' and 'Good Chemical Status'. In 2009 the ERBD River Basin Management Plan (RBMP) 2009-2015 was published. In the ERBD RBMP, the impacts of a range of pressures were assessed including diffuse and point pollution, water abstraction and morphological pressures (e.g., water regulation structures). The purpose of this exercise was to identify water bodies at risk of failing to meet the objectives of the WFD by 2015 and include a programme of measures to address and alleviate these pressures by 2015. This was the first River Basin Management planning cycle (2010-2015). The second cycle river basin management plan for Ireland is currently in place and will run between 2018-2021 with the previous management districts now merged into one Ireland River Basin District (Ireland RBD).

This second-cycle RBMP aims to build on the progress made during the first cycle. Key measures during the first cycle included the licensing of urban waste-water discharges (with an associated investment in urban waste-water treatment) and the implementation of the Nitrates Action Programme (Good Agricultural Practice Regulations). In more general terms, three key lessons have emerged from the first cycle and the public consultation processes. These lessons have been firmly integrated into the development of the second cycle RBMP. Firstly, the structure of multiple RBDs did not prove effective, either in terms of developing the plans efficiently or in terms of implementing those plans. Secondly, the governance and delivery structures in place for the first cycle were not as effective as expected. Thirdly, the targets set were too ambitious and were not grounded on a sufficiently developed evidence base. The second cycle RBMP has been developed to address these points.

The strategies and objectives of the WFD in Ireland have influenced a range of national legislation and regulations. These include the following:

- European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003);
- European Communities (Drinking Water) Regulations 2014 (S.I. 122 of 2014);
- European Communities Environmental Objectives (Surface Waters); Regulations, 2009 (S.I. No. 272 of 2009 as amended by SI No. 77 of 2019);
- European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010, S.I. No. 366 of 2016);
- European Communities (Good Agricultural Practice for Protection of Waters) Regulations, 2010 (S.I. No. 610 of 2010);
- European Communities (Technical Specifications for the Chemical Analysis and Monitoring of Water Status) Regulations, 2011 (S.I. No. 489 of 2011);
- Statutory Instrument (SI) No. 293 of 1988 European Communities (Quality of Salmonid Waters) Regulations 1988;
- Local Government (Water Pollution) Acts 1977-1990;

- SI No. 258 of 1988 Water Quality Standards for Phosphorus Regulations 1998.

The Griffeen River belongs to the Liffey_170 WFD surface water body. The most recent published status (www.epa.ie – River Waterbody WFD Status 2013-2018) of this waterbody is '*Moderate*' and its WFD risk score is '*At risk of not achieving good status*'. This '*Moderate*' status is related to its biological conditions (Phytobenthos Status or Potential) and its nitrate conditions which have been recorded as '*Moderate*'.

The Griffeen River discharges into the River Liffey which in turn outfalls into Dublin Bay. The Dublin Bay has also a WFD status of '*Good*'. The most recent water quality assessment of Dublin Bay WFD Waterbody undertaken by the EPA (Water Quality in 2020: An Indicator Report, 2021) also shows that Dublin Bay on the whole, currently has an '*Unpolluted*' water quality status (refer to www.catchments.ie). Under the 2015 'Trophic Status Assessment Scheme' classification of the EPA, '*Unpolluted*' means there have been no breaches of the EPA's threshold values for nutrient enrichment, accelerated plant growth, or disturbance of the level of dissolved oxygen normally present.

The above status for the Griffeen River is related to data from 1 no. EPA active water quality station in Lucan Village' (RS09G010600), located in Lucan c. 200 m upstream from where the Griffeen River enters the River Liffey.

Surface water quality is monitored periodically by the EPA at various regional locations along with principal and other smaller watercourses. 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. Q Values are used by the EPA to express biological water quality, based on changes in the macro invertebrate communities of riffle areas brought about by organic pollution. See Table 7.1 below for an explanation of the ratings. Q1 indicates a seriously polluted water body; Q5 indicates unpolluted water of high quality. Q Values for the Griffeen River are shown in Table 7.2 below.

Table 7.1 EPA Biological Q Ratings

Quality ratings (Q)	Status	Water quality
Q5, Q4-5	High	Unpolluted
Q4	Good	Unpolluted
Q3-4	Moderate	Slightly polluted
Q3, Q2-3	Poor	Moderately polluted
Q2, Q1-2, Q1	Bad	Seriously polluted

Table 7.2 Q Ratings for Griffeen River

Station	Q Values			
	1984	1988	1991	2019
GRIFFEEN - In Lucan Village (Gauging Station)	3-4	3	2-3	3

The status recorded from the Griffeen station and provided by the EPA in 2019 is classified as Q3-Poor, which is related to poor ecological conditions recorded in August 2019.

7.3.4 Foul Water Services

All process wastewater from the existing TILGC campus is directed to the existing process drainage and treatment system via the overhead pipe rack for treatment prior to discharge to the TILGC Waste Water Treatment Plant (WWTP). The WWTP provides storage of process wastewater pending testing to ensure the wastewater meets IEL limits prior to controlled release (at EP-WW-01) in accordance with site operating procedures and IEL requirements. Thereafter the process wastewater connects with the site sanitary (foul) wastewater stream arising from P1 and the Administration Building, then it gets discharged to the SDCC sewer to the north of the site. Sanitary (foul) wastewater from P2 and P3 in the south of the site is collected in a separate onsite foul drainage system, which only collects sanitary (foul) wastewater and discharges to the east of the site out falling to the SDCC public foul sewer to the east. The wastewater from both discharge points ultimately discharges to Ringsend WWTP for treatment. The TILGC load contributions to the Ringsend WWTP are a very small fraction of the overall influent load to the WWTP.

7.3.5 Flood Risk Assessment

A Flood Risk Assessment (FRA) was carried out by Malachy Walsh Partners in 2017 for the existing TILGC site at Grange Castle and the now operational P2 project.

The report includes a detailed Stage 3 FRA which details the construction of a hydraulic model of the Griffeen River and flood plains based on the OPWs Eastern Catchment Flood Risk Assessment and Management (CFRAM) Hydrology Report (2016) and Eastern CFRAM Flood Maps. The analysis shows that a 1 in 100 or a 1% AEP (Annual Exceedance Probability) year storm event will not affect the site. A 1 in 1000 or 0.1% AEP year storm event has the potential to affect the new development site. The site is therefore in Flood Zone B as defined in the Flood Risk Management Guidelines. This has been confirmed with the most recent OPW flooding maps (available on www.floodinfo.ie).

The report details that the maximum water surface level within the footprint of the P2 Building was 63.20m OD for the 1% AEP MRFS flood event and 64.15m OD for the 0.5% AEP current flood event. However, the existing level in the Proposed Development site area is c. 63.3m OD. The 0.5% AEP current flood event results in the highest finished floor level of 64.1m OD (63.5m OD water surface level plus a free board of 0.60 meters) Therefore the Finished Floor Level (FFL) of the VOC abatement system plinth and utilities building was set at 64.1m OD and therefore complies with the Greater Dublin Strategic Drainage Scheme.

It should be noted that the Proposed Development will set its FFL above the 1% AEP MRFS flood level to ensure that the development is not at risk of flooding. This is in line with the recommendations of the greater Dublin Strategic Drainage Scheme. Furthermore, the Proposed Development design has no potential impact on flood risk for the overall TILGC site and other neighbouring properties.

7.3.6 Areas of Conservation

The lands in which the development is located have no formal designations. The nearest designated land to the site at Grange Castle Business Park is the Grand Canal pNHA (Site Code: 002104) at c. 300m to the north of the northern boundary of the subject site. As the canal is a contained feature (fully lined) there is no potential for a source pathway linkage. In addition, there is an indirect hydrological pathway to nationally designated sites in Liffey Valley and in Dublin Bay via the Griffeen River.

According to the NPWS (2022) online database, the following area of conservations are in hydraulic connection to the Griffeen:

- North Dublin Bay Special Area of Conservation (SAC) (Site Code 000206) – c. 18.2 km east of the site;
- South Dublin Bay Special Area of Conservation (SAC) (Site Code 000210) – c. 15.75 km east of the site;
- North Bull Island Special Protection Area (SPA) (Site Code 004006) – c. 18.19 km east of the site;
- South Dublin Bay and River Tolka Estuary Special Protection Area (SPA) (Site Code 004024) – c. 15.09 km east of the site.

7.3.7 Rating of importance of Hydrological Attributes

Based on the TII methodology (2009) (See Appendix 7.1), the importance of the hydrological features at this site is rated as 'Low Importance'. The Attribute has a low quality or value on a local scale.

7.4 CHARACTERISTICS OF THE DEVELOPMENT

The Proposed Development comprises the development for the following works:

- A Volatile Organic Compound (VOC) Abatement system comprising of a Thermal Oxidiser (TO), associated plant equipment and scrubbers positioned on a bunded concrete plinth
- A single storey utilities workshop
- A new pipe rack with the addition of a second-tier extension to the existing pipe rack
- Contractors compound
- Modifications to the existing internal access road
- Permanent pedestrian crossing to the existing internal access road
- New access road and footpaths to perimeter of proposed development
- Modifications to the existing site lighting, signage, surface water, foul and process wastewater drainage, hard and soft landscaping

The Proposed Development is described in detail in Chapter 2 (Description of the Proposed Development). The details of the construction and operation of the Proposed Development in terms of hydrology is described below.

The existing construction backfill is to be removed and disposed of offsite by a permitted/licenced waste management contractor. The volume of fill to be removed is 7,400 m^3.

In response to the recommendations from the flood risk assessment report (refer to Section 7.3.5) the ground level to the VOC abatement system compound, utilities workshop and new access road are to be set 600mm above the 1% AEP MRFS flood level.

The temporary contractor's compound will be in use for 2 no. of years. After this time it will be removed and the site returned to its original state. To facilitate the compound, it is proposed that all excavated soil is scraped back and set aside in the form of a berm along the northern perimeter of the compound. The berm will be planted in native grasses and pollinator friendly plants and will shield the view of the compound from the site entrance and main administration building. The surface

finish of the compound will be a permeable stone permitting free drainage to the soil below. A geotexile liner membrane is to be installed below the stone onto a prepared surface to capture any contaminants and separate from the existing underlying stratums.

The principal aspects related to the hydrological environment are presented in the following sections.

7.4.1 Surface Water Drainage

The development site will be connected to the existing TILGC surface water drainage collecting network which collects surface/rainwater from the non-process areas and roof areas of the site and outfalls into monitoring chamber at the north of the site. As mentioned in the Section 7.3.2 above, the TILGC site discharges its surface water run-off from roofs and hardstanding areas currently to one location (EP-WS-01) which is an existing licensed emission point. This discharge point discharges uncontaminated surface water run-off to the public surface water system, which ultimately discharges to the Griffeen River, which is a tributary of the River Liffey. A hydrobrake ensures that discharge flows are controlled and limits the water outflow from the site to a greenfield rate.

SUDs measures will be implemented in order to minimise any increase in surface water discharge into the existing system. The new access road are to be constructed of permeable asphalt with an underlying stone build-up on top of a geotextile filter membrane. Swales will be placed between the VOC Abatement system compound plinth and the access road allowing drainage directly into the ground. Surface water from the roof of the utilities building will feed directly into a local soakaway positioned to the north of the new access road is to discharge to a local soakaway designed in accordance with BRE 354 soakaway design and in accordance with the requirements of the local authority. The area over the soakaway will be planted with native grasses.

The proposed VOC compound will be finished in concrete hardstanding with bunded containment areas. Surface water collecting within the bunded areas will be routed to local sumps and will discharged to the existing foul drainage system for onsite treatment prior to controlled discharge in accordance with site operating procedures and IE Licence requirements.

The remaining hardstanding / paved areas in compound will drain into Aco channel drains which will be connected to the existing onsite drainage system. The increase in area represents less than 0.1% of the total paved area on the site and will have minimal impact on the downstream surface water drainage system. All other landscaping finishes are to be permeable and thus no additional discharge into the existing surface water drainage system is required.

In relation to the proposed temporary contractor's compound, it is proposed to construct the compound by removing the existing grassed topsoil and replacing with compacted hardcore. A geotextile filter membrane is to be installed below the hardcore onto a prepared surface to capture any contaminants and separate from the existing underlying stratums.

Further details on the proposed design of the surface water drainage are provided within the Engineering Infrastructure Report - Planning (Planning Document Ref. A21DB035-CV-IR-001) prepared by DPS Group and on accompanying drawing A21DB035-CV-100 included with the planning documentation.

7.4.2 Wastewater

No new connections to the public foul sewers are proposed as part of the Proposed Development.

During construction allowance has been made for contractors' compound with a proposed occupancy of 30 people. Welfare facilities will be provided for the contractors via portable sanitary facilities within the construction compound site during the construction works.

A sump is to be constructed within the footprint of the contractor's compound will be pumped to the existing drainage system within the TILGC site. There is no trade effluent associated with the construction phase.

A new handwash sink will be provided within the utilities workshop. Foul drainage from the new sink will be pumped into the existing TILGC foul drainage network.

Within the VOC abatement system plinth there will be two bunded areas for the VOC abatement system and the Urea tanks storage area. The concrete bund (designed in compliance with EPA guidance for design of containment bunds) at 350mm high encloses the concrete plinth laid at falls towards a process drainage sump, where any rainwater or potential contamination will be captured by the drainage sump. Liquid from the sump will be pumped up onto the proposed pipe rack to the existing onsite process drainage and treatment system prior to controlled discharge. No drainage from within the bunded areas will enter the surface water system or the ground directly.

Process wastewater from the VOC abatement system will be connected to the existing onsite process drainage and treatment system via the overhead piperack for treatment prior to discharge to the TILGC WWTP. The WWTP provides storage of process wastewater pending testing to ensure the wastewater meets the TILGC IE Licence limits prior to controlled release (at EP-WW-01) in accordance with site operating procedures and IE Licence requirements.

Further details on the proposed design of the foul water drainage are provided within the Engineering Infrastructure Report – Planning (Document Ref. A21DB035-CV-IR-001, DPS, 2022) and on accompanying drawing A21DB035-CV-100 included with the planning documentation.

7.5 POTENTIAL IMPACTS OF THE DEVELOPMENT

An analysis of the potential impacts of the Proposed Development on the hydrological environment during the construction and operation is outlined below. Due to the inter-relationship between land, soils, geology and hydrogeology and surface water the following impacts discussed will be considered applicable to Chapter 6. Waste Management is also considered an interaction. Remediation and mitigation measures included in the design of this project to address these potential impacts are presented in Section 7.6 below.

7.5.1 Construction Phase

In the absence of mitigation, the following potential effects to hydrology have been considered for the construction phase.

7.5.1.1 Increased Sediments Loading in Run-Off

Surface water runoff during the construction phase may contain increased silt levels or become polluted from construction activities. Runoff containing large amounts of silt can cause damage to surface water systems and receiving watercourses. Silt water can arise from dewatering excavations, exposed ground, stockpiles and access roads. Mitigation measures highlighted in Section 7.6 below will be employed to remove the risk to affect the local hydrological environment.

Site investigation and laboratory analysis carried out in 2022 has not identified any existing contamination. In the event that contaminated soil/water is encountered, it will be required to be removed offsite by a licensed waste contractor. Further soil sampling will be undertaken during pre-development works to confirm the classification of the contaminated material prior recovery/disposal. The contractor will be required to adhere to the Resource and Waste Management Plan (RWMP) which is included as Appendix 15.1 of this EIA Report.

7.5.1.2 Accidental Spills and Leaks

During construction of the development, there is a risk of accidental pollution incidences from the following sources if not adequately mitigated:

- Spillage or leakage of oils and fuels stored on site;
- Spillage or leakage of oils and fuels from construction machinery or site vehicles;
- Spillage of oil or fuel from refuelling machinery on site; and
- The use of concrete and cement during pad foundation construction.

The mitigation measures incorporated into the design comprise designated bunded areas for storage of construction materials as fuels, oils, solvents and paints; refuelling area away from surface water or drains; a mobile double skinned tank for storage of fuel for vehicles; and the installation of silt and sediment barriers at the perimeter of earthworks construction areas to limit transport of erodible soils outside of the site.

Based on the points stated above in relation to the construction phase the potential impact on the surface water and hydrology during construction (EPA 2022) is considered to have a ***temporary-short term – imperceptible*** impact with a ***neutral*** impact on quality. i.e. an impact capable of measurement but without noticeable consequences. This is based on the expected low potential loading and high level of dilution in the surface water drainage system and the treatment of the surface water via hydrocarbon interceptors prior to controlled discharge into the Griffeen River, which is the receiving waterbody as set out in Section 7.3.2. Significant dilution in the surface water sewer will ensure any released contaminants are at background levels (i.e., with no likely impact above water quality objectives as outlined in S.I. No. 272 of 2009, S.I. No. 386 of 2015 and S.I. No. 77 of 2019).

7.5.2 Operational Phase

There will be no direct discharges to any waterbodies. As stated in Section 7.4.1, SUDs measures, i.e. permeable asphalt, swales and a soakaway, have been incorporated into the design in order to minimise any increase in surface water discharge into the existing system. The remaining hardstanding / paved areas in the VOC compound will drain into Aco channel drains which will be connected to the existing onsite drainage system. The increase in area represents less than 0.1% of the total paved area on the site and will have minimal impact on the downstream

surface water drainage system. This will have an imperceptible effect on local recharge to ground and the overall hydrological regime.

The permeable asphalt will have an underlying stone build-up on top of a geotextile filter membrane. In addition, the temporary contractors compound will be finished with a permeable compacted stone overlying a geotextile filter membrane. In the event of a spill/leak from vehicles, the geotextile filter membranes will capture any contaminants and separate them from underlying soil.

The FLL of the VOC compound and utilities building have been designed to be above the 1% AEP MRFS flood level. This is in accordance with the recommendations of the Greater Dublin Strategic Drainage Scheme.

Based on the points stated above in relation to the operational phase the potential impact on the surface water and hydrology during operation (EPA 2022) is considered to have a ***long-term – imperceptible*** impact with a ***neutral*** impact on quality.

7.6 REMEDIAL AND MITIGATION MEASURES

The design has taken account of the potential impacts of the development on the hydrological environment local to the area where construction is taking place and containment of contaminant sources during operation. Measures have been incorporated in the design to mitigate the potential effects on the surrounding hydrology. These are described below.

The site is drained by the public stormwater network. This network ultimately flows towards the South Dublin Bay (via the Griffeen River and the River Liffey) which hosts Natura Sites (SPA/SAC/pNHA) and is located c. 15 Km to the east of the site. Thus, the site would have an indirect hydrological connection with the Dublin Bay through the local drainage networks.

Due to the inter-relationship between soils, geology, hydrogeology and hydrology, the following mitigation measures discussed will be considered applicable to all. Waste Management is also considered an interaction in some sections.

7.6.1 Construction Phase

7.6.1.1 Construction Environmental Management Plan (CEMP)

In advance of work starting on site, DPS Group 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. 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.

As a minimum, the CEMP will be formulated in accordance with 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;
- Eastern Regional Fisheries Board, (2006), Fisheries Protection Guidelines: Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites;
- CIRIA 697, The SUDS Manual, 2007; and
- UK Pollution Prevention Guidelines (PPG) UK Environment Agency, 2004.

In order to reduce impacts on the hydrological environment, the mitigation measures detailed below and in the CEMP will be adopted as part of the construction works on site.

7.6.1.2 Surface Water Run-off

As there is potential for run-off to enter current stormwater systems and indirectly discharge to a watercourse, mitigation measures 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 prior to discharge to the existing surface water drainage system. 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 surface water drains, refuelling of machinery off site, where possible). All surface water drainage from the TILGC site is treated via hydrocarbon interceptors prior to controlled discharge offsite.

Any minor ingress of groundwater and collected rainfall in the excavations will be pumped out during construction. It is estimated that the inflow rate of groundwater will be low and limited to localised perched water. It is therefore proposed that the water be discharged via the existing surface water drainage system. Monitoring will be adopted to ensure that the water is of sufficient quality to discharge to the surface water drainage system. The use of silt reduction measures as outlined above (if required) will be adopted if the monitoring indicates the requirements for the same with no silt permitted to discharge to the surface water drainage system. There may be localised pumping of surface run-off from the excavations during and after heavy rainfall events to ensure that the excavations are kept relatively dry. Due to the very low permeability of the Dublin Boulder Clay and the relative shallow nature for excavations, infiltration to the underlying aquifer is not anticipated. Based on SI information (Ground Investigations Ireland, 2022, included as Appendix 6.2), it is not anticipated that there will be rock removal required to facilitate construction of the development.

Care will be taken to ensure that exposed soil surfaces are stable to minimise erosion.

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 surface water 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.

7.6.1.3 Fuel and Chemical Handling

To minimise any impact on the underlying subsurface strata from material spillages, all oils, solvents and paints used during construction will be stored within temporary bunded areas. Oil and fuel storage tanks shall be stored in designated areas, and these areas shall be bunded to a volume of 110% of the capacity of the largest tank/container within the bunded area(s) (plus an allowance of 30 mm for rainwater ingress). Drainage from the bunded area(s) shall be diverted for collection and safe disposal.

Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles will take place in a designated area (or where possible off the site), this should be sensitively located away from surface water, gulleys or drains. These refuelling areas are to be identified in the CEMP. In the event of a machine requiring refuelling outside of this area, fuel will be transported in a mobile double skinned tank. An adequate supply of spill kits and hydrocarbon adsorbent packs will be stored in this area. All relevant personnel will be fully trained in the use of this equipment. Guidelines such as "Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors" (CIRIA 532, 2001) will be complied with.

Where feasible 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 surface water to the underlying subsoil. Wash down and washout of concrete transporting vehicles will take place at an appropriate facility offsite.

In the case of drummed fuel or other chemicals which may be used during construction, containers should be stored in a dedicated internally bunded chemical storage cabinet and labelled clearly to allow appropriate remedial action in the event of a spillage.

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.

7.6.1.4 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 2022 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.

7.6.2 Operational Phase

The Proposed Development will provide an improvement to the local drainage catchment as it is proposed to provide SUDs measures in compliance with the requirements of the Greater Dublin Strategic Drainage Study. A number of design measures (refer to Section 7.4.1.2 above) will be put in place to minimise the likelihood of any spills entering the water environment to include the design of the access road and contractors compound parking area which will have underlying geotextile filter membranes and the unbunded hardstanding areas on the VOC compound will be connected to the existing surface water drainage system via Aco drains which ensures any spills/leaks can be contained on site pending assessment, treatment and controlled discharge once IEL limits are met (refer to Section 7.4.1.2 above) in accordance with the site procedures and IEL requirements. In the event of an accidental leakage of oil from vehicles along the access road or car parking area, this will be intercepted by the geotextile filter membrane.

7.7 PREDICTED IMPACTS OF THE DEVELOPMENT

7.7.1 Construction Phase

The implementation of mitigation measures outlined above will ensure that the predicted impacts on the hydrological environment do not occur during the construction phase and that the residual impact will be ***temporary-short term-imperceptible-neutral***. Following the TII criteria (refer to Appendix 7.1) for rating the magnitude and significance of impacts on the hydrological related attributes, the magnitude of impact is considered ***negligible.***

7.7.2 Operational Phase

The implementation of mitigation measures outlined above will ensure that the predicted impacts on the hydrological environment do not occur during the operational phase and that the residual impact will be ***long term-imperceptible-neutral***. Following the TII criteria (refer to Appendix 7.1) for rating the magnitude and significance of impacts on the hydrological related attributes, the magnitude of impact is considered ***negligible***.

7.8 RESIDUAL IMPACTS

The implementation of the mitigation measures outlined in Section 7.6 will ensure that there will be no impact on the receiving water environment in accordance with relevant legislation (S.I No 77/2019 EU Environmental Objectives (Surface Waters) Amendment Regulations 2019).

7.9 CUMULATIVE IMPACTS

This section considers the residual impacts with potential cumulative impacts or effects on the hydrological environment of the Proposed Development with other existing, planned and permitted developments in the locality.

As has been identified in the receiving environment section all cumulative developments that are already built and in operation contribute to our characterisation of the baseline environment. As such any further environmental impacts that the Proposed Development may have in addition to these already constructed and operational cumulative developments has been assessed in the preceding sections of this chapter.

7.9.1 Construction Phase

The review of the planned and permitted projects in the locality of the Proposed Development is presented in Chapter 3 (Planning and Development Context). All developments which may be undertaking construction works simultaneously to the Proposed Development are required to ensure they do not have an impact on the receiving water environment in accordance with the relevant legislation (S.I No 77/2019 EU Environmental Objectives (Surface Waters) Amendment Regulations 2019) such that they would be required to manage runoff and fuel leakages. As such, it can be concluded that the in-combination effects of surface water arising from the Proposed Development taken together with that of other developments will not be significant based on the low potential chemical and sediment loading.

Therefore, the residual cumulative impact on hydrology for the construction phase is anticipated to be ***neutral, imperceptible***, and ***temporary-short term*** for the construction phase, once appropriate mitigation measures to manage potential contaminant sources in compliance with legislative requirement are put in place for each development.

7.9.2 Operational Phase

The existing and permitted projects set out in Chapter 3 (Planning and Development Context) have been considered in this assessment. Accidental releases from fuel storage/unloading could contaminate surface water environments unless mitigated adequately i.e. bunded tanks and delivery areas. Localised accidental discharge of hydrocarbons could occur in car parking areas and along roads unless diverted to surface water drainage system with petrol interceptors. However, all developments are required to ensure they do not have an impact on the receiving water environment in accordance with relevant legislation (European Communities Environmental Objectives (Surface water) Regulations (S.I. 77 of 2019). As such, they would be required to manage runoff and fuel leakages.

The residual cumulative impact on water and hydrology for the operational phases is anticipated to be ***neutral, imperceptible,*** and ***long-term***, once appropriate mitigation measures to manage potential contaminant sources in compliance with legislative requirement are put in place for each development.

APPENDIX 7.1

CRITERIA FOR RATING THE MAGNITUDE AND SIGNIFICANCE OF IMPACTS AT EIA STAGE NATIONAL ROADS AUTHORITY

NRA – TII, 2009

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

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

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

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

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

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

8.0 BIODIVERSITY (INCLUDING AA)

8.1 INTRODUCTION

This chapter provides an assessment of the impacts of the Proposed Development; the construction and operation and decommissioning of a VOC abatement system at the TILGC facility on the ecological environment, i.e. flora and fauna. It has been compiled in compliance with 2014 EIA Directive, the Planning and Development Act 2000 as amended, and the European Commission's guidance on the preparation of the EIA Report (2017) and follows the EPA EIA Report Guidelines (2022).

The development site is predominately comprised of recolonising bare ground, amenity grassland and artificial surfaces of the TILGC site at Grange Castle.

The subject site is drained by an existing surface water system which is directed to hydrocarbon interceptors and through a hydrobrake flow control device prior to the controlled discharge of clean water to the Griffeen River to the north of the site. There are no direct pathways from the Proposed Development areas to the surface water drainage.

In terms of operation, a thermal oxidation abatement system was identified as the most efficient unit for air pollutant abatement ensuring compliance with Best Available Techniques (BAT) guidance and to allow for future product expansion at this site.

The VOC Abatement System comprises of a Thermal Oxidizer (for VOCs oxidation), a Caustic Scrubber (for acids removal) and a SCR (Selective Catalytic Reducer - for NOx reduction). The treated gas is released at the stack, while the scrubber wastewater is directed to the tank farm and thereafter routed to the wastewater treatment plant (WWTP).

The likely significant effects of the Proposed Development on biodiversity have been assessed during both the Construction Phase, including impacts on air and water quality, on habitats, and on flora and fauna from construction activities such as earth movement and utility diversions, in addition to effects associated with the Operational Phase of the Proposed Development.

The methodologies used to collate information on the baseline biodiversity environment and assess the likely significant impacts of the Proposed Development are detailed in the following sections.

8.1.1 Legislation, Policy & Guidance

8.1.1.1 EU Habitats Directive

The "Habitats Directive" (Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna) is the main legislative instrument for the protection and conservation of biodiversity within the European Union and lists certain habitats and species that must be protected within wildlife conservation areas, considered to be important at a European as well as at a national level. A "Special Conservation Area" or SAC is a designation under the Habitats Directive. The Habitats Directive sets out the protocol for the protection and management of SACs.

The Directive sets out key elements of the system of protection including the requirement for Appropriate Assessment of plans and projects.

8.1.1.2 EU Birds Directive

The "Birds Directive" (Council Directive 79/409/EEC amended by Council Directive 2009/147/EC on the Conservation of Wild Birds) provides for a network of sites in all member states to protect birds at their breeding, feeding, roosting and wintering areas. This Birds Directive identifies species that are rare, in danger of extinction or vulnerable to changes in habitat and which need protection (Annex I species). Appendix I indicates Annex I bird species as listed on the Birds Directive. A "Special Protection Area" or SPA, is a designation under The Birds Directive.

Special Areas of Conservation and Special Protection Areas form a pan-European network of protected sites known as Natura 2000 sites and any plan or project that has the potential to impact upon a Natura 2000 site requires appropriate assessment.

8.1.1.3 Wildlife Acts (1976 - 2021)

The primary legislation providing for the protection of wildlife in general, and the control of some activities adversely impacting upon wildlife is the Wildlife Act 1976, as amended. The aims of the wildlife act according to the National Parks and Wildlife Service are "... to provide for the protection and conservation of wild fauna and flora, to conserve a representative sample of important ecosystems, to provide for the development and protection of game resources and to regulate their exploitation, and to provide the services necessary to accomplish such aims." All bird species are protected under the Wildlife Act 1976. The Wildlife (Amendment) Act 2000 was amended improve the effectiveness of the Wildlife Act 1976 to achieve its aims.

8.1.1.4 Birds and Natural Habitats Regulations

The European Communities (Birds and Natural Habitats) Regulations 2011 are also a key piece of legislation (S.I. No. 477/2011) included in the Planning and Development Acts containing legal direction on the protection of flora and fauna . The Planning and Development Acts also incorporates the AA requirements into the planning regime.

The Habitats Directive and the Birds Directive have been transposed into Irish law by Part XAB of the Planning and Development Acts and the European Communities (Birds and Natural Habitats) Regulations 2011, as amended.

8.2 METHODOLOGY

This chapter of the EIA Report concentrates on ecological features within the development area of particular significance, primarily designated habitats and species. This includes habitats/species listed in Annex I, II and IV of the EU Habitats Directive, rare plants listed in the Flora Protection Order and other semi-natural habitats of conservation value.

Desktop research to determine existing records in relation to habitats and species present in the study areas was firstly undertaken. This included research on the National Parks and Wildlife Services (NPWS) metadata website, the National Biodiversity Data Centre (NBDC) database and a literature review of published information on flora and fauna occurring in the Proposed Scheme study areas.

This included research on the National Parks and Wildlife Service (NPWS) metadata website, the National Biodiversity Data Centre (NBDC) database and a data review of published information where available on flora and fauna occurring in the Proposed Development area (sources listed at the end of this section).

Other environmental information for the area was reviewed, e.g. in relation to soils, geology, hydrogeology and hydrology (Chapter 6 and Chapter 7 of this EIA Report). Interactions in terms of the Chapters on these topics presented in this EIA Report were important in the determination of source vector pathways and links with potentially hydrologically connected areas outside the Proposed Development site.

The potential effects on European sites are assessed in this chapter of the EIA Report in relation to the requirements of the EIA Directive and Irish legislation and does not purport to comprise information for the purposes of the screening assessment to be carried out by the competent authority or authorities pursuant to Article 6(3) of the Habitats Directive. The obligation to undertake appropriate assessment derives from Article 6(3) of the Habitats Directive and is the subject of an Appropriate Assessment Screening Report.

8.2.1 Study Area

While the main focus of biodiversity was on the Proposed Development site within the red line boundary, the surrounding environment was taken into account in terms of biological and hydrological connectivity, particularly in relation to European sites. The Department of Housing Planning and Local Government (previously DoEHLG) Guidance on Appropriate Assessment (2009) recommends an assessment of European sites within a potential Zone of Influence. The zone of influence has been identified taking consideration of the nature and location of the Proposed Scheme to ensure all European sites with connectivity to it are considered in terms of a catchment-based assessment.

The ecological surveys were designed based upon the characteristics of the Proposed Development and its likely significant impacts on the baseline environment during construction and/or operation. The study areas are described as follows:

Habitats

The area within or immediately adjacent to the Proposed Development footprint where habitats could be directly or indirectly affected during construction/operation.

Rare and/or Protected Flora

The area within or immediately adjacent to the Proposed Development footprint where rare and/or protected flora could be directly or indirectly affected during construction/operation.

Fauna species other than those listed below (includes badger, otter, other protected mammal species, amphibians, and reptiles)

The area within or immediately adjacent to the Proposed Development footprint where fauna species could be directly or indirectly affected during construction/operation.

Bats

The area suitable for roosting, foraging and/or commuting bats (e.g. bridges, hedgerows, treelines, woodland and/or watercourses) within or immediately adjacent to the Proposed Development footprint where bats could be directly or indirectly affected during construction/operation.

Wintering Birds

The area suitable for wintering birds within or immediately adjacent to the Proposed Development footprint where wintering birds could be directly affected during construction/operation.

The study area of this assessment included the footprint of the existing light industrial areas of the existing TILGC site as detailed below and shown on Figure 8.1.

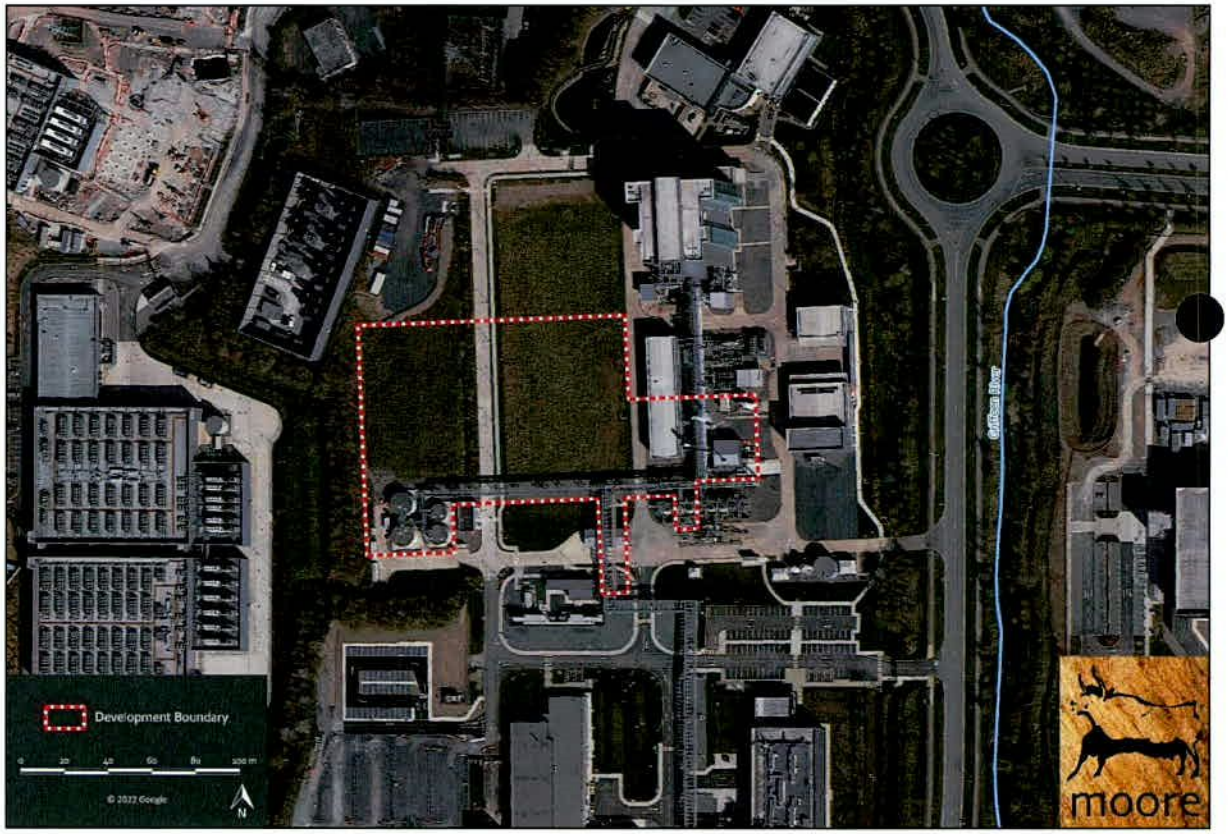

Figure 8.1 Detail of site Location and redline boundary at the TILGC site at Grange Castle.

8.2.2 Ecology Surveys

8.2.2.1 Habitat Surveys

The habitat survey was carried out in two stages. The first stage comprised desktop research to determine existing records in relation to habitats and species present in the study area as defined by the area of the Proposed Development, site boundaries and surrounding buffer zones up to 150 m away.

The second stage of the survey involved site visits to establish the existing environment in the footprint of the Proposed Development area. Areas which were highlighted during desktop assessment were investigated in closer detail according to the Heritage Council Best Practice Guidance for Habitat Survey and Mapping (Smith et al., 2011). Habitats in the Proposed Development area were classified according to the Heritage Council publication "A Guide to Habitats in Ireland" (Fossitt, 2000). This publication sets out a standard scheme for identifying, describing and classifying wildlife habitats in Ireland. This form of classification uses codes to classify different habitats based on the plant species present. Species recorded in this report are given in both their Latin and English names. Latin names for plant species follow the nomenclature of "An Irish Flora" (Parnell & Curtis, 2012).

Habitats were surveyed on 4 May 2022 by conducting a study area walkover covering the main ecological areas identified in the desktop assessment. The survey date is appropriate for surveying flora, birds and non-volant mammals such as badgers. A photographic record was made of features of interest.

The key ecological receptors were determined from desktop review of draft plans to be potential effects on water quality of the Griffeen River species including and salmonids.

8.2.2.2 Mammals (Excluding Bats)

Signs of mammals such as badgers and otters were searched for while surveying the study area noting any sights, signs or any activity in the vicinity especially along adjacent boundaries.

8.2.2.3 Bats

A desktop assessment of the suitability of the site for usage by bats was undertaken. The site is enclosed in an existing light industrial campus and it was determined by the ecologist that given the limited change in the existing habitats at the design stage, a bat detector survey was not necessary to inform the assessment process.

8.2.2.4 Breeding Birds

Breeding Birds were surveyed using standard transect methodology and signs were recorded where encountered during the field walkover survey.

A desk study was carried out to identify any potential suitable inland feeding and / or roosting sites for winter birds located within or directly adjacent to the Proposed Development areas.

Field surveys carried out in the light industrial areas of the Proposed Development deemed the lands to be unsuitable feeding and/or roosting sites for wintering birds, due to habitat conditions being dominated by mosaics of bare ground and artificial surfaces and/or subject to high levels of disturbance. As such it was not deemed necessary to carry out detailed wintering bird surveys in these areas. The results of the desk-based study have informed the assessment of potential impacts on wintering bird species arising from the Proposed Development.

8.2.3 Categorisation of the Baseline Environment

Desktop research to determine existing records in relation to habitats and species present in the study areas included research on the National Parks and Wildlife Services (NPWS) metadata website, and the National Biodiversity Data Centre (NBDC) database. The following resources assisted in the production of this chapter of the report.

- The following mapping and Geographical Information Systems (GIS) data sources, as required:
  - National Parks & Wildlife (NPWS) protected site boundary data;
  - Ordnance Survey of Ireland (OSI) mapping and aerial photography;
  - OSI/Environmental Protection Agency (EPA) rivers and streams, and catchments;
  - Open Street Maps;
  - Digital Elevation Model over Europe (EU-DEM);
  - Google Earth and Bing aerial photography 1995-2022;

- Online data available on Natura 2000 sites as held by the National Parks and Wildlife Service (NPWS) from www.npws.ie including:
    - Natura 2000 - Standard Data Form;
    - Conservation Objectives;
    - Site Synopses;
- National Biodiversity Data Centre records:
    - Online database of rare, threatened and protected species;
    - Publicly accessible biodiversity datasets.
- Status of EU Protected Habitats in Ireland. (National Parks & Wildlife Service, 2019); and
- Relevant Development Plans;
    - South Dublin County Development Plan 2016-2022;
    - Draft South Dublin County Development Plan 2022-2028.

8.2.4 Assessment Methodology

Following desktop assessment and fieldwork, an evaluation of the development area and determination of the potential effects on the flora and fauna of the area is based on the following guidelines and publications:

- Assessment of plans and projects significantly affecting Natura 2000 sites (EC, 2002);
- Managing Natura 2000 Sites (EC, 2018);
- Guidance document on Article 6(4) of the Habitats Directive 92/43/EEC (EC, 2007);
- Guidance document on the strict protection of animal species of Community interest under the Habitats Directive (EC, 2021);
- Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities (DEHLG, December 2009, Rev 2010);
- EPA Guidelines on Information to be contained in an EIAR (EPA, 2022);
- Best Practice Guidance for Habitat Survey and Mapping (Heritage Council, 2011);
- Ecological Surveying Techniques for Protected Flora & Fauna (NRA, 2008);
- Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009);
- Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM, 2019).

8.3 RECEIVING ENVIRONMENT

The Proposed Development site essentially comprises the developed areas of the existing TILGC campus adjacent to the wastewater treatment plant, intervening landscaping hedgerows, roads and artificial surfaces and an area of amenity grassland.

The following sections provide a description of the flora and fauna of the existing environment in the study area.

8.3.1 Zone of Influence

The ZoI, or distance over which a likely significant effect may occur will differ across the subject ecological receptors, depending on the predicted impacts and the potential impact pathway(s). The results of both the desk study and the suite of ecological field surveys undertaken have established the habitats and species present along the

Proposed Development. The ZoI is then informed and defined by the sensitivities of each of the ecological receptors present, in conjunction with the nature and potential impacts associated with the Proposed Development. In some instances, the ZoI extends beyond the study area (e.g. surface water quality effects of a sufficient magnitude can extend, and affect, receptors at significant distances downstream).

The ZoI of the Proposed Development in relation to terrestrial habitats is generally limited to the footprint of the Proposed Development and the immediate environs (to take account of shading or other indirect impacts, such as air quality). Hydrogeological / hydrological linkages (e.g. rivers or groundwater flows) between impact sources and wetland / aquatic habitats can often result in impacts occurring at significant distances.

The unmitigated hydrogeological ZoI for the Proposed Development is variable depending on the nature of the proposed works at specific locations and the receiving environment ground conditions, this is deemed not to extend beyond the Proposed Development boundary and is discussed with reference to specific construction activities in Chapter 6 (Land, Soils, Geology & Hydrogeology).

The ZoI of air quality effects is generally local to the Proposed Development and not greater than a distance of 50m from the Proposed Development boundary, and 500m from Construction Compound during the Construction Phase, and up to 200m the Proposed Scheme boundary during the Operational Phase (refer to Chapter 9 (Air Quality) for more detail).

With regards to hydrological impacts, the distances over which water-borne pollutants are likely to remain in sufficient concentrations to have a likely significant effect on receiving waters and associated wetland / terrestrial habitat is highly site-specific and related to the predicted magnitude of any potential pollution event. Evidently, it will depend on volumes of discharged waters, concentrations and types of pollutants (in this case sediment and/or hydrocarbons), volumes of receiving waters, and the ecological sensitivity of the receiving waters. In the case of the Proposed Development, this includes: all riverine habitats downstream of where the Proposed Development to which the Proposed Development will drain.

The ZoI for impacts to aquatic fauna species, such as Salmonids, is limited to those water courses that will be crossed by the Proposed Development or water bodies to which runoff from the Proposed Development could drain to during construction.

The ZoI of the Proposed Development in relation to likely significant effects on most breeding bird species is generally limited to habitat loss within the footprint of the Proposed Development, and disturbance / displacement during construction and disruption in territorial singing due to noise during operation.

8.3.2 Designated Conservation Areas

The Department of Housing, Planning and Local Government (previously DoEHLG)'s Guidance on Appropriate Assessment (2009) recommends an assessment of European sites within a Zone of Influence (ZoI) of 15km. However, this distance is a guidance only and a zone of influence of a Proposed Development is the geographical area over which it could affect the receiving environment in a way that could have significant effects on the Qualifying Interests of a European site. In accordance with the OPR Practice Note, PN01, the ZoI should be established on a case-by-case basis using the Source- Pathway-Receptor framework and not by arbitrary distances (such as 15km).

The Zone of Influence may be determined by connectivity to the Proposed Development in terms of:

- Nature, scale, timing and duration of works and possible impacts, nature and size of excavations, storage of materials, flat/sloping sites;
- Distance and nature of pathways (dilution and dispersion; intervening 'buffer' lands, roads etc.); and
- Sensitivity and location of ecological features.

The potential for source pathway receptor connectivity is firstly identified through GIS interrogation and detailed information is then provided on sites with connectivity. European sites that are located within a potential Zone of Influence of the Proposed Development are listed in Table 1 and presented in Figures 8.2 and 8.3, below. Spatial boundary data on the Natura 2000 network was extracted from the NPWS website (www.npws.ie) on 1 July 2022. This data was interrogated using GIS analysis to provide mapping, distances, locations and pathways to all sites of conservation concern including pNHAs, NHA and European sites.

Table 8.1 European Sites located within the potential zone of impact[1] of the Project.

Site Code	Site name	Distance (km)[2]
000206	North Dublin Bay SAC	18.20
000210	South Dublin Bay SAC	15.75
004006	North Bull Island SPA	18.19
004024	South Dublin Bay and River Tolka Estuary SPA	15.09

Sustainable Urban Drainage Systems (SUDS) measures will be implemented in order to minimise any increase in surface water discharge into the existing system. The new access road and footpath are to be constructed of permeable asphalt with an underlying stone build-up on top of a geotextile filter membrane. Swales will be placed between the VOC Abatement system compound plinth and the access road allowing drainage directly into the ground. Surface water from the roof of the utilities building will feed directly into a local soakaway positioned to the north of the new access road is to discharge to a local soakaway. The area over the soakaway will be planted with native grasses.

The remaining hardstanding / paved areas in compound will drain into Aco channel drains which will be connected to the existing onsite drainage system which will treat the surface water via hydrocarbon interceptors prior to controlled discharge into the Griffeen River.

Foul wastewater will be directed to the existing foul drainage system. Process wastewater from the Proposed Development will be directed to the tank farm and thereafter routed to the on-site wastewater treatment plant for storage pending manually controlled discharge off site.

[1] All European sites potentially connected irrespective of the nature or scale of the Proposed Development.

[2] Distances indicated are the closest geographical distance between the Proposed Development and the European site boundary, as made available by the NPWS. Connectivity along hydrological pathways may be significantly greater.

This analysis found that the Rye Water Valley/Carton SAC [001398] at c. 4.6km northwest and the Glenasmole Valley SAC [001209] at c. 9.34km south are the closest European sites. However, there are no pathways or connectivity to either of these two sites and they are excluded at this preliminary screening stage.

The Proposed Development is located within the hydrological catchment of the Griffeen which flows into the River Liffey c. 3.5 river kilometres downstream. There is indirect connectivity to the European sites located in Dublin Bay albeit at a significant distance with a large dilution factor in Dublin Bay.

There is no potential for connectivity to any other European sites.

NHAs are designations under Section 16 of the Wildlife Acts to protect habitats, species or geology of national importance.

In addition to NHAs, there are pNHAs which are also sites of significance for wildlife and habitats and were published on a non-statutory basis in 1995 but have not since been statutorily proposed or designated. pNHAs are offered protection in the interim period under the county or city development plans which requires that planning authorities give due regard to their protection in planning policies and decisions.

With the exception of one site, the pNHA sites in the ZoI of the Proposed Development overlap with the boundaries of European sites and as such are considered under this higher-level conservation status. The only other pNHA associated with the receiving environment of the Griffeen River is the Liffey Valley pNHA (Site code 000128).

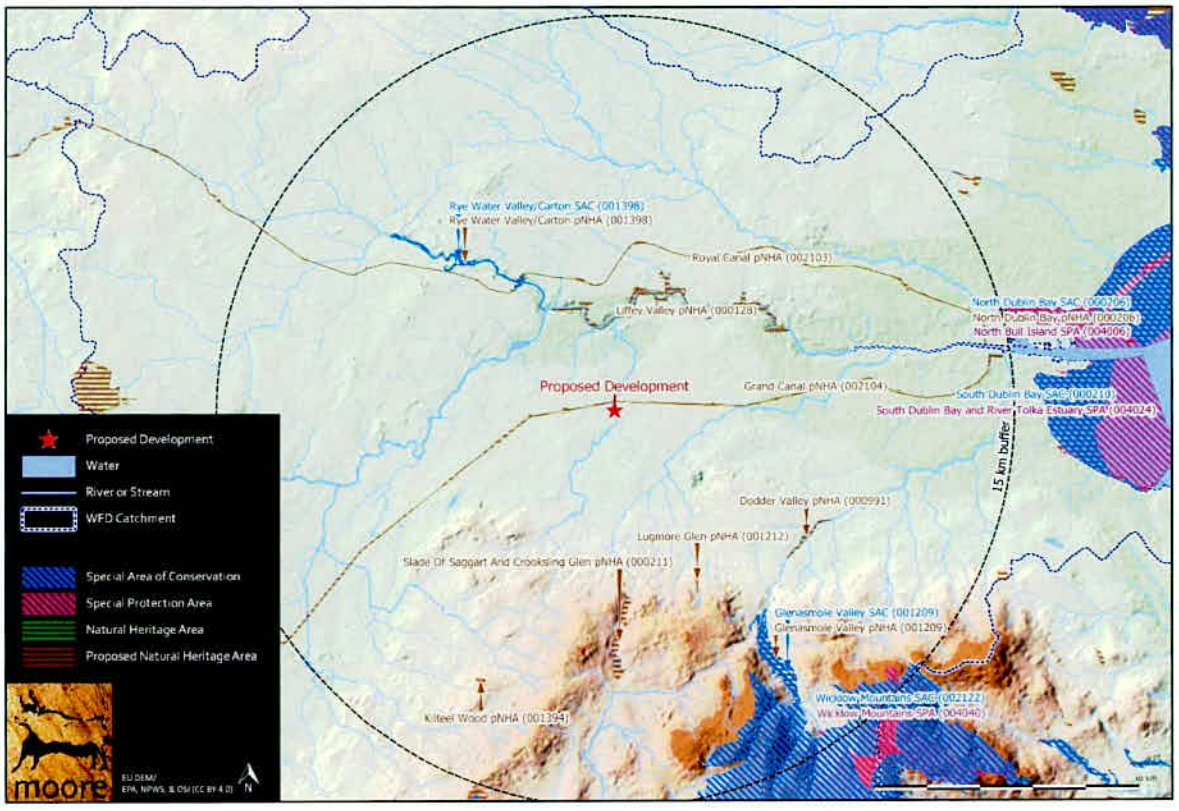

Figure 8.2 Detail of site Location in relation to nearby designated sites.

8.3.3 Habitats, Flora & Fauna

In general, there are few natural habitats in the Proposed Development site area. They have either been modified or are artificial. The main natural habitats of conservation concern are the Griffeen River. Habitats are classified under the Fossitt codes (Fossitt, 2000).

The following is an overview of the main habitat types present in proposed works areas. Detailed habitat descriptions are provided in areas that either intersect or have hydrological connectivity with European sites, see Figure 8.3

The main habitats are presented on the recent aerial photography (April 2021) in Figure 8.3. A list of habitats recorded and their corresponding Fossitt codes is presented in Table 8.2.

Table 8.2 Details of habitats recorded and their corresponding Fossitt codes.

Habitat	Habitat Category	Habitat Type
(G) Grassland	(GA) Improved grassland	(GA2) Amenity grassland
(W) Woodland and Scrub	(WD) Highly modified/non-native woodland	(WD1) Mixed broad leved woodland
	(WL) Linear woodland	(WL1) Hedgerows
(E) Exposed rock and disturbed ground	(ED) Disturbed ground	(ED3) Recolonising bare ground

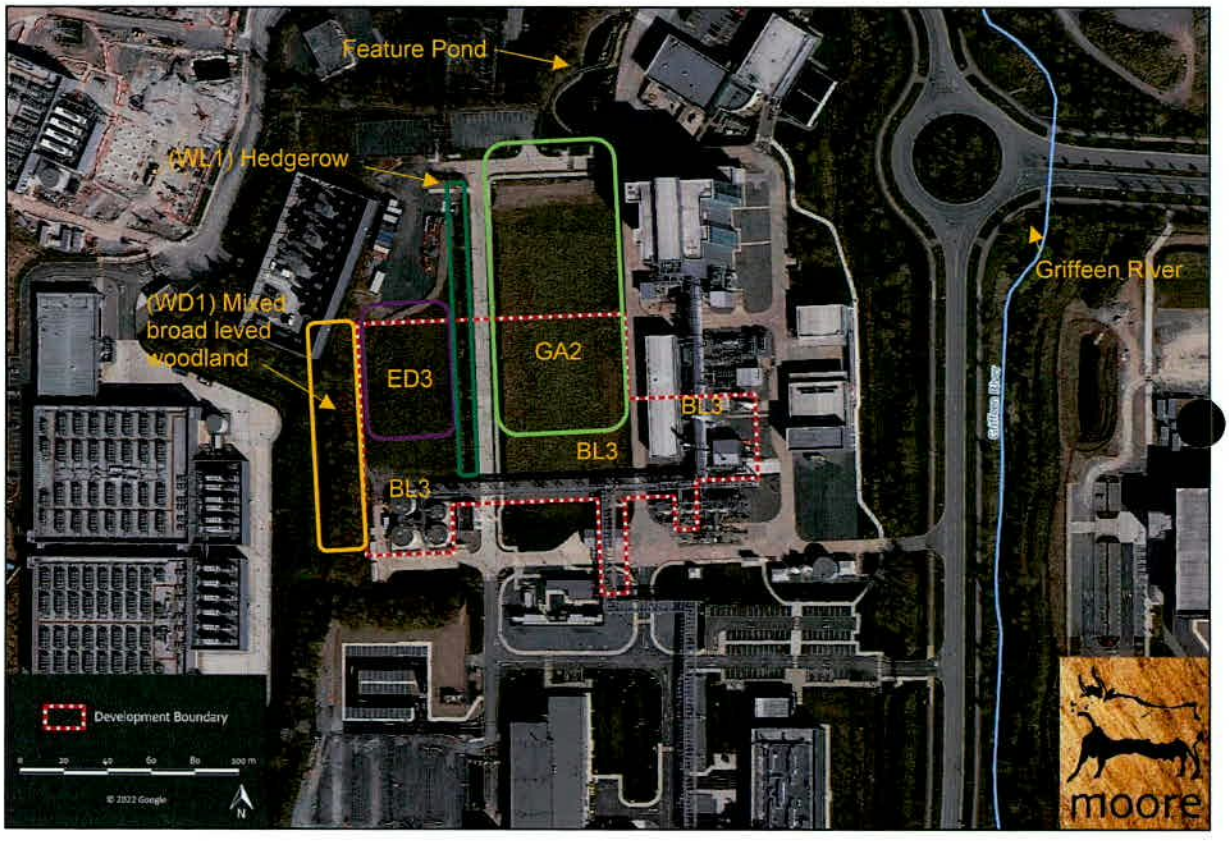

Figure 8.2 Habitats recorded at the Proposed Development site at TILGC.

8.3.3.1 (GA2) Amenity grassland

This habitat refers to the area of the proposed temporary contractor's compound at the centre of the site which comprises amenity grassland which has been mown at the edges and allowed to grow out for biodiversity promotion. Species present include

Cocks foot (*Dactylis glomerata*), Bent (*Agrostis* spp.), and Meadow grass (*Poa* spp.). Ribwort plantain (*Plantago lanceolata*), Creeping buttercup (*Ranunculus repens*), Daisy (*Bellis perennis*), along with Dandelion (*Taraxacum* spp.), Common Vetch (*Vicia sativa* agg.) and Common Mouse-ear (*Cerastium fontanum ssp. vulgare*). Occasional Gorse bushes (*Ulex europaeus*) are present with occasional Curled dock (*Rumex crispus*).

8.3.3.2 (WD1) Mixed broad leved woodland

There is a landscaped planted embankment to the west of the proposed new VOC abatement system footprint area comprising Cherry trees (*Prunus serrulata*), Birch (*Betula* pubescens), Willow (*Salix* spp.), Pine (*Pinus* spp.) and Dogwood (*Cornus* spp.). The understorey has limited flora with Bramble (*Rubus fruticosus* agg.) most frequent along with occasional Great willowherb (*Epilobium hirsutum*) and Creeping buttercup (*Ranunculus repens*).

8.3.3.3 (WL1) Hedgerow

This habitat refers the boundary between the proposed new VOC abatement system footprint area and the central access road and the proposed temporary contractor's compound. The predominant species present is Cherry (*Prunus serrulata*) with frequent Gorse, Alder (*Alnus glutinosa*), Blackthorn (*Prunus spinosa*) and Willow (*Salix* spp), Field Maple (*Acer campestre*) and abundant Dogwood (*Cornus* spp.). The understory has the same species listed as the woodland habitat listed above with occasional records of the recolonising ground listed below. In addition, Common knapweed (*Centaurea nigra*), Cleavers (*Galium aparine*) and Scarlet Pimpernel (*Anagallis arvensis*) were common.

8.3.3.4 (WL1) Recolonising ground

This habitat refers to the proposed new VOC abatement system footprint area. The area presents as a previously disturbed and mounded area of spoil and the species composition reflects the recolonisation of the spoil over time. Species present includes abundant Rapeseed (*Brassica napus subsp. napus*), abundant Common Vetch, Common ramping fumitory (*Fumaria muralis*), Ragwort, (*Senecio jacobaea*), frequent Red campion (*Silene dioica*), Broadleaved Dock (*Rumex obtusifolius*), Dandelion (*Taraxacum officinale* agg.), Nettle (Urtica dioica), Thistles (*Cirsium* spp.), Creeping buttercup, Clovers (*Trifolium* spp.), Lesser burdock (*Arctium minus*), Ribwort plantain (*Plantago lanceolata*) and occasional Coltsfoot (*Tussilago farfara*).

The southern end of this area has frequent Cowslip (*Primula veris*) and abundant Yarrow (*Achillea millefolium*) and occasional Curled dock.

8.3.4 Invasive Species

There were no invasive species recorded during the habitat survey.

8.3.5 Fauna

8.3.5.1 Badgers

There were no badger setts along field boundaries which would be disturbed and no signs of badgers in the study area.

8.3.5.2 Otters

There are no suitable habitats for otters on the site. There is a known otter holt on the Griffeen River further upstream near the Old Nangor Road bridge, c. 1.6 river km upstream and it is likely that otters commute along the Griffeen River outside the site.

8.3.5.3 Bats

Results from the NBDC datacentre show that there are no records of bats in a specific polygon surrounding the TILGC site. A search of the wider area including the Grand Canal to the north of Grange Castle Business Park returns records for Brown Long-eared Bat (*Plecotus auritus*), Daubenton's Bat (*Myotis daubentonii*), Leisler's Bat (*Nyctalus leisleri*), Common Pipistrelle (*Pipistrellus pipistrellus sensu lato*) and Soprano Pipistrelle (*Pipistrellus pygmaeus*). With the exception of Brown-long-eared Bats, these species are commonly occurring species in the area of the Grand Canal while Daubenton's Bats prefer to feed over open water ways such as canals and slow moving rivers.

There are no mature trees to be removed and no bat roosts to be disturbed.

8.3.5.4 Birds

Species recorded included regular passerines such as Great Tit (*Parus major*), Chaffinch (*Fringilla coelebs*), Blackbird (*Turdus merula*), Wren (*Troglodytes troglodytes*).

A list of breeding bird species recorded during fieldwork in May 2020 is presented in Table 8.3.

Table 8.3 Details of birds encountered during fieldwork.

Birds	Scientific name	BWI Status	Habitat Type
Blackbird	*Turdus merula*	Green	Dense woodland to open moorland, common in gardens
Chaffinch	*Fringilla coelebs*	Green	Hedgerows, gardens and farmland
Magpie	*Pica*	Green	Farmland, open country with scattered trees or bushes, increasingly in urban areas
Woodpigeon	*Columba palumbus*	Green	Gardens, woods, hedges
Wren	*Troglodytes*	Green	Low cover anywhere, especially woodlands

8.3.6 Habitat Evaluation

The ecological value of the site was assessed following the guidelines set out in the Institute of Ecology and Environmental Management's Guidelines for Ecological Impact Assessment (2019) and according to the Natura Scheme for evaluating ecological sites (after Nairn & Fossitt, 2004) in the TII Guidelines (formerly NRA) for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009) which outlines the methodology for evaluating ecological impacts Judgements on the evaluation were made using geographic frames of reference, e.g. European, National, Regional or Local outlined as follows:

Ecological valuation: Examples

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;
- Site that fulfills 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;
- 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) 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. 293 of 1988).

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) of the following:
    - Species protected under the Wildlife Acts; and/or
    - Species listed on the relevant Red Data list;
- Site containing 'viable areas' of the habitat types listed in Annex I of the Habitats Directive County Importance:
- Area of Special Amenity.
- 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) of the following:
  - Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
  - Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;
  - Species protected under the Wildlife Acts; and/or
  - Species listed on the relevant Red Data list.
- Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the 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 BAP, 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) 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.

Due cognisance of features of the landscape which are of major importance for wild flora and fauna, such as those with a "*stepping stone*" and ecological corridors function, as referenced in Article 10 of the Habitats Directive were considered in this assessment.

The Griffeen River leads to the River Liffey c. 3.5 river km downstream of the TILGC site and discharges to the sea at Dublin Bay over 24 river km downstream of the site.

There are no direct pathways from the development areas to the Griffeen River which leads to the River Liffey and Dublin Bay. There are no predicted effects from the construction phase.

As stated in Section 8.3.2, SUDs measures, i.e. permeable asphalt, swales and a soakaway, have been incorporated into the design in order to minimise any increase in surface water discharge into the existing system. The remaining hardstanding / paved areas in the VOC compound will drain into Aco channel drains which will be connected to the existing onsite drainage system which will treat the surface water via hydrocarbon interceptors prior to controlled discharge into the Griffeen River. Foul wastewater will be directed to the existing foul drainage system. Process wastewater from the proposed development will be directed to the tank farm and thereafter routed to the on-site wastewater treatment plant for storage pending manually controlled discharge off site. There are no predicted effects from the operational phase.

The footprint habitats are considered of low biodiversity value at a local level. The landscaped mixed broadleaved woodland and internal hedgerow are considered of high biodiversity value at a local level.

8.4 CHARACTERISTICS OF THE DEVELOPMENT

The Proposed Development consists of:

- A Volatile Organic Compound (VOC) Abatement system comprising of a Thermal Oxidiser (TO), associated plant equipment and scrubbers positioned on a bunded concrete plinth
- A single storey utilities workshop
- A new pipe rack with the addition of a second-tier extension to the existing pipe rack
- Contractors compound
- Modifications to the existing internal access road
- Permanent pedestrian crossing to the existing internal access road
- New access road and footpaths to perimeter of proposed development
- Modifications to the existing site lighting, signage, surface water, foul and process wastewater drainage, hard and soft landscaping

A thermal oxidation abatement system was identified as the most efficient unit for air pollutant abatement ensuring compliance with Best Available Techniques (BAT) guidance and to allow for future product expansion at this site.

The VOC Abatement System comprises of a Thermal Oxidizer (for VOCs oxidation), a Caustic Scrubber (for acids removal) and a SCR (Selective Catalytic Reducer - for NOx reduction). The treated gas is released at the stack, while the scrubber wastewater is directed to the tank farm and thereafter to the wastewater treatment plant.

Drainage is described as follows. The VOC abatement system and urea IBC tanks are set within a bunded plinth. This ties into the process drain that will connect to the tank farm and wastewater treatment plant.

Utilities workshop: The handwash will tie into the existing foul drainage system. Surface water from the roof of the utilities building will feed directly into a local soakaway positioned to the north of the new access road is to discharge to a local soakaway designed in accordance with BRE 354 soakaway design and in accordance with the requirements of the local authority. The area over the soakaway will be planted with native grasses.

New access road: Hardstanding will tie into the surface water drain leading to the existing on-site surface water drainage system.

Contractor's compound: It is proposed to construct the compound by removing the existing grassed topsoil and replacing with compacted hardcore. A geotextile filter membrane is to be installed below the hardcore onto a prepared surface to capture any contaminants and separate from the existing underlying stratums. The welfare facilities (toilets, sinks and kitchen) will tie into the existing foul drainage system.

A full description of the Proposed Development is provided in Chapter 2 (Description of the Proposed Development).

8.5 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

8.5.1 Construction Phase

8.5.1.1 Habitats

There will be a permanent minor loss of recolonised ground. The potential effects on local ecology are ***neutral*** and ***imperceptible*** for the construction phase.

There will be a temporary minor loss of amenity grassland habitats of low local value. The overall area is c. 0.81 Ha and approximately 0.4 Ha would be affected. The potential effects on local ecology are ***neutral*** and ***imperceptible*** for the construction phase.

There would be a permanent loss of c. 38m of internal hedgerow to facilitate access and egress and c. 100m of hedgerow would be retained and conserved *in situ*. The hedgerow is considered high value on a local level. The potential effects on local ecology are ***negative*** but ***not significant*** for the construction phase.

There will be no effect on the adjacent landscaped woodland area.

There are no direct pathways from the development areas to the Griffeen River which leads to the River Liffey and Dublin Bay. The FFL of the development is set 600mm above the adjoining access road level to ensure no contamination of surface or flood water in the event of flooding on the site. Refer to Chapter 7 (Hydrology) and the Stage 3 Flood Risk Assessment document which is included as Appendix 5 of the DPS Planning Report. There are no predicted effects from the construction phase on the Griffeen River, the River Liffey or on Dublin Bay.

8.5.1.2 Fauna

Badgers

There were no badger setts along field boundaries which would be disturbed and no signs of badgers in the study area. There is no potential for effects on badgers.

Otters

There were no signs of otters and no suitable habitats for otters in the Proposed Development area. There is no potential for effects on otters.

Bats

There will be no loss of bat roosts or bat commuting habitat. The potential effect on bats is ***neutral*** and ***imperceptible*** for the construction phase.

Birds

Potential effects on nesting birds may occur as a result of vegetation cutting. The potential effects on local bird populations is ***not significant*** and can be avoided.

8.5.2 Operational Phase

8.5.2.1 Habitats

There are no direct pathways from the development areas to the Griffeen River which leads to the River Liffey and Dublin Bay.

As stated in Section 8.3.2, SUDs measures, i.e. permeable asphalt, swales and a soakaway, have been incorporated into the design in order to minimise any increase in surface water discharge into the existing system. The remaining hardstanding / paved areas will be connected to the existing onsite drainage system which will treat the surface water via hydrocarbon interceptors prior to controlled discharge into the Griffeen River. Process wastewater will be directed to the onsite treatment plant via treatment in the tank farm. There are no predicted effects from the operational phase.

Fauna

Badgers

There is no potential for effects on badgers during the operational phase.

Otters

As stated in Section 8.3.2, SUDs measures, i.e. permeable asphalt, swales and a soakaway, have been incorporated into the design in order to minimise any increase in surface water discharge into the existing system. The remaining hardstanding / paved areas will be connected to the existing onsite drainage system which will treat the surface water via hydrocarbon interceptors prior to controlled discharge into the Griffeen River. Process wastewater will be directed to the onsite treatment plant via treatment in the tank farm. There is no potential for effects on otters or sources of food during the operational phase.

Bats

Guidance on lighting is based on the Bats & Lighting document; (BCI 20, the Bats and artificial lighting in the UK Guidance Note 08/18 (BCT, 2018) and Guidelines for consideration of bats in lighting projects. EUROBATS Publication Series No. 8 (Voigt, 2018). Lighting can alter the behaviour of bats and the insects they prey on. The potential effect on bats from lighting relates to avoidance of feeding habitat. Given the relatively low potential for bat commuting on an existing light industrial site with existing level of urban light, the predicted effect on bats is not significant for the operational phase.

Birds

There is no potential for effects on birds during the operational phase.

8.6 MITIGATION MEASURES

Potential impacts on birds will be avoided by cutting of vegetation outside the bird nesting season March 1st to August 31st.

In addition to retention of existing hedgerows where feasible, the Proposed Development includes a Landscape Strategy which provides for increased biodiversity through the additional planting.

The proposed landscape scheme as set out in the DPS Planning Report includes the mounding and conservation of the seedbank of stripped topsoil in order to reuse the seed store in landscaped areas. Thus, retuning a similar species composition to the landscaped areas.

The protection and enhancement of the existing landscape is an important aspect of the overall landscape strategy. The landscape scheme proposes to enhance and strengthen the existing hedgerow using native hedgerow and woodland species, while retaining the existing trees planted in and around the hedgerow. In addition to strengthening the remnants of the existing hedgerow, planting of native hedgerow species is also proposed.

Planting along site boundaries and on earth berms create dense belts of native woodland spaces which act as native habitat and similarly to the native hedgerows, form ecological corridors which connect with other landscape elements throughout the site.

8.7 RESIDUAL IMPACTS OF THE DEVELOPMENT

Specific local mitigation measures include the avoidance of cutting of vegetation during the bird nesting season with regard to the construction phase. There will be a loss of relatively low value local habitats including sections of hedgerow up to 38m, grassland and recolonising ground. However, this 38m of hedgerow will be replanted around the new development plus approx. 25% additional trees /hedgerow resulting in an overall net gain. The remaining hedgerow habitat to be conserved in site is c. 100m in length. The overall effect is considered ***neutral, imperceptible, and long-term.***

With the employment of appropriate mitigation measures outlined in Section 8.6 with regard to local biodiversity, the Proposed Development will have a ***neutral, imperceptible*** and ***long-term effect*** on biodiversity.

8.8 MONITORING

No ecological monitoring is required during the construction phase of development.

No reinstatement measures are proposed.

8.9 CUMULATIVE IMPACTS

A review of the National Planning Application Database was undertaken. The first stage of this review confirmed that there were no data gaps in the area where the Proposed Development is located. The database was then queried for developments granted planning permission within 500m of the Proposed Development within the last three years, these are presented in Table 8.4 below.

Table 8.4 Details of birds encountered during fieldwork.

Planning Ref.	Description of development	Comments
SD19A/0042	Phased development that will include 4 single storey data halls all with associated plant at roof level; 32 standby generators with associated flues associated office and service areas; service road infrastructure and car parking; ESB sub-station/transformer yard with an overall gross floor area of 17,685sq.m; temporary gas powered generation plant within a walled yard containing 19 generator units with associated flues (each 17m high) to be located to the west of the proposed data halls on a site within the townland of Ballymakaily; Phase 1, 2 single storey data halls (6,950sq.m.) with roof plant and 16 stand-by generators with associated flues (each 15m high) as well as associated water tower and pump room and other services; single storey goods receiving area/store and single storey office area (1,522sq.m.) located attached and to the north-east of the data halls; temporary gas powered generation plant with 15 generators with associated flues (each 17m high) to be located within a compound to the west of the proposed data halls; attenuation pond; two storey ESB sub-station (494sq.m) with associated transformer yard and single storey transformer building (247sq.m) within compound; Phase 2, 2 single storey data halls (6,950sq.m.) with roof plant and 16 stand-by generators with associated flues (each 15m high) as well as associated water tower and pump room and other services; single storey goods receiving area/store and single storey office area (1,522sq.m) located attached and to the east of the data halls under this Phase and attached and to the north of the offices proposed under Phase 1; 4 additional generators with associated flues (each 17m high) to be constructed within the temporary gas powered generation plant; also ancillary site works; connections to existing infrastructural services as well as fencing; signage; vehicular access off the realigned R120 to provide a new vehicular access into the site as well as internal service roads and entrance gates; car park for 39 car parking spaces (including 4 disabled car parking spaces); sheltered bicycle parking to serve the development	No potential for in-combination effects given the scale and location of the project.
SD19A/0004	Enabling works to facilitate the future development of the site; topsoil strip and a cut and fill operation across the site; temporary construction access will be created off the R120 to facilitate the works within the townland of Ballymakaily to the west of the Newcastle Road (R120).	No potential for in-combination effects given the scale and location of the project.
SD19A/0322	Construction of 1 & 2 storey office building, c.9.43m in height providing a total GFA of 459sq.m.; provision of 11 total car parking spaces; 8 covered cycle parking spaces; the removal of the existing temporary structures, landscaping, tree planting and all associated site and infrastructural works.	No potential for in-combination effects given the scale and location of the project.
SD19A/0342	Retention and continuance of the use for a further two years of the temporary gas powered generation plant which is located to the rear of the Takeda Ireland complex, is sited within a walled yard of 2,836sq.m containing 12 generator units with associated flues (each 15m high) which was permitted for a period of three years on the 10th January 2017	No potential for in-combination effects given the scale and location of the project.

Planning Ref.	Description of development	Comments
SD20A/0031	Relocation of the temporary gas powered generation plant for a further two years to lands to the immediate north-west within the Edgeconnex campus and to the immediate east of the data centre the relocated temporary gas powered generation plant will be enclosed within a walled yard of 2,836sq.m containing 12 generator units with associated flues, vehicular access to the generation plant will remain from the permitted service road into the Edgeconnex site and Grange Castle Business Park as originally permitted.	No potential for in-combination effects given the scale and location of the project.
SD20A/0147	Construction of P3 Phase II expansion of the existing P3 biopharma production facility which includes the construction of a circa 2,155sq.m, two storey biopharma production facility; single storey administration extension; courier pick up/drop off area with 5 parking spaces; extension to existing external utilities yard; new internal site circulation road and re-alignment of existing circulation road; 48 additional car parking spaces; 24 covered bicycle stands, hard and soft landscaping and external lighting	No potential for in-combination effects given the scale and location of the project.
SD20A/0283	Demolition of existing single storey vacant house, garage and outhouse and removal of existing temporary construction car park; Construction of a single 1-4 storey Central Administration Building and 2 2-storey (with mezzanine) data centres (DUB14 & DUB15) all to be located west of data centres DUB9, DUB10, DUB12 & DUB13 within the MS campus; The Central Administration Building will comprise central office administration, with staff cafeteria, staff gym and reception with provision of PV panels on the roof; each data centre will include data halls, admin blocks and a variety of mechanical and electrical plant areas/structures.; DUB14 will also include 21 diesel generators and associated sub-stations (E-houses) and 11 mechanical flues. Provision of a gas generator compound; Provision of a Gas Networks Ireland gas skid including 3 kiosk buildings; Expansion of existing electrical sub-station compound; 2 sprinkler tank and pump house areas, 1 additional rainwater harvesting plant; Provision of 168 permanent car parking spaces and 40 cycle parking spaces; Provision of additional western access to the MS campus (to serves the Central Administration Building) from the Business Park estate road (including bridge over the Griffeen River) with existing temporary access to be extinguished; All associated site development works, drainage and services provision, landscaping, boundary treatments (including security fencing) and associated works.	No potential for in-combination effects given the scale and location of the project.
SD21A/0042	Construction of two single storey data centres with associated office and service areas; and three gas powered generation plant buildings with an overall gross floor area of 24,624sq.m. Construction of 2 single storey data centres, with 24 standby diesel generators with associated flues that will be attached to a single storey goods receiving area/store and a single storey office area; Amendments to the internal access road and omission of access to loading bay; and new internal access roads to serve the proposed development that will provide access to 39 new car parking spaces and sheltered bicycle parking to serve the new data centres; The development will also include the phased development of 3 two storey gas powered generation plants to provide power to facilitate the development of the overall site. These plants will be built to provide power to each data centre, if and, when required. The gas plants will be	No potential for in-combination effects given the scale and location of the project.

Planning Ref.	Description of development	Comments
	required as back up power generation once the permitted power connection via the permitted substation is achieved; New attenuation pond to the north of the site;; Proposed above ground gas installation compound to contain single storey kiosk (93sq.m) and boiler room (44sq.m	
SD21A/0127	Retention of 1 standby diesel generator with an associated flue (15m high) within the permitted generator compound located to the east of the data centre granted under SDCC Reg. SD16A/0345 increasing the number of standby diesel generators from 5 to 6 within the permitted compound.	No potential for in-combination effects given the scale and location of the project.
SD21A/0203	Modifications and minor additions to previously approved scheme (comprising of the following changes to previously approved scheme SD20A/0283; Approved Central Administration Building (CAB), relocation of building to the east; reconfiguration of building plans at all levels (including roof level) resulting in increase in building footprint associated changes to building elevations (design and finishes); approved single storey Cafeteria Element, additional basement level below cafeteria to accommodate plant; approved four-storey Office element, parapet at roof level to be raised by approx. 1.1m (increased from approved 19.5m in height to proposed 20.6m); overall increase in GIFA of 395sq.m;, reconfiguration and setting out affecting building locations and plans at all levels (including roof level) resulting in reduction in overall building footprint (for each building) by 48sq.m (from 13,442sq.m to 13,394sq.m), relocation, modifications to design and expansion of approved Water Treatment Building and associated plant to include, Water Treatment Tanks, 2 sprinkler tanks and relocated approved pump house; Gas Generator Compound - Relocation & reconfiguration of previously approved gas generator compound including, additional 4 generators (from 20 approved to 24 proposed), omission of approved E-houses; additional 7 electrical rooms, additional 7 flues (from 5 approved to 12 proposed); modifications to approved layout of internal site roads, yards and footpaths; relocation and modifications to design of approved Sprinkler Tanks and Pump Houses; relocation of Approved Gas Networks Ireland (GNI) gas skid & compound including approved 3 kiosk buildings	No potential for in-combination effects given the scale and location of the project.
SD22A/0022	The construction of a 2-storey extension and any associated site works to the south elevation of the existing engineering stores in the administration offices building. The application relates to development which comprises of an activity, which requires an Industrial Emissions Licence in accordance with the First Schedule of the EPA Act 1922 as amended.	No potential for in-combination effects given the scale and location of the project.

The listed developments have been granted permission in most cases with conditions relating to sustainable development by the consenting authority in compliance with the relevant Local Authority Development Plan and in compliance with the Local Authority requirement with regard to the Habitats Directive. The development cannot have received planning permission without having met the consenting authority requirement in this regard.

There are no predicted in-combination effects given that it is predicted that the Proposed Development will have no effect on any European site.

Once operational, the landscape strategy for the project to enhance and strengthen the existing native floral species, while retaining the existing trees remaining hedgerow.

With the employment of appropriate mitigation measures with regard to local biodiversity, the project will have a ***neutral, imperceptible*** and ***long-term effect*** on biodiversity.

8.10 REFERENCES

- CIEEM (2019) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine; September 2018; Version 1.1 - Updated September 2019. Institute of Ecology and Environmental Management.
- Department of the Environment, Heritage and Local Government (2010) Guidance on Appropriate Assessment of Plans and Projects in Ireland (as amended February 2010).
- EC (2000) Managing Natura 2000 sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC.
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- EC (2001) Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43EEC. European Commission, Brussels.
- EC (2007) Guidance document on Article 6(4) of the 'Habitats Directive '92/43/EEC: Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interests, compensatory measures, overall coherence and opinion of the Commission. European Commission, Brussels.
- EPA (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. EPA, May 2022.
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- Nairn, R. and J. Fossitt (2004) The Ecological Impacts of Roads, and an Approach to their Assessment for National Road Schemes. In: J. Davenport and J.L Davenport (eds) The Effects of Human Transport on Ecosystems: Cars and Planes, Boats and Trains, 98-114. Dublin. Royal Irish Academy.
- NRA (2009) Guidelines for Assessment of Ecological Impacts of National Road Schemes. Dublin: National Roads Authority. Available at: http://www.nra.ie/Environment/
- Parnell, J. and T. Curtis (2012) Webb's An Irish Flora. Cork University Press.
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APPENDIX 8.1

APPROPRIATE ASSESSMENT SCREENING REPORT

Prepared by Moore Group

Report for the purposes of Appropriate Assessment Screening

Takeda Thermal Oxidiser Development

Prepared by: Moore Group – Environmental Services

11 July 2022

On behalf of Takeda

Project Proponent	Takeda
Project	Takeda VOC Abatement System Project
Title	Report for the purposes of Appropriate Assessment Screening Takeda VOC Abatement System Project

Project Number	22114	**Document Ref**	22114 Takeda TO AAS1 Rev1	
Revision	**Description**	**Author**		**Date**
Rev1	Amended Layout	G. O'Donohoe		11 July 2022
Moore Archaeological and Environmental Services Limited				

Table of Contents

Abbreviations

AA	Appropriate Assessment
EEC	European Economic Community
EPA	Environmental Protection Agency
EU	European Union
GIS	Geographical Information System
LAP	Local Area Plan
NHA	Natural Heritage Area
NIS	Natura Impact Statement
NPWS	National Parks and Wildlife Service
OSI	Ordnance Survey Ireland
pNHA	proposed Natural Heritage Area
SAC	Special Area of Conservation
SPA	Special Protection Area
SuDS	Sustainable Drainage System
WFD	Water Framework Directive

1. Introduction

1.1. General Introduction

This report for the purposes of Appropriate Assessment (AA) Screening has been prepared to support a Planning Application for the Proposed Development (described in Section 3 below). This report contains information required for the competent authority to undertake screening for Appropriate Assessment (AA) in respect of the construction and operation and decommissioning of a new VOC abatement system at the Takeda facility at Grange Castle, Dublin 22 (hereafter referred to as the Proposed Development) to determine whether it is likely individually or in combination with other plans and projects to have a significant effect on any European sites, in light of best scientific knowledge.

Having regard to the provisions of the Planning and Development Act 2000 – 2021 (the "Planning Acts") (section 177U), the purpose of a screening exercise under section 177U of the PDA 2000 is to assess, in view of best scientific knowledge, if the proposed development, individually or in combination with another plan or project is likely to have a significant effect on a European site.

If it cannot be *excluded* on the basis of objective information that the proposed development, individually or in combination with other plans or projects, will have a significant effect on a European site then it is necessary to carry out a Stage 2 appropriate assessment under section 177V of the Planning Acts.

When screening the project, there are two possible outcomes:

- the project poses no potential for a likely significant effect and as such requires no further assessment; and
- the project has potential to have likely significant effect (or this is uncertain) unless mitigation measures are applied, and therefore an AA of the project is necessary.

This report has been prepared by Moore Group - Environmental Services to enable South Dublin County Council to carry out AA screening in relation to the Proposed Development. The report was compiled by Ger O'Donohoe (B.Sc. Applied Aquatic Sciences (GMIT, 1993) & M.Sc. Environmental Sciences (TCD, 1999)) who has 27 years' experience in environmental impact assessment and has completed numerous Appropriate Assessment Screening Reports and Natura Impact Statements on terrestrial and aquatic habitats for various development types.

1.2. Legislative Background - The Habitats and Birds Directives

Article 6 of the Habitats Directive is transposed into Irish Law inter alia by the Part XAB of the Planning Acts (section 177U and 177V) govern the requirement to carry out appropriate assessment screening and appropriate assessment, where required, per Section 1.1 above.

The Habitats Directive (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora) is the main legislative instrument for the protection and conservation of biodiversity in the European Union (EU). Under the Habitats Directive, Member States are obliged to designate Special Areas of Conservation (SACs) which contain habitats or species considered important for protection and conservation in a EU context.

The Birds Directive (Council Directive 2009/147/EC on the conservation of wild birds), transposed into Irish law by the Bird and Natural Habitats Regulations 2011, as amended, is concerned with the long-term protection and management of all wild bird species and their habitats in the EU. Among other things, the Birds Directive requires that Special Protection Areas (SPAs) be established to protect migratory species and species which are rare, vulnerable, in danger of extinction, or otherwise require special attention.

SACs designated under the Habitats Directive and SPAs, designated under the Birds Directive, form a pan-European network of protected sites known as Natura 2000. The Habitats Directive sets out a unified system for the protection and management of SACs and SPAs. These sites are also referred to as European sites.

Articles 6(3) and 6(4) of the Habitats Directive set out the requirement for an assessment of proposed plans and projects likely to have a significant effect on Natura 2000 sites.

Article 6(3) establishes the requirement to screen all plans and projects and to carry out an appropriate assessment if required (Appropriate Assessment (AA)). Article 6(4) establishes requirements in cases of imperative reasons of overriding public interest:

> ***Article 6(3):*** *"Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subjected to an appropriate assessment of its implications for the site in view of the site's conservation objectives. In light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public."*

2. Methodology

The Commission's methodological guidance (EC, 2002, 2018, 2021 see Section 2.1 below) promotes a four-stage process to complete the AA and outlines the issues and tests at each stage. An important aspect of the process is that the outcome at each successive stage determines whether a further stage in the process is required.

Stages 1 and 2 deal with the main requirements for assessment under Article 6(3). Stage 3 may be part of Article 6(3) or may be a necessary precursor to Stage 4. Stage 4 is the main derogation step of Article 6(4).

Stage 1 Screening: This stage examines the likely effects of a project either alone or in combination with other projects upon a Natura 2000 site and considers whether it can be objectively concluded that these effects will not be significant. In order to screen out a project, it must be excluded, on the basis of objective information, that the Proposed Development, individually or in combination with other plans or projects, will have a significant effect on a European site.

Stage 2 Appropriate Assessment: In this stage, there is a consideration of the impact of the project with a view to ascertain whether there will be any adverse effect on the integrity of the Natura 2000 site either alone or in combination with other projects or plans, with respect to the site's structure and function and its conservation objectives. Additionally, where there are predicted impacts, an assessment of the potential mitigation of those impacts is considered.

Stage 3 Assessment of Alternative Solutions: This stage examines alternative ways of implementing the project that, where possible, avoid any adverse impacts on the integrity of the Natura 2000 site.

Stage 4 Assessment where no alternative solutions exist and where adverse impacts remain: Where imperative reasons of overriding public interest (IROPI) exist, an assessment to consider whether compensatory measures will or will not effectively offset the damage to the sites will be necessary.

To ensure that the Proposed Development complies fully with the requirements of Article 6 of the Habitats Directive and all relevant Irish transposing legislation, Moore Group compiled this report to enable South Dublin County Council to carry out AA screening in relation to the Proposed Development to determine whether the Proposed Development, individually or in combination with another plan or project will have a significant effect on a Natura 2000 site.

2.1. Guidance

This report has been compiled in accordance with guidance contained in the following documents:

- Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities. (Department of Environment, Heritage and Local Government, 2010 rev.).

- Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities. Circular NPWS 1/10 & PSSP 2/10.
- Assessment of Plans and Projects Significantly Affecting Natura 2000 sites: Methodological Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC (European Commission Environment Directorate-General, 2001); hereafter referred to as the EC Article 6 Guidance Document.
- Managing Natura 2000 Sites: The Provisions of Article 6 of the Habitat's Directive 92/43/EEC (EC Environment Directorate-General, 2000); hereafter referred to as MN2000.
- Managing Natura 2000 Sites: The Provisions of Article 6 of the Habitat's Directive 92/43/EEC (EC, 2018).
- Guidance document on the strict protection of animal species of Community interest under the Habitats Directive (EC, 2021).
- Assessment of plans and projects in relation to Natura 2000 sites - Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC (EC, 2021).
- Office of the Planning Regulator (OPR) Practice Note PN01 Appropriate Assessment Screening for Development Management (OPR, 2021).

2.2. Data Sources

Sources of information that were used to collect data on the Natura 2000 network of sites, and the environment within which they are located, are listed below:

- The following mapping and Geographical Information Systems (GIS) data sources, as required:
    - National Parks & Wildlife (NPWS) protected site boundary data;
    - Ordnance Survey of Ireland (OSI) mapping and aerial photography;
    - OSI/Environmental Protection Agency (EPA) rivers and streams, and catchments;
    - Open Street Maps;
    - Digital Elevation Model over Europe (EU-DEM);
    - Google Earth and Bing aerial photography 1995-2022;
- Online data available on Natura 2000 sites as held by the National Parks and Wildlife Service (NPWS) from www.npws.ie including:
    - Natura 2000 - Standard Data Form;
    - Conservation Objectives;
    - Site Synopses;
- National Biodiversity Data Centre records;
    - Online database of rare, threatened and protected species;
    - Publicly accessible biodiversity datasets.
- Status of EU Protected Habitats in Ireland. (National Parks & Wildlife Service, 2019); and
- Relevant Development Plans;
    - South Dublin County Development Plan 2016-2022

- Draft South Dublin County Development Plan 2022-2028

3. Description of the Proposed Development

The Proposed Development consists of the construction and operation of a volatile organic compound (VOC) abatement system at the Takeda facility at Grange Castle, Dublin 22, to consist of:

- A Volatile Organic Compound (VOC) Abatement system comprising of a thermal oxidiser (TO), associated plant equipment and scrubbers positioned on a bunded concrete plinth
- A single storey utilities workshop
- A new pipe rack with the addition of a second-tier extension to the existing pipe rack
- Contractors compound
- Modifications to the existing internal access road
- permanent pedestrian crossing to the existing internal access road
- New access road and footpaths to perimeter of proposed development
- Modifications to the existing site lighting, signage, surface water, foul and process wastewater drainage, hard and soft landscaping

A thermal oxidation abatement system was identified as the most efficient unit for air pollutant abatement ensuring compliance with Best Available Techniques (BAT) guidance and to allow for future product expansion at this site.

The VOC Abatement System comprises of a Thermal Oxidizer (for VOCs oxidation), a Caustic Scrubber (for acids removal) and a SCR (Selective Catalytic Reducer - for NOx reduction). The treated gas is released at the stack, while the scrubber wastewater is directed to the tank farm and thereafter to the wastewater treatment plant.

Drainage is described as follows:

The VOC abatement system and urea IBC tanks are set within a bunded plinth. This ties into the process drain that will connect to the tank farm and wastewater treatment plant.

Utilities workshop: The handwash sink will tie into the existing foul drainage system. Surface water from the roof of the utilities building will feed directly into a local soakaway positioned to the north of the new access road is to discharge to a local soakaway designed in accordance with BRE 354 soakaway design and in accordance with the requirements of the local authority. The area over the soakaway will be planted with native grasses.

New access road: Hardstanding will tie into the surface water drain leading to the existing on-site attenuation system.

Contractor's compound: It is proposed to construct the compound by removing the existing grassed topsoil and replacing with compacted hardcore. A geotextile filter membrane is to be installed below the hardcore onto a prepared surface to capture any contaminants and separate from the existing underlying stratums. The welfare facilities (toilets, sinks and kitchen) will tie into the existing foul drainage system.

The existing environment of the proposed development area can be divided in three main habitat types; BL3 Buildings and artificial surfaces which make up the roads and buildings on site; and area of recolonised ground (ED3) which will facilitate the new TO and an area of Amenity grassland (GA2) which will facilitate the temporary contractor's compound.

There are no rare or protected habitats on site and the surface water drainage is contained within the site drainage system. There is indirect connectivity to the Griffeen River.

Figure 1 shows the Proposed Development location and Figure 2 shows a detailed view of the Proposed Development boundary on recent aerial photography. Figure 3 shows the layout of the Proposed Development.

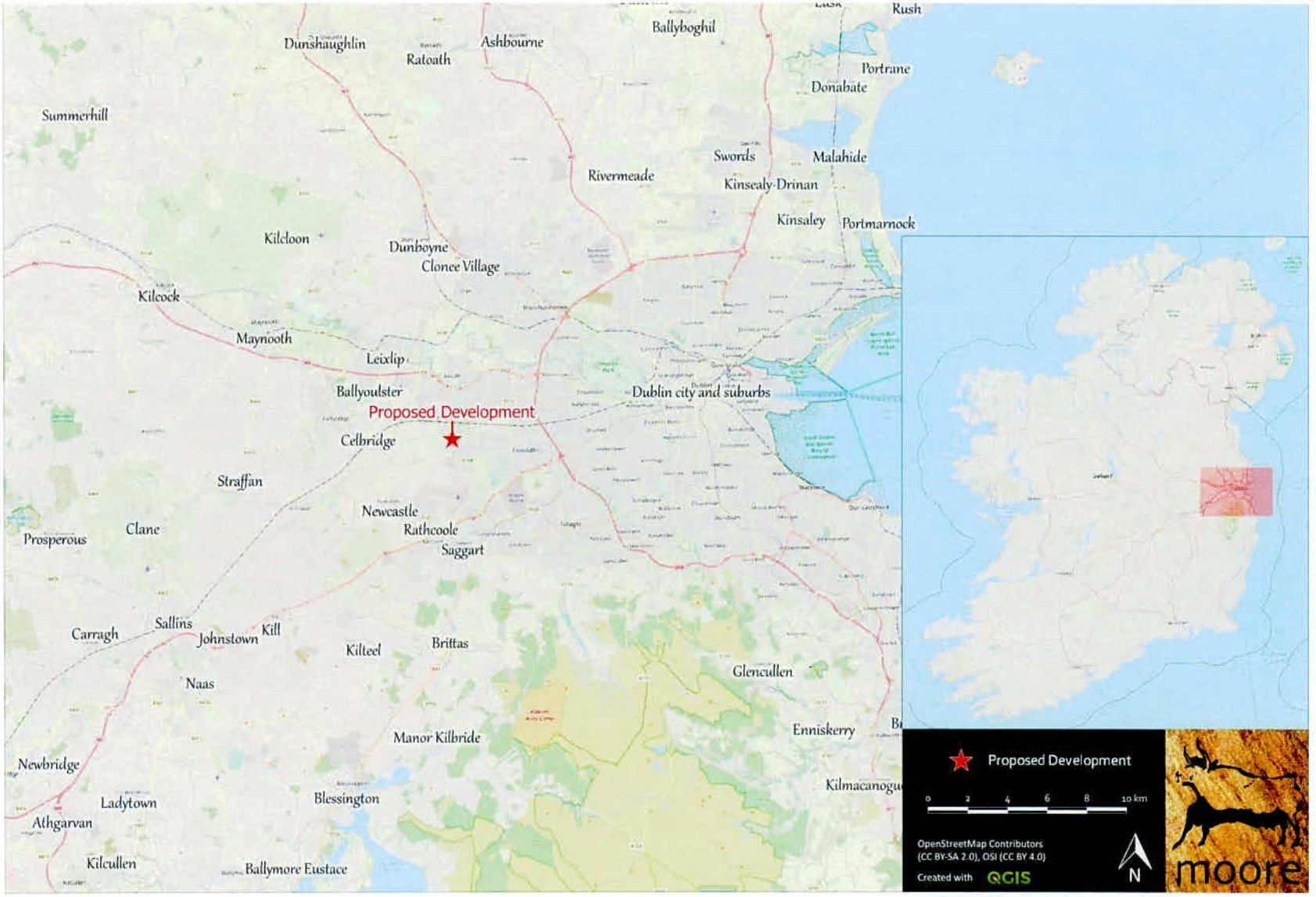

Figure 1. Showing the Proposed Development location at Grange Castle, Dublin 22.

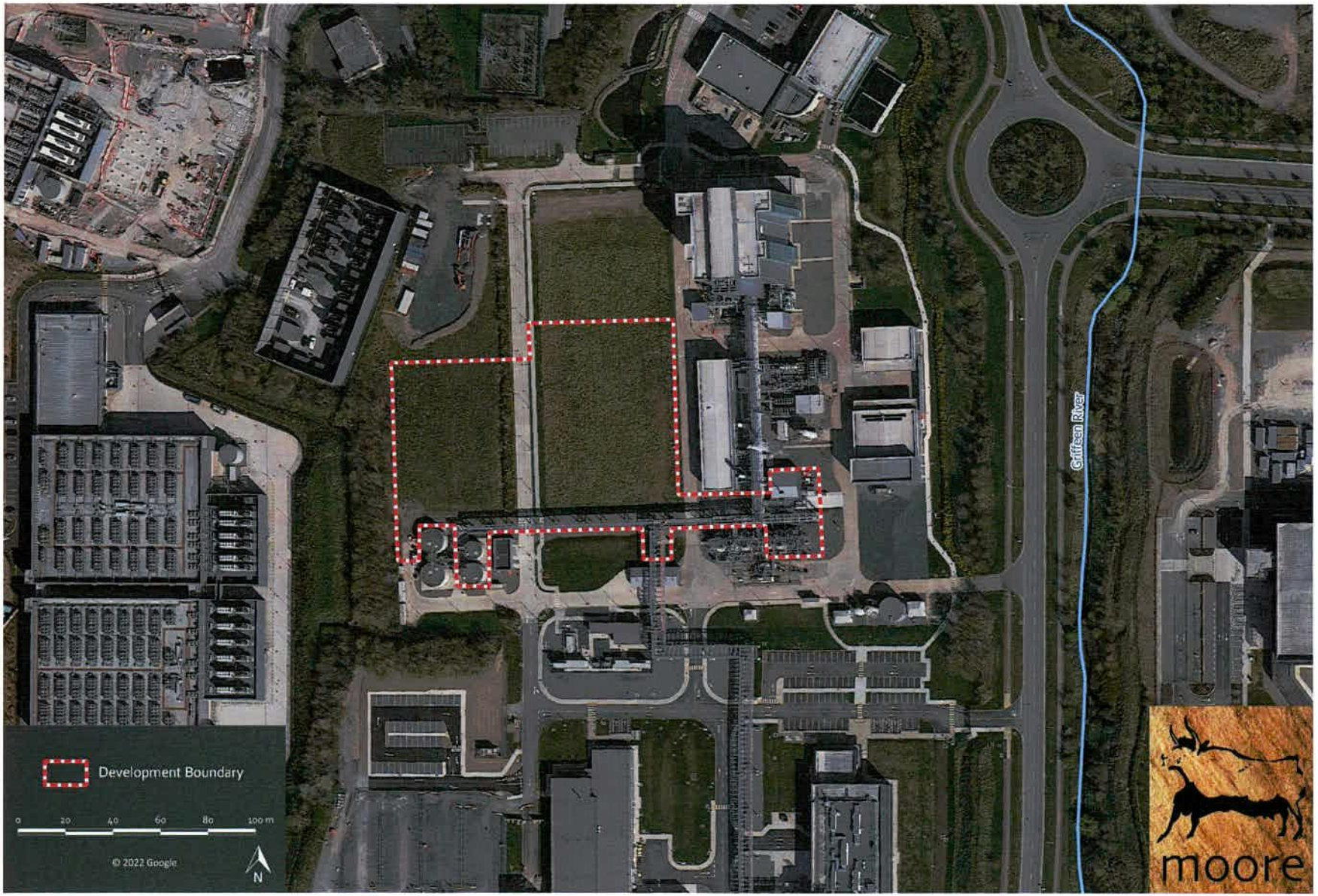

Figure 2. Showing the Proposed Development boundary on recent aerial photography.

Group Environmental Services (info@mooregroup.ie)

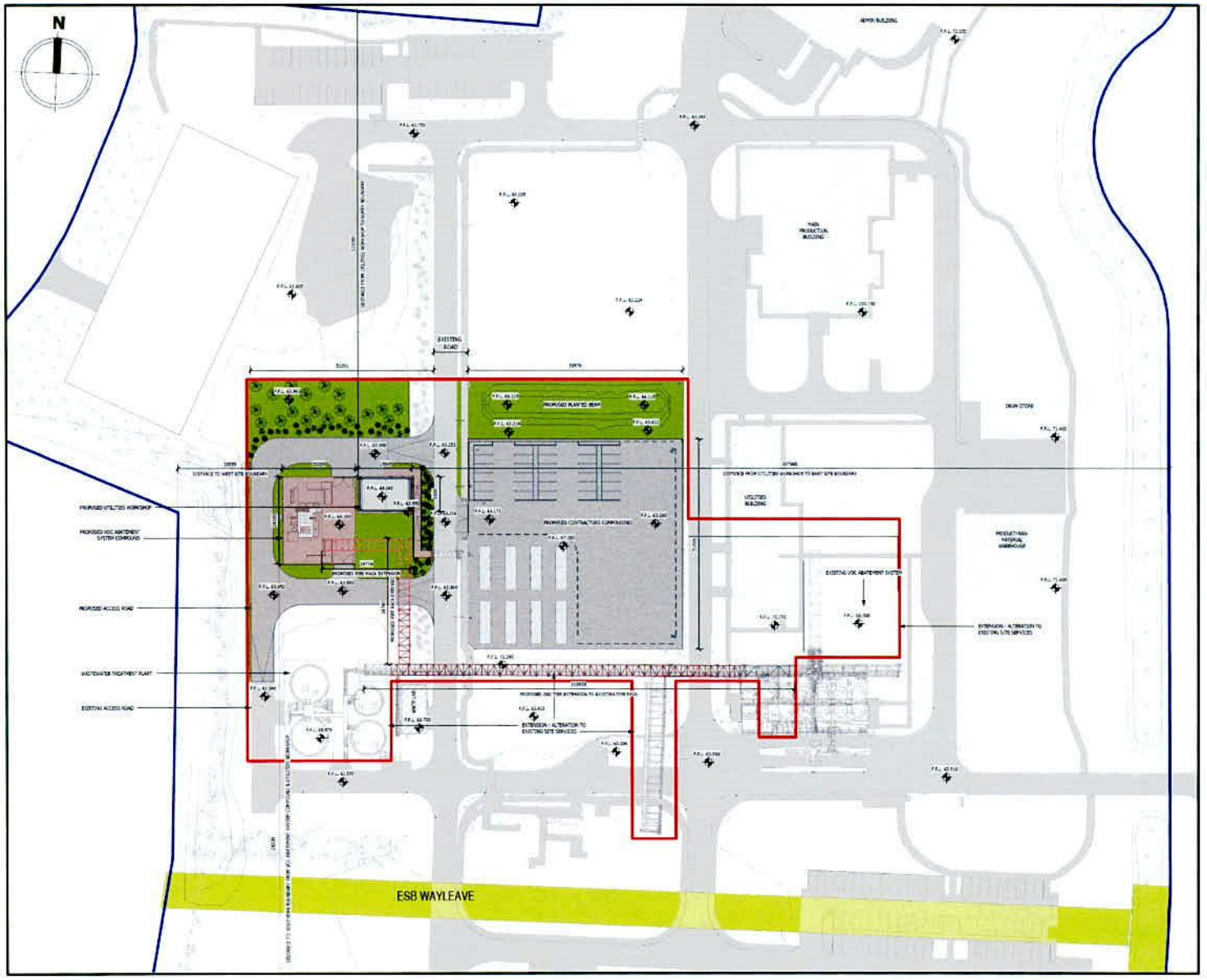

Figure 3. Plan of the Proposed Development.

4. Identification of Natura 2000 Sites

4.1. Description of Natura Sites Potentially Significantly Affected

The Department of Housing, Planning and Local Government (previously DoEHLG)'s Guidance on Appropriate Assessment (2009) recommends an assessment of European sites within a Zone of Influence (ZoI) of 15km. However, this distance is a guidance only and a zone of influence of a proposed development is the geographical area over which it could affect the receiving environment in a way that could have significant effects on the Qualifying Interests of a European site. In accordance with the OPR Practice Note, PN01, the ZoI should be established on a case-by-case basis using the Source- Pathway-Receptor framework and not by arbitrary distances (such as 15km).

The Zone of Influence may be determined by considering the Proposed Development's potential connectivity with European sites, in terms of:

- Nature, scale, timing and duration of works and possible impacts, nature and size of excavations, storage of materials, flat/sloping sites;
- Distance and nature of pathways (dilution and dispersion; intervening 'buffer' lands, roads etc.); and
- Sensitivity and location of ecological features.

The potential for source pathway receptor connectivity is firstly identified through GIS interrogation and detailed information is then provided on sites with connectivity. European sites that are located within a potential Zone of Influence of the Proposed Development are listed in Table 1 and presented in Figures 4 and 5, below. Spatial boundary data on the Natura 2000 network was extracted from the NPWS website (www.npws.ie) on 1 July 2022. This data was interrogated using GIS analysis to provide mapping, distances, locations and pathways to all sites of conservation concern including pNHAs, NHA and European sites.

Table 1 European Sites located within the potential Zone of Influence[1] of the Proposed Development.

Site Code	Site name	Distance (km)[2]
000206	North Dublin Bay SAC	18.20
000210	South Dublin Bay SAC	15.75
004006	North Bull Island SPA	18.19
004024	South Dublin Bay and River Tolka Estuary SPA	15.09

Sustainable Urban Drainage Systems (SUDS) measures will be implemented in order to minimise any increase in surface water discharge into the existing system. The new access road and footpath are to be constructed of

[1] All European sites potentially connected irrespective of the nature or scale of the Proposed Development.
[2] Distances indicated are the closest geographical distance between the Proposed Development and the European site boundary, as made available by the NPWS.

permeable asphalt with an underlying stone build-up on top of a geotextile filter membrane. Swales will be placed between the VOC Abatement system compound plinth and the access road allowing drainage directly into the ground. Surface water from the roof of the utilities building will feed directly into a local soakaway positioned to the north of the new access road is to discharge to a local soakaway. The area over the soakaway will be planted with native grasses.

The remaining hardstanding / paved areas in compound will drain into Aco channel drains which will be connected to the existing onsite drainage system which will treat the surface water via hydrocarbon interceptors prior to controlled discharge into the Griffeen River.

Foul wastewater will be directed to the existing foul drainage system. Process wastewater from the proposed development will be directed to the tank farm and thereafter routed to the on-site wastewater treatment plant for storage pending manually controlled discharge off site.

This analysis found that the Rye Water Valley/Carton SAC [001398] at c.4.6km northwest and the Glenasmole Valley SAC [001209] at c. 9.34km south are the closest European sites. However, there are no pathways or connectivity to either of these two sites and they are excluded at this preliminary screening stage.

The Proposed Development is located within the hydrological catchment of the Griffeen which flows into the River Liffey c.3.5 river kilometres downstream. There is indirect connectivity to the European sites located in Dublin Bay albeit at a huge distance with a large dilution factor in Dublin Bay.

The Qualifying Interests (QIs) and Special Conservation Interests (SCIs) of the European sites in the Zone of influence of the Proposed Development are provided in Table 2 below.

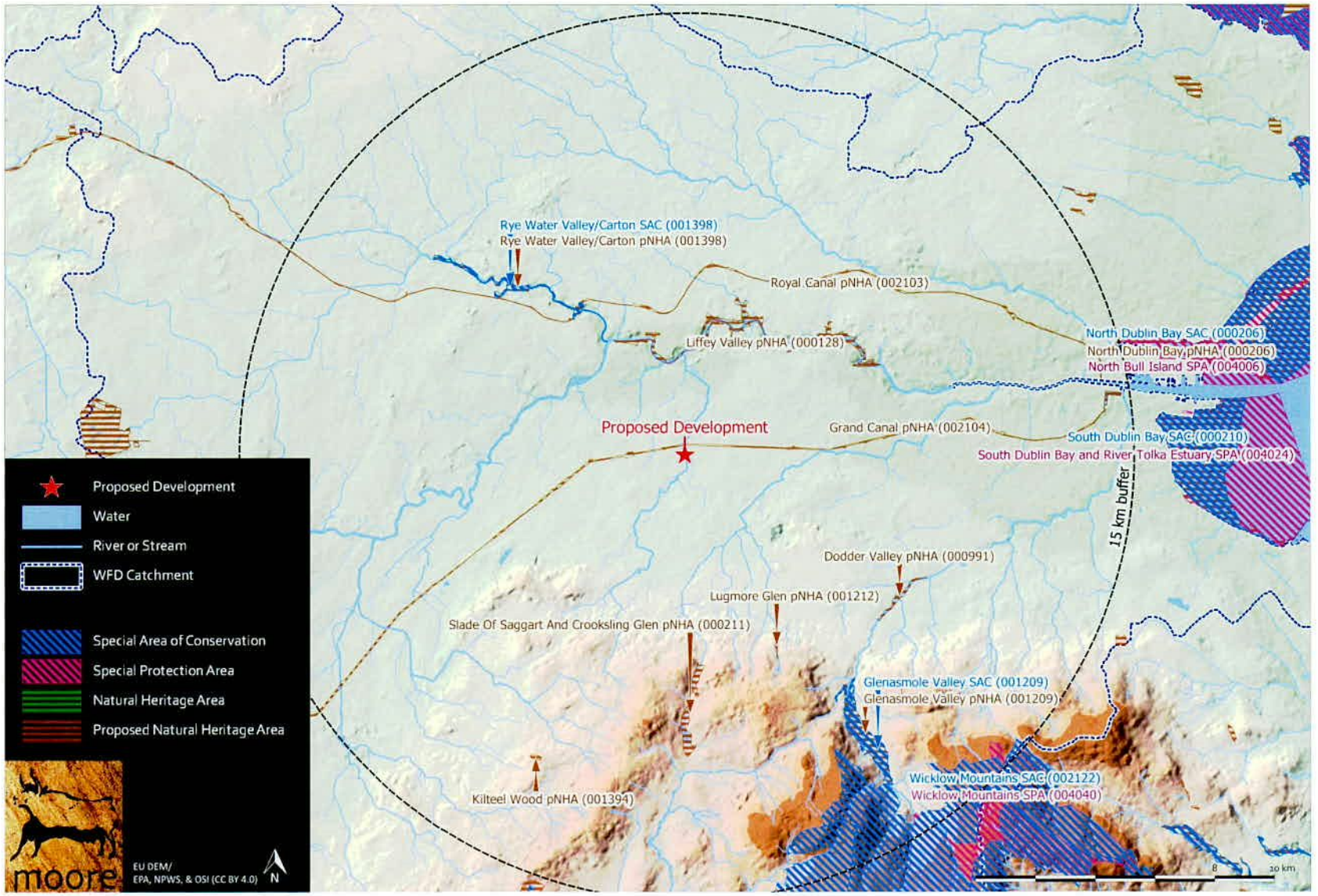

Figure 4. Showing European sites and NHAs/pNHAs within the wider Potential Zone of Influence of the Proposed Development.

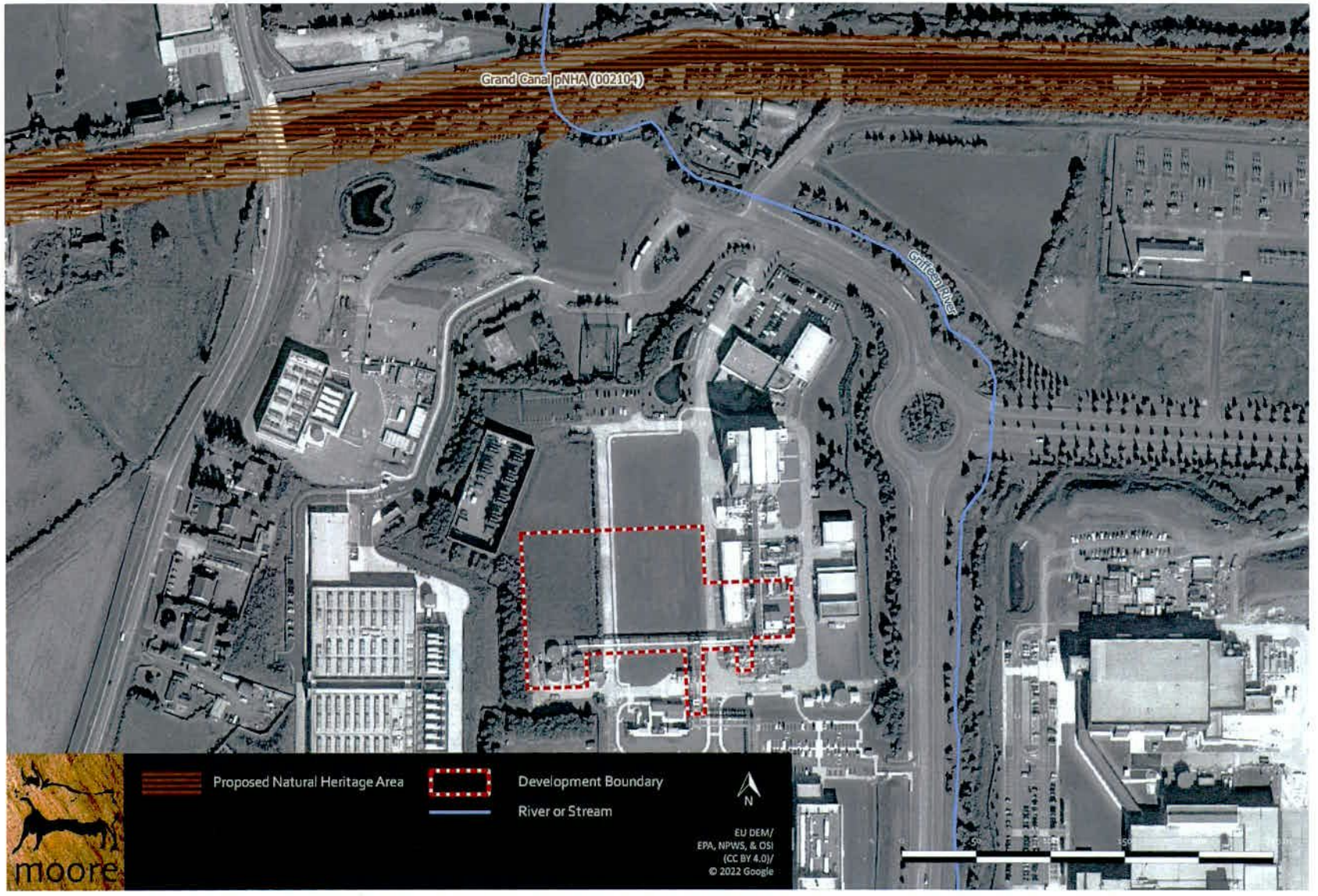

Figure 5. Detailed view of European sites in the nearer Potential Zone of Influence of the Proposed Development.

*Table 2 Identification of relevant European sites using Source-Pathway-Receptor model and compilation of information QIs and conservation objectives. *Priority Habitats*

European site name & Site code	Location Relative to the Proposed Development Site	Connectivity – Source-Pathway-Receptor	Considered further in Screening – Y/N
North Dublin Bay SAC (000206) 1140 Mudflats and sandflats not covered by seawater at low tide 1210 Annual vegetation of drift lines 1310 *Salicornia* and other annuals colonising mud and sand 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) 1395 Petalwort *Petalophyllum ralfsii* 1410 Mediterranean salt meadows (*Juncetalia maritimi*) 2110 Embryonic shifting dunes 2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) 2130 Fixed coastal dunes with herbaceous vegetation (grey dunes) 2190 Humid dune slacks NPWS (2013) Conservation Objectives: North Dublin Bay SAC 000206. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.	Over 20km downstream of the Proposed Development	Surface water will discharge to ground via SUDs measures with only a small proportion of the surface water directed to existing site drainage which is treated and discharged at a controlled rate with attenuation where flow is above greenfield runoff rate of 13 l/s. Foul wastewater will be directed to the existing foul drainage system. Process wastewater will be directed to the onsite treatment plant via treatment in the tank farm.	N
South Dublin Bay SAC (000210) 1140 Mudflats and sandflats not covered by seawater at low tide NPWS (2013) Conservation Objectives: South Dublin Bay SAC 000210. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.	Over 20km downstream of the Proposed Development	Surface water will discharge to ground via SUDs measures with only a small proportion of the surface water directed to existing site drainage which is treated and discharged at a controlled rate with attenuation where flow is above greenfield runoff rate of 13 l/s. Foul wastewater will be directed to the existing foul drainage system. Process wastewater will be directed to the onsite treatment	N

European site name & Site code	Location Relative to the Proposed Development Site	Connectivity – Source-Pathway-Receptor	Considered further in Screening – Y/N
		plant via treatment in the tank farm.	
North Bull Island SPA (004006) A046 Light-Bellied Brent Goose *Branta bernicla hrota* A048 Shelduck *Tadorna tadorna* A052 Teal Anas *crecca* A054 Pintail *Anas acuta* A056 Shoveler *Anas clypeata* A130 Oystercatcher *Haematopus ostralegus* A140 Golden Plover *Pluvialis apricaria* A141 Grey Plover *Pluvialis squatarola* A143 Knot *Calidris canutus* A144 Sanderling *Calidris alba* A149 Dunlin *Calidris alpina alpina* A156 Black-tailed Godwit *Limosa limosa* A157 Bar-tailed Godwit *Limosa lapponica* A160 Curlew *Numenius arquata* A162 Redshank *Tringa totanus* A169 Turnstone *Arenaria interpres* A179 Black-headed Gull *Chroicocephalus ridibundus* A999 Wetlands NPWS (2015) Conservation Objectives: North Bull Island SPA 004006. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.	Over 20km downstream of the Proposed Development	Surface water will discharge to ground via SUDs measures with only a small proportion of the surface water directed to existing site drainage which is treated and discharged at a controlled rate with attenuation where flow is above greenfield runoff rate of 13 l/s. Foul wastewater will be directed to the existing foul drainage system. Process wastewater will be directed to the onsite treatment plant via treatment in the tank farm.	N
South Dublin Bay and River Tolka Estuary SPA (004024) A046 Light-Bellied Brent Goose *Branta bernicla hrota* A130 Oystercatcher *Haematopus ostralegus* A137 Ringed Plover *Charadrius hiaticula* A141 Grey Plover *Pluvialis squatarola*	Over 20km downstream of the Proposed Development	Surface water will discharge to ground via SUDs measures with only a small proportion of the surface water directed to existing site drainage which is treated and discharged at a controlled rate with attenuation where	N

European site name & Site code	Location Relative to the Proposed Development Site	Connectivity – Source-Pathway-Receptor	Considered further in Screening – Y/N
A143 Knot *Calidris canutus* A144 Sanderling *Calidris alba* A149 Dunlin *Calidris alpina alpina* A157 Bar-tailed Godwit *Limosa lapponica* A162 Redshank *Tringa totanus* A179 Black-headed Gull *Chroicocephalus ridibundus* A192 Roseate Tern *Sterna dougallii* A193 Common Tern *Sterna hirundo* A194 Arctic Tern *Sterna paradisaea* A999 Wetlands NPWS (2015) Conservation Objectives: South Dublin Bay and River Tolka Estuary SPA 004024. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.		flow is above greenfield runoff rate of 13 l/s. Foul wastewater will be directed to the existing foul drainage system. Process wastewater will be directed to the onsite treatment plant via treatment in the tank farm. No Due to distance and the lack of any relevant ex-situ factors of significance to these species or habitat.	

4.2. Ecological Network Supporting Natura 2000 Sites

A concurrent GIS analysis of the proposed Natural Heritage Areas (pNHA) and designated Natural Heritage Areas (NHA) in terms of their role in supporting the species using Natura 2000 sites was undertaken along with GIS investigation of European sites. It was assumed that these supporting roles mainly related to mobile fauna such as mammals and birds which may use pNHAs and NHAs as "stepping stones" between Natura 2000 sites.

Article 10 of the Habitats Directive and the Habitats Regulations 2011 place a high degree of importance on such non-Natura 2000 areas as features that connect the Natura 2000 network. Features such as ponds, woodlands and important hedgerows were taken into account during the preparation of this AA Screening report.

The NHAs and pNHAs identified in Figure 4 are either located outside the Zone of Influence with the exception of the Grand Canal pNHA. However, there are no pathways to the Grand Canal and there are no predicted effects on the Grand Canal pNHA.

5. Identification of Potential Impacts & Assessment of Significance

The Proposed Development is not directly connected with or necessary to the management of the sites considered in the assessment and therefore potential impacts must be identified and considered.

5.1. Assessment of Likely Significant Effects

There is no direct connectivity to the Griffeen River or to any European sites within or outside the potential Zone of Influence.

The consideration of all potential direct and indirect impacts that may result in significant effects on the conservation objectives of a European site, taking into account the size and scale of the Proposed Development are presented in Table 3.

Table 3 Assessment of Likely Significant Effects.

Identification of all potential direct and indirect impacts that may result in significant effects on the conservation objectives of a European site, taking into account the size and scale of the project.	
Impacts:	**Significance of Impacts:**
Construction phase e.g. Vegetation clearance Demolition Surface water runoff from soil excavation/infill/landscaping (including borrow pits) Dust, noise, vibration Lighting disturbance Impact on groundwater/dewatering Storage of excavated/construction materials Access to site Pests	None The Proposed Development site is located within the boundary of the existing operating facility with a change in minor locally low value habitats. There are no direct pathways from the development areas to the Griffeen River which leads to the River Liffey and Dublin Bay. There are no predicted effects from the construction phase.
Operational phase e.g. Direct emission to air and water	All foul drainage, once the facility is operational, will be contained on site and discharged to urban drainage systems.

Surface water runoff containing contaminant or sediment Lighting disturbance Noise/vibration Changes to water/groundwater due to drainage or abstraction Presence of people, vehicles and activities Physical presence of structures (e.g. collision risks) Potential for accidents or incidents	Surface water will discharge to ground via SUDs measures with only a small proportion of the surface water directed to existing site drainage which is treated and discharged at a controlled rate with attenuation where flow is above greenfield runoff rate of 13 l/s. There is no real likelihood of any significant effects on European Sites in the wider catchment area. The facility is located at a distance of removal such that there will be no disturbance to qualifying interest species in any European sites.
Describe any likely changes to the European site:	
Examples of the type of changes to give consideration to include: Reduction or fragmentation of habitat area Disturbance to QI species Habitat or species fragmentation Reduction or fragmentation in species density Changes in key indicators of conservation status value (water quality etc.) Changes to areas of sensitivity or threats to QI Interference with the key relationships that define the structure or ecological function of the site Climate change	None. The Proposed Development site is not located adjacent or within a European site, therefore there is no risk of habitat loss or fragmentation or any effects on QI habitats or species directly or ex-situ.
Are 'mitigation' measures necessary to reach a conclusion that likely significant effects can be ruled out at screening?	
No	N/A

On the basis of the information supplied, which is considered adequate to undertake a screening determination and having regard to:

- the nature and scale of the proposed development,
- the intervening land uses and distance from European sites,
- the lack of direct connections with regard to the Source-Pathway-Receptor model,

It may be concluded that the proposed development, individually or in-combination with other plans or projects, would not be likely to have a significant effect on the above listed European sites or any other European site, in view of the said sites' conservation objectives.

5.2. Assessment of Potential In-Combination Effects

In-combination effects are changes in the environment that result from numerous human-induced, small-scale alterations. In-combination effects can be thought of as occurring through two main pathways: first, through persistent additions or losses of the same materials or resource, and second, through the compounding effects as a result of the coming together of two or more effects.

As part of the Screening for an Appropriate Assessment, in addition to the Proposed Development, other relevant plans and projects in the area must also be considered at this stage. This step aims to identify at this early stage any possible significant in-combination effects of the Proposed Development with other such plans and projects on European sites.

A review of the National Planning Application Database was undertaken. The first stage of this review confirmed that there were no data gaps in the area where the Proposed Development is located. The database was then queried for developments granted planning permission within 500m of the Proposed Development within the last three years, these are presented in Table 4 below.

Table 4 .Planning applications granted permission in the vicinity of the Proposed Development.

Planning Ref.	Description of development	Comments
SD19A/0042	Phased development that will include 4 single storey data halls all with associated plant at roof level; 32 standby generators with associated flues associated office and service areas; service road infrastructure and car parking; ESB sub-station/transformer yard with an overall gross floor area of 17,685sq.m; temporary gas powered generation plant within a walled yard containing 19 generator units with associated flues (each 17m high) to be located to the west of the proposed data halls on a site within the townland of Ballymakaily; Phase 1, 2 single storey data halls (6,950sq.m.) with roof plant and 16 stand-by generators with associated flues (each 15m high) as well as associated water tower and pump room and other services; single storey goods receiving area/store and single storey office area (1,522sq.m.) located attached and to the north-east of the data halls; temporary gas powered generation plant with 15 generators with associated flues (each 17m high) to be located within a compound to the west of the proposed data halls; attenuation pond; two storey ESB sub-station (494sq.m) with associated transformer yard and single storey transformer building (247sq.m) within compound; Phase 2, 2 single storey data halls (6,950sq.m.) with roof plant and 16 stand-by generators with associated flues (each 15m high) as well as associated water tower and pump room and other services; single storey goods receiving area/store and single storey office area (1,522sq.m) located attached and to the east of the data halls under this Phase and attached and to the north of the offices proposed under Phase 1; 4 additional generators with associated flues (each 17m high) to be	No potential for in-combination effects given the scale and location of the project.

Planning Ref.	Description of development	Comments
	constructed within the temporary gas powered generation plant; also ancillary site works; connections to existing infrastructural services as well as fencing; signage; vehicular access off the realigned R120 to provide a new vehicular access into the site as well as internal service roads and entrance gates; car park for 39 car parking spaces (including 4 disabled car parking spaces); sheltered bicycle parking to serve the development	
SD19A/0004	Enabling works to facilitate the future development of the site; topsoil strip and a cut and fill operation across the site; temporary construction access will be created off the R120 to facilitate the works within the townland of Ballymakaily to the west of the Newcastle Road (R120).	No potential for in-combination effects given the scale and location of the project.
SD19A/0322	Construction of 1 & 2 storey office building, c.9.43m in height providing a total GFA of 459sq.m.; provision of 11 total car parking spaces; 8 covered cycle parking spaces; the removal of the existing temporary structures, landscaping, tree planting and all associated site and infrastructural works.	No potential for in-combination effects given the scale and location of the project.
SD19A/0342	Retention and continuance of the use for a further two years of the temporary gas powered generation plant which is located to the rear of the Takeda Ireland complex, is sited within a walled yard of 2,836sq.m containing 12 generator units with associated flues (each 15m high) which was permitted for a period of three years on the 10th January 2017	No potential for in-combination effects given the scale and location of the project.
SD20A/0031	Relocation of the temporary gas powered generation plant for a further two years to lands to the immediate north-west within the Edgeconnex campus and to the immediate east of the data centre the relocated temporary gas powered generation plant will be enclosed within a walled yard of 2,836sq.m containing 12 generator units with associated flues, vehicular access to the generation plant will remain from the permitted service road into the Edgeconnex site and Grange Castle Business Park as originally permitted.	No potential for in-combination effects given the scale and location of the project.
SD20A/0147	Construction of P3 Phase II expansion of the existing P3 biopharma production facility which includes the construction of a circa 2,155sq.m, two storey biopharma production facility; single storey administration extension; courier pick up/drop off area with 5 parking spaces; extension to existing external utilities yard; new internal site circulation road and re-alignment of existing circulation road; 48 additional car parking spaces; 24 covered bicycle stands, hard and soft landscaping and external lighting	No potential for in-combination effects given the scale and location of the project.
SD20A/0283	Demolition of existing single storey vacant house, garage and outhouse and removal of existing temporary construction car park; Construction of a single 1-4 storey Central Administration Building and 2 2-storey (with mezzanine) data centres (DUB14 & DUB15) all to be located west of data centres DUB9, DUB10, DUB12 & DUB13 within the MS campus; The Central Administration Building will comprise central office administration, with staff cafeteria, staff gym and reception with provision of PV panels on the roof; each data centre will include data halls, admin blocks and a variety of mechanical and electrical plant areas/structures.; DUB14 will also include 21 diesel generators and associated sub-stations (E-houses) and 11 mechanical flues. Provision of a gas generator compound; Provision of a Gas Networks Ireland gas skid including 3 kiosk buildings; Expansion of existing electrical sub-station compound; 2 sprinkler tank and pump house areas, 1 additional rainwater harvesting plant; Provision of 168 permanent car parking spaces and 40 cycle parking spaces; Provision of additional western access to the MS campus (to serves the Central Administration Building) from the Business Park estate road (including bridge over the Griffeen River) with existing temporary access to be extinguished; All associated site development works, drainage and services provision,	No potential for in-combination effects given the scale and location of the project.

Planning Ref.	Description of development	Comments
	landscaping, boundary treatments (including security fencing) and associated works.	
SD21A/0042	Construction of two single storey data centres with associated office and service areas; and three gas powered generation plant buildings with an overall gross floor area of 24,624sq.m. Construction of 2 single storey data centres, with 24 standby diesel generators with associated flues that will be attached to a single storey goods receiving area/store and a single storey office area; Amendments to the internal access road and omission of access to loading bay; and new internal access roads to serve the proposed development that will provide access to 39 new car parking spaces and sheltered bicycle parking to serve the new data centres; The development will also include the phased development of 3 two storey gas powered generation plants to provide power to facilitate the development of the overall site. These plants will be built to provide power to each data centre, if and, when required. The gas plants will be required as back up power generation once the permitted power connection via the permitted substation is achieved; New attenuation pond to the north of the site;; Proposed above ground gas installation compound to contain single storey kiosk (93sq.m) and boiler room (44sq.m	No potential for in-combination effects given the scale and location of the project.
SD21A/0127	Retention of 1 standby diesel generator with an associated flue (15m high) within the permitted generator compound located to the east of the data centre granted under SDCC Reg. SD16A/0345 increasing the number of standby diesel generators from 5 to 6 within the permitted compound.	No potential for in-combination effects given the scale and location of the project.
SD21A/0203	Modifications and minor additions to previously approved scheme (comprising of the following changes to previously approved scheme SD20A/0283; Approved Central Administration Building (CAB), relocation of building to the east; reconfiguration of building plans at all levels (including roof level) resulting in increase in building footprint associated changes to building elevations (design and finishes); approved single storey Cafeteria Element, additional basement level below cafeteria to accommodate plant; approved four-storey Office element, parapet at roof level to be raised by approx. 1.1m (increased from approved 19.5m in height to proposed 20.6m); overall increase in GIFA of 395sq.m;, reconfiguration and setting out affecting building locations and plans at all levels (including roof level) resulting in reduction in overall building footprint (for each building) by 48sq.m (from 13,442sq.m to 13,394sq.m), relocation, modifications to design and expansion of approved Water Treatment Building and associated plant to include, Water Treatment Tanks, 2 sprinkler tanks and relocated approved pump house; Gas Generator Compound - Relocation & reconfiguration of previously approved gas generator compound including, additional 4 generators (from 20 approved to 24 proposed), omission of approved E-houses; additional 7 electrical rooms, additional 7 flues (from 5 approved to 12 proposed); modifications to approved layout of internal site roads, yards and footpaths; relocation and modifications to design of approved Sprinkler Tanks and Pump Houses; relocation of Approved Gas Networks Ireland (GNI) gas skid & compound including approved 3 kiosk buildings	No potential for in-combination effects given the scale and location of the project.
SD22A/0022	The construction of a 2-storey extension and any associated site works to the south elevation of the existing engineering stores in the administration offices building. The application relates to development which comprises of an activity, which requires an Industrial Emissions Licence in accordance with the First Schedule of the EPA Act 1922 as amended.	No potential for in-combination effects given the scale and location of the project.

The South Dublin County Development Plan in complying with the requirements of the Habitats Directive requires that all Projects and Plans that could affect the Natura 2000 sites in the same potential Zone of Influence of the Proposed Development site would be initially screened for Appropriate Assessment and if requiring Stage 2 AA, that appropriate employable mitigation measures would be put in place to avoid, reduce or ameliorate negative impacts. In this way any, in-combination impacts with Plans or Projects for the proposed development area and surrounding townlands in which the proposed development site is located, would be avoided.

The listed developments have been granted permission in most cases with conditions relating to sustainable development by the consenting authority in compliance with the relevant Local Authority Development Plan and in compliance with the Local Authority requirement with regard to the Habitats Directive. The development cannot have received planning permission without having met the consenting authority requirement in this regard.

There are no predicted in-combination effects given that it is predicted that the Proposed Development will have no effect on any European site.

Any new applications for the Proposed Development area will be assessed on a case by case basis *initially* by South Dublin County Council which will determine the requirement for AA Screening as per the requirements of Article 6(3) of the Habitats Directive.

6. Conclusion

There are no pathways from the development areas to the Griffeen River which leads to the River Liffey and Dublin Bay. There are no predicted effects from the construction phase.

Surface water will discharge to ground via SUDs measures with only a small proportion of the surface water directed to existing site drainage which is treated and discharged at a controlled rate with attenuation where flow is above the greenfield runoff rate (13 l/s). Foul wastewater will be directed to the existing foul drainage system. Process wastewater will be directed to the onsite treatment plant via treatment in the tank farm. There are no predicted effects from the operational phase.

There are no predicted effects on any European sites given:

- The distance between the Proposed Development and any European Sites, over 20 river km downstream;
- There are no predicted emissions to air, water or the environment during the construction or operational phases that would result in significant effects.

It has been objectively concluded by Moore Group Environmental Services that:

1. The Proposed Development is not directly connected with, or necessary to the conservation management of the European sites considered in this assessment.
2. The Proposed Development is unlikely to either directly or indirectly significantly affect the Qualifying interests or Conservation Objectives of the European sites considered in this assessment.
3. The Proposed Development, alone or in combination with other projects, is not likely to have significant effects on the European sites considered in this assessment in view of their conservation objectives.
4. It is possible to conclude that significant effects can be excluded at the screening stage.

It can be *excluded*, on the basis of objective information, that the Proposed Development, individually or in combination with other plans or projects, will have a significant effect on a European site.

An appropriate assessment is not, therefore, required.

A finding of no significant effects report is presented in Appendix A in accordance with the EU Commission's methodological guidance (European Commission, 2002).

7. References

Department of the Environment, Heritage and Local Government (2010) Guidance on Appropriate Assessment of Plans and Projects in Ireland (as amended February 2010).

European Commission (2000) Managing Natura 2000 sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC.

European Commission Environment DG (2002) Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43EEC. European Commission, Brussels.

European Commission (2007) Guidance document on Article 6(4) of the 'Habitats Directive '92/43/EEC: Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interests, compensatory measures, overall coherence and opinion of the Commission. European Commission, Brussels.

European Commission (2018) Managing Natura 2000 sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC.

European Commission (2021) Assessment of plans and projects in relation to Natura 2000 sites - Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC, Brussels 28.9.21.

European Commission (2021) Guidance document on the strict protection of animal species of Community interest under the Habitats Directive, Brussels 12.10.21.

NPWS (2019) The Status of EU Protected Habitats and Species in Ireland. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin.

NPWS (2022) National Parks and Wildlife Service Metadata available online at https://www.npws.ie/maps-and-data

Office-of-the-Planning-Regulator (2021) Appropriate Assessment Screening for Development Management OPR Practice Note PN01. March 2021

Appendix A

FINDING OF NO SIGNIFICANT EFFECTS REPORT

Finding no significant effects report matrix

Name of project or plan

Takeda VOC Abatement System Project

Name and location of the Natura 2000 site(s)

European sites that are located within a potential Zone of Influence of the Proposed Development are listed in Table 1.

Table 5 European Sites located within the potential Zone of Influence of the Proposed Development.

Site Code	Site name	Distance (km)[3]
000206	North Dublin Bay SAC	18.20
000210	South Dublin Bay SAC	15.75
004006	North Bull Island SPA	18.19
004024	South Dublin Bay and River Tolka Estuary SPA	15.09

The Proposed Development is located within the hydrological catchment of the Griffeen which flows into the River Liffey c.3.5 river kilometres downstream. There is indirect connectivity to the European sites located in Dublin Bay albeit at a huge distance with a large dilution factor in Dublin Bay.

Description of the project or plan

The Proposed Development consists of the construction and operation of a volatile organic compound (VOC) abatement system at the Takeda facility at Grange Castle, Dublin 22, to consist of:

- A Volatile Organic Compound (VOC) Abatement system comprising of a thermal oxidiser (TO), associated plant equipment and scrubbers positioned on a bunded concrete plinth
- A single storey utilities workshop
- A new pipe rack with the addition of a second-tier extension to the existing pipe rack
- Contractors compound
- Modifications to the existing internal access road
- permanent pedestrian crossing to the existing internal access road
- New access road and footpaths to perimeter of proposed development
- Modifications to the existing site lighting, signage, surface water, foul and process wastewater drainage, hard and soft landscaping

A thermal oxidation abatement system was identified as the most efficient unit for air pollutant abatement ensuring compliance with Best Available Techniques (BAT) guidance and to allow for future product expansion at this site.

The VOC Abatement System comprises of a Thermal Oxidizer (for VOCs oxidation), a Caustic Scrubber (for acids removal) and a SCR (Selective Catalytic Reducer - for NOx reduction). The treated gas is released at the stack, while the scrubber wastewater is directed to the tank farm and thereafter to the wastewater treatment plant.

[3] Distances indicated are the closest geographical distance between the Proposed Development and the European site boundary, as made available by the NPWS.

Drainage is described as follows. The VOC abatement system and urea IBC tanks are set within a bunded plinth. This ties into the process drain that will connect to the tank farm and wastewater treatment plant.

Utilities workshop: The handwash will tie into the existing foul drainage system. Surface water from the roof of the utilities building will feed directly into a local soakaway positioned to the north of the new access road is to discharge to a local soakaway designed in accordance with BRE 354 soakaway design and in accordance with the requirements of the local authority. The area over the soakaway will be planted with native grasses.

New access road: Hardstanding will tie into the surface water drain leading to the existing on-site attenuation system.

Contractor's compound: It is proposed to construct the compound by removing the existing grassed topsoil and replacing with compacted hardcore. A geotextile filter membrane is to be installed below the hardcore onto a prepared surface to capture any contaminants and separate from the existing underlying stratums. The welfare facilities (toilets, sinks and kitchen) will tie into the existing foul drainage system.

The existing environment of the proposed development area can be divided in three main habitat types; BL3 Buildings and artificial surfaces which make up the roads and buildings on site; and area of recolonised ground (ED3) which will facilitate the new TO and an area of Amenity grassland (GA2) which will facilitate the contractors compound.

There are no rare or protected habitats on site and the surface water drainage is contained within the site drainage system. There is indirect connectivity to the Griffeen River.

Is the project or plan directly connected with or necessary to the management of the site(s)

No

Are there other projects or plans that together with the projects or plan being assessed could affect the site

A review of the National Planning Application Database was undertaken. The first stage of this review confirmed that there were no data outages in the area where the Proposed Development is located. The database was then queried for developments granted planning permission within 500m of the Proposed Development within the last three years, these are presented in the Table below.

Planning applications granted permission in the vicinity of the Proposed Development.

Planning Ref.	Description of development	Comments
SD19A/0042	Phased development that will include 4 single storey data halls all with associated plant at roof level; 32 standby generators with associated flues associated office and service areas; service road infrastructure and car parking; ESB sub-station/transformer yard with an overall gross floor area of 17,685sq.m; temporary gas powered generation plant within a walled yard containing 19 generator units with associated flues (each 17m high) to be located to the west of the proposed data halls on a site within the townland of Ballymakaily; Phase 1, 2 single storey data halls (6,950sq.m.) with roof plant and 16 stand-by generators with associated flues (each 15m high) as well as associated water tower and pump room and other services; single storey goods receiving area/store and single storey office area (1,522sq.m.) located attached and to the north-east of the data halls; temporary gas powered generation plant with 15 generators with associated flues (each 17m high) to be located within a compound to the west of the proposed data halls; attenuation pond; two storey ESB sub-station (494sq.m) with associated transformer yard and single storey transformer building (247sq.m) within compound; Phase 2, 2 single storey data halls (6,950sq.m.) with roof plant and 16 stand-by generators with associated flues (each 15m high) as well as associated water tower and pump room and other services; single storey goods receiving area/store and single storey office area (1,522sq.m) located attached and to the east of the data halls under this Phase and attached and	No potential for in-combination effects given the scale and location of the project.

Planning Ref.	Description of development	Comments
	to the north of the offices proposed under Phase 1; 4 additional generators with associated flues (each 17m high) to be constructed within the temporary gas powered generation plant; also ancillary site works; connections to existing infrastructural services as well as fencing; signage; vehicular access off the realigned R120 to provide a new vehicular access into the site as well as internal service roads and entrance gates; car park for 39 car parking spaces (including 4 disabled car parking spaces); sheltered bicycle parking to serve the development	
SD19A/0004	Enabling works to facilitate the future development of the site; topsoil strip and a cut and fill operation across the site; temporary construction access will be created off the R120 to facilitate the works within the townland of Ballymakaily to the west of the Newcastle Road (R120).	No potential for in-combination effects given the scale and location of the project.
SD19A/0322	Construction of 1 & 2 storey office building, c.9.43m in height providing a total GFA of 459sq.m.; provision of 11 total car parking spaces; 8 covered cycle parking spaces; the removal of the existing temporary structures, landscaping, tree planting and all associated site and infrastructural works.	No potential for in-combination effects given the scale and location of the project.
SD19A/0342	Retention and continuance of the use for a further two years of the temporary gas powered generation plant which is located to the rear of the Takeda Ireland complex, is sited within a walled yard of 2,836sq.m containing 12 generator units with associated flues (each 15m high) which was permitted for a period of three years on the 10th January 2017	No potential for in-combination effects given the scale and location of the project.
SD20A/0031	Relocation of the temporary gas powered generation plant for a further two years to lands to the immediate north-west within the Edgeconnex campus and to the immediate east of the data centre the relocated temporary gas powered generation plant will be enclosed within a walled yard of 2,836sq.m containing 12 generator units with associated flues, vehicular access to the generation plant will remain from the permitted service road into the Edgeconnex site and Grange Castle Business Park as originally permitted.	No potential for in-combination effects given the scale and location of the project.
SD20A/0147	Construction of P3 Phase II expansion of the existing P3 biopharma production facility which includes the construction of a circa 2,155sq.m, two storey biopharma production facility; single storey administration extension; courier pick up/drop off area with 5 parking spaces; extension to existing external utilities yard; new internal site circulation road and re-alignment of existing circulation road; 48 additional car parking spaces; 24 covered bicycle stands, hard and soft landscaping and external lighting	No potential for in-combination effects given the scale and location of the project.
SD20A/0283	Demolition of existing single storey vacant house, garage and outhouse and removal of existing temporary construction car park; Construction of a single 1-4 storey Central Administration Building and 2 2-storey (with mezzanine) data centres (DUB14 & DUB15) all to be located west of data centres DUB9, DUB10, DUB12 & DUB13 within the MS campus; The Central Administration Building will comprise central office administration, with staff cafeteria, staff gym and reception with provision of PV panels on the roof; each data centre will include data halls, admin blocks and a variety of mechanical and electrical plant areas/structures.; DUB14 will also include 21 diesel generators and associated sub-stations (E-houses) and 11 mechanical flues. Provision of a gas generator compound; Provision of a Gas Networks Ireland gas skid including 3 kiosk buildings; Expansion of existing electrical sub-station compound; 2 sprinkler tank and pump house areas, 1 additional rainwater harvesting plant; Provision of 168 permanent car parking spaces and 40 cycle parking spaces; Provision of additional western access to the MS campus (to serves the Central Administration Building) from the Business Park estate road (including bridge over the Griffeen River) with existing temporary access to be extinguished; All associated site development works, drainage and services provision, landscaping, boundary treatments (including security fencing) and associated works.	No potential for in-combination effects given the scale and location of the project.
SD21A/0042	Construction of two single storey data centres with associated office and service areas; and three gas powered generation plant buildings with an overall gross floor area of 24,624sq.m. Construction of 2 single storey data centres, with 24 standby diesel generators with associated flues that will be	No potential for in-combination effects given

Planning Ref.	Description of development	Comments
	attached to a single storey goods receiving area/store and a single storey office area; Amendments to the internal access road and omission of access to loading bay; and new internal access roads to serve the proposed development that will provide access to 39 new car parking spaces and sheltered bicycle parking to serve the new data centres; The development will also include the phased development of 3 two storey gas powered generation plants to provide power to facilitate the development of the overall site. These plants will be built to provide power to each data centre, if and, when required. The gas plants will be required as back up power generation once the permitted power connection via the permitted substation is achieved; New attenuation pond to the north of the site;; Proposed above ground gas installation compound to contain single storey kiosk (93sq.m) and boiler room (44sq.m	the scale and location of the project.
SD21A/0127	Retention of 1 standby diesel generator with an associated flue (15m high) within the permitted generator compound located to the east of the data centre granted under SDCC Reg. SD16A/0345 increasing the number of standby diesel generators from 5 to 6 within the permitted compound.	No potential for in-combination effects given the scale and location of the project.
SD21A/0203	Modifications and minor additions to previously approved scheme (comprising of the following changes to previously approved scheme SD20A/0283; Approved Central Administration Building (CAB), relocation of building to the east; reconfiguration of building plans at all levels (including roof level) resulting in increase in building footprint associated changes to building elevations (design and finishes); approved single storey Cafeteria Element, additional basement level below cafeteria to accommodate plant; approved four-storey Office element, parapet at roof level to be raised by approx. 1.1m (increased from approved 19.5m in height to proposed 20.6m); overall increase in GIFA of 395sq.m;, reconfiguration and setting out affecting building locations and plans at all levels (including roof level) resulting in reduction in overall building footprint (for each building) by 48sq.m (from 13,442sq.m to 13,394sq.m), relocation, modifications to design and expansion of approved Water Treatment Building and associated plant to include, Water Treatment Tanks, 2 sprinkler tanks and relocated approved pump house; Gas Generator Compound - Relocation & reconfiguration of previously approved gas generator compound including, additional 4 generators (from 20 approved to 24 proposed), omission of approved E-houses; additional 7 electrical rooms, additional 7 flues (from 5 approved to 12 proposed); modifications to approved layout of internal site roads, yards and footpaths; relocation and modifications to design of approved Sprinkler Tanks and Pump Houses; relocation of Approved Gas Networks Ireland (GNI) gas skid & compound including approved 3 kiosk buildings	No potential for in-combination effects given the scale and location of the project.
SD22A/0022	The construction of a 2-storey extension and any associated site works to the south elevation of the existing engineering stores in the administration offices building. The application relates to development which comprises of an activity, which requires an Industrial Emissions Licence in accordance with the First Schedule of the EPA Act 1922 as amended.	No potential for in-combination effects given the scale and location of the project.

There are no predicted in-combination effects given that the reasons discussed in the 'Comments' column of the Table above and given that the Proposed Development is unlikely to have any adverse effects on any European sites.

The South Dublin County Development Plan in complying with the requirements of the Habitats Directive requires that all Projects and Plans that could affect the Natura 2000 sites in the same potential Zone of Influence of the Proposed Development site would be initially screened for Appropriate Assessment and if requiring Stage 2 AA, that appropriate employable mitigation measures would be put in place to avoid, reduce or ameliorate negative impacts. In this way any, in-combination impacts with Plans or Projects for the proposed development area and surrounding townlands in which the proposed development site is located, would be avoided.

The listed developments have been granted permission in most cases with conditions relating to sustainable development by the consenting authority in compliance with the relevant Local Authority Development Plan and in compliance with the Local Authority requirement for regard to the Habitats Directive. The development cannot have received planning permission without having met the consenting authority requirement in this regard. There are no predicted in-combination effects given that it is predicted that the Proposed Development will have no effect on any European site.

Any new applications for the Proposed Development area will be assessed on a case by case basis *initially* by South Dublin County Council which will determine the requirement for AA Screening as per the requirements of Article 6(3) of the Habitats Directive.

THE ASSESSMENT OF SIGNIFICANCE OF EFFECTS

Describe how the project or plan (alone or in combination) is likely to affect the Natura 2000 site.

There are no pathways from the development areas to the Griffeen River which leads to the River Liffey and Dublin Bay. There are no predicted effects from the construction phase.
SUDs measures, i.e. permeable asphalt, swales and a soakaway, have been incorporated into the design in order to minimise any increase in surface water discharge into the existing system. The remaining hardstanding / paved areas in the VOC compound will drain into Aco channel drains which will be connected to the existing onsite drainage system which will treat the surface water via hydrocarbon interceptors prior to controlled discharge into the Griffeen River. Foul wastewater will be directed to the existing foul drainage system. Process wastewater will be directed to the onsite treatment plant via treatment in the tank farm. There are no predicted effects from the operational phase.

Explain why these effects are not considered significant.

There are no predicted effects on any European sites given:

- The distance between the Proposed Development and any European Sites, over 15 river km downstream;
- There are no predicted emissions to air, water or the environment during the construction or operational phases that would result in significant effects.

List of agencies consulted: provide contact name and telephone or e-mail address

The requirement for Appropriate Assessment Screening was determined during pre-planning discussion with South Dublin County Council.

Response to consultation

N/A.

DATA COLLECTED TO CARRY OUT THE ASSESSMENT

Who carried out the assessment

Moore Group Environmental Services.

Sources of data

NPWS database of designated sites at www.npws.ie

National Biodiversity Data Centre database http://maps.biodiversityireland.ie

Level of assessment completed

Desktop Assessment. Fieldwork was carried out as part of the EIA process.

Where can the full results of the assessment be accessed and viewed

South Dublin County Council Planning web portal.

OVERALL CONCLUSIONS

There are no pathways from the development areas to the Griffeen River which leads to the River Liffey and Dublin Bay. There are no predicted effects from the construction phase.
SUDs measures, i.e. permeable asphalt, swales and a soakaway, have been incorporated into the design in order to minimise any increase in surface water discharge into the existing system. The remaining hardstanding / paved areas in the VOC compound will drain into Aco channel drains which will be connected to the existing onsite drainage system which will treat the surface water via hydrocarbon interceptors prior to controlled discharge into the Griffeen River. Foul wastewater will be directed to the existing foul drainage system. Process wastewater will be directed to the onsite treatment plant via treatment in the tank farm. There are no predicted effects from the operational phase.
There are no predicted effects on any European sites given:

- The distance between the Proposed Development and any European Sites, over 15 river km downstream;
- There are no predicted emissions to air, water or the environment during the construction or operational phases that would result in significant effects.

It has been objectively concluded by Moore Group Environmental Services that:

1. The Proposed Development is not directly connected with, or necessary to the conservation management of the European sites considered in this assessment.
2. The Proposed Development is unlikely to either directly or indirectly significantly affect the Qualifying interests or Conservation Objectives of the European sites considered in this assessment.
3. The Proposed Development, alone or in combination with other projects, is not likely to have significant effects on the European sites considered in this assessment in view of their conservation objectives.
4. It is possible to conclude that significant effects can be excluded at the screening stage.

It can be *excluded*, on the basis of objective information, that the Proposed Development, individually or in combination with other plans or projects, will have a significant effect on a European site.

An appropriate assessment is not, therefore, required.

9.0 AIR QUALITY & CLIMATE

9.1 INTRODUCTION

This chapter evaluates the impacts which the Proposed Development may have on Air Quality & Climate during the construction, operational and decommissioning stages as defined in the EPA EIA Report Guidelines 2022 and EPA Draft Advice Notes for EIS 2015, as well as in line with Article 94 and Schedule 6 of the Planning and Development Regulations 2001 (as amended) and Article 5 and Annex IV of the EIA Directive (2011/92/EU, as amended).

An assessment of the likely dust related impacts as a result of construction activities and decommissioning activities was undertaken and used to inform a series of mitigation measures presented in this chapter.

Air dispersion modelling of operational stage emissions from the existing emission points and the new thermal oxidiser was carried out using the United States Environmental Protection Agency's regulated model AERMOD as recommended by the EPA (EPA, 2020a).

Air dispersion modelling has thus been undertaken both based on normal operations of EP-P1-03, EP-UT-01 and a proposed new thermal oxidiser (TO), as well as bypass operations of the new TO via the existing VOC abatement system EP-P1-02.

In line with EPA publication "Agency Protocol for the Bypass of Air Emissions Abatement Equipment" (EPA, 2008), the environmental significance of any emission needs to be determined on a case-by-case basis for each bypass event and should be determined with consideration of the following:

- Concentration or mass coupled with duration of bypass;
- Maximum worst case emission on a kg/hr basis compared with relevant emission limit values and/or mass emission thresholds (e.g. TA Luft);
- Results of air and/or odour dispersion modelling to assess impact;
- Odour impacts and/or complaints; and
- Geographical location including sensitive receptors.

The purpose of this modelling study is to determine whether the emissions from the site will lead to ambient concentrations which are in compliance with the relevant ambient air quality standards for NO_2 and VOCs and to identify the location and maximum of the worst-case ground level concentrations for each compound assessed. In relation to emissions from the combustion sources onsite, CO emissions are likely to be negligible relative to the ambient air quality standard (i.e. the CO emission level is likely to be of a similar magnitude to NO_X emissions whilst the CO ambient air quality standard is 10,000 $\mu g/m^3$ compared to the NO_2 limit of 200 $\mu g/m^3$) and thus CO emissions have been screened out of the current assessment.

This chapter describes the outcome of this study. The study consists of the following components:

- Review of emission data and other relevant information needed for the modelling study;
- Summary of background NO_2 and VOCs levels;
- Dispersion modelling of NO_2 and VOCs under the maximum emission scenario;
- Dispersion modelling of NO_2 under a cumulative emission scenario;

- Dispersion modelling of VOCs (and associated odour) under the worst-case bypass scenarios;
- Presentation of predicted ground level concentrations of released substances; and
- Evaluation of the significance of these predicted concentrations, including consideration of whether these ground level concentrations are likely to exceed the relevant ambient air quality limit values.

9.2 METHODOLOGY

9.2.1 Criteria for Rating of Impacts

9.2.1.1 Ambient Air Quality Standards

In order to reduce the risk to health from poor air quality, the Department of the Environment, Heritage and Local Government in Ireland and the European Parliament and Council of the European Union have set limit values in ambient air for a range of air pollutants. These limit values or "Air Quality Standards" are health or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set (see Table 9.1).

Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland include the Air Quality Standards Regulations 2011, which give effect to European Commission Directive 2008/50/EC which has set limit values for the pollutants NO_2, PM_{10}, and $PM_{2.5}$ relevant to this assessment. Council Directive 2008/50/EC combines the previous Air Quality Framework Directive (96/62/EC) and its subsequent daughter directives (including 1999/30/EC and 2000/69/EC) and also includes ambient limit values relating to $PM_{2.5}$.

Table 9.1 Air Quality Standards Regulations 2011 (based on EU Council Directive 2008/50/EC)

Pollutant	Regulation (Note 1)	Limit Type	Value
Nitrogen Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	200 µg/m^3 NO_2
	2008/50/EC	Annual limit for protection of human health	40 µg/m^3 NO_2
Nitrogen Oxides ($NO + NO_2$)	2008/50/EC	Critical limit for the protection of vegetation and natural ecosystems	30 µg/m^3 $NO + NO_2$
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50 µg/m^3 PM_{10}
	2008/50/EC	Annual limit for protection of human health	40 µg/m^3 PM_{10}
Particulate Matter (as $PM_{2.5}$)	2008/50/EC	Annual limit for protection of human health	25 µg/m^3 $PM_{2.5}$
Dust Deposition	TA Luft (German VDI 2002)	Annual average limit for nuisance dust	350 mg/(m^2*day)

Note 1 EU 2008/50/EC – Clean Air For Europe (CAFÉ) Directive replaces the previous Air Framework Directive (1996/30/EC) and daughter directives 1999/30/EC and 2000/69/EC

Emissions of Volatile Organic Compounds from Organic Solvent Regulations (2002) (SI No. 543 of 2002) and subsequently the Industrial Emission Directive (2010/75/EU)

outlines appropriate mass emission limits of volatile organic compounds from a range of industries. However, no statutory air quality standards for the individual organic compounds exist in Irish legislation. In the absence of statutory standards, it is common practice to reference other suitable authorities such as the World Health Organisation (WHO) or derive an ambient air quality guideline from occupational exposure limits (OEL).

In line with the approach outlined in AG4 (EPA, 2020a), where no EU air quality standard exists, relevant statutory standards from other EU countries such as the UK, Germany or Denmark should be used. The most stringent European guideline / limit value from the sources outlined below should be referenced when determining compliance in the absence of an applicable EU ambient air quality standard. The relevant statutory guidance can be obtained from the following sources:

- Environmental Assessment Level (EAL) based on the Health & Safety Authority publication 2020 Code of Practice for the Safety, Health and Welfare at Work (Chemical Agents) Regulations 2001 (S.I. No. 619 of 2001). The EAL should be derived using the approach outlined in Appendix D of UK Environment Agency "IPPC H1 - IPPC Environmental Assessment and Appraisal of BAT" (UKEA, 2003). The guidance outlines the approach for deriving both short-term and long-term EALs. In relation to the long-term (annual) EAL, this can be derived by applying a factor of 100 to the 8-hour Occupational Exposure Level (OEL). The factor of 100 allows for both the greater period of exposure and the greater sensitivity of the general population. For short-term (1-hour) exposure, the EAL is derived by applying a factor of 10 to the short term exposure limit (STEL). In this case, only the sensitivity of the general population need be taken into account as there is no need for additional safety factors in terms of the period of exposure. Where STELs are not listed then a value of 3 times the 8-hour time weighted average occupational exposure limit may be used (UKEA, and DEFRA, 2016);

- EALs outlined at the UK DEFRA website https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit (UKEA, and DEFRA, 2016).

Error! Reference source not found. identifies the appropriate short-term and long-term EALs, derived from the most stringent sources above, for the VOC compounds which are likely to be used on-site.

Table 9.2 VOC Guideline Values Derived From EAL/OEL For Compounds Used Onsite

Pollutant	Regulation	Limit Type	Annual Mean Value	1-Hour Value
1-Ethyl-3-(3-dimethylaminopropyl)carbodiimide	-	-	-	-
2-butanol	2021 Code of Practice EAL	Guideline Value	30,000	4,500
Acetic acid	IPPC H1 EAL	Guideline Value	250	3,700
Acetic anhydride	IPPC H1 EAL	Guideline Value	1	40
Acetone	IPPC H1 EAL	Guideline Value	18,100	362,000
Acetonitrile	IPPC H1 EAL	Guideline Value	680	10,200
Acetyl chloride	-	-	-	-

Pollutant	Regulation	Limit Type	Annual Mean Value	1-Hour Value
Chlorobenzene	IPPC H1 EAL	Guideline Value	2,340	70,200
Cyclopentyl methyl ether	-	-	-	-
Dichloromethane	IPPC H1 EAL	Guideline Value	700	3,000
Difluorophenylboronic acid	-	-	-	-
Diisopropylamine	IPPC H1 EAL	Guideline Value	210	6,300
Dimethyl phosphonate	-	-	-	-
Mimethyl sulfoxide (DMSO)	-	-	-	-
Dimethylacetamide (DMAC)	IPPC H1 EAL	Guideline Value	360	7,200
Dimethylformamide (DMF)	IPPC H1 EAL	Guideline Value	300	6,100
Ethane	-	-	-	-
Ethanol	IPPC H1 EAL	Guideline Value	19,200	576,000
Ethyl acetate	IPPC H1 EAL	Guideline Value	14,600	420,000
Ethyl sulfonyl chloride	-	-	-	-
Ethylene	-	-	-	-
Formaldehyde	IPPC H1 EAL	Guideline Value	5	100
Hexane	IPPC H1 EAL	Guideline Value	720	21,600
Isopropanol	IPPC H1 EAL	Guideline Value	9,990	125,000
Isopropyl acetate	IPPC H1 EAL	Guideline Value	-	84,900
Methane	-	-	-	-
Methanol	IPPC H1 EAL	Guideline Value	2,660	33,300
Methyl tert-butyl ether	2021 Code of Practice EAL	Guideline Value	18,350	3,670
Methylamine	IPPC H1 EAL	Guideline Value	130	3,900
Methylcyclohexane	2021 Code of Practice EAL	Guideline Value	4,800	160,000
N,N-Diisopropylethylamine (DIPEA)	-	-	-	-
N-Acetyl-L-Cysteine	-	-	-	-
N-Heptane	Derived from OEL	Guideline Value	20,850	62,550
N-Methylimidazole	-	-	-	-
Palladium triphenylphosphine	-	-	-	-
Propane	-	-	-	-
Propionyl chloride	-	-	-	-

Pollutant	Regulation	Limit Type	Annual Mean Value	1-Hour Value
Pyridine 4-boronic acid	-	-	-	-
Pyridine-3-sulfonyl chloride (PSC)	-	-	-	-
Pyrrolidine	-	-	-	-
THF	IPPC H1 EAL	Guideline Value	3,000	59,900
Toluene	IPPC H1 EAL	Guideline Value	19,190	8,000
Triethylamine	IPPC H1 EAL	Guideline Value	420	6,300
Triphenylphosphine	-	-	-	-

In line with EPA publication "*Agency Protocol for the Bypass of Air Emissions Abatement* Equipment" (EPA, 2008), the environmental significance of odorous compounds needs to be assessed for each bypass event.

The EPA publication "*Air Dispersion Modelling from Industrial Installations Guidance Note (AG4)* (EPA, 2020a)" has outlined a range of odour criteria relating to emissions from industrial facilities from 1.5 OU_E/m^3 (most offensive) – 6.0 OU_E/m^3 (least offensive) as a 98th%ile of hourly averages. Given that emissions are mainly solvent based, and similar to paint-spraying operations, a mediumly offensive odour of criteria of 3.0 OU_E/m^3 as a 98th%ile of hourly averages would be appropriate. The odour detection threshold criteria associated with the solvents used onsite is outlined in **Error! Reference source not found.**. In order to compare to the odour criteria, a value of three times the odour detection threshold, which by definition is 1.0 OU_E/m^3, should be used.

Table 9.3 Odour Detection Thresholds & Nuisance Criteria For Compounds Used Onsite

Pollutant	Source	Odour Detection Threshold	Odour Concentration Equivalent To 3.0 OU_E/m^3
1-Ethyl-3-(3-dimethylaminopropyl)carbodiimide	-	-	-
2-butanol	IPPC H4 Threshold	3,000	9,000
Acetic acid	IPPC H4 Threshold	43	129
Acetic anhydride	IPPC H4 Threshold	1.3	4
Acetone	IPPC H4 Threshold	13,900	41,700
Acetonitrile	USEPA Hazard Summary	282,000	846,000
Acetyl chloride	-	-	-
Chlorobenzene	USEPA Hazard Summary	1,000	3,000
Cyclopentyl methyl ether	-	-	-
Dichloromethane	IPPC H4 Threshold	3,420	10,260
Difluorophenylboronic acid	-	-	-
Diisopropylamine	National Institutes for Health PubChem	52	157
Dimethyl phosphonate	-	-	-

Pollutant	Source	Odour Detection Threshold	Odour Concentration Equivalent To 3.0 OU_E/m^3
Mimethyl sulfoxide (DMSO)	-	-	-
Dimethylacetamide (DMAC)	AEA Technology	39,700	119,100
Dimethylformamide (DMF)	USEPA Hazard Summary	6,380	19,140
Ethane	-	-	-
Ethanol	IPPC H4 Threshold	280	840
Ethyl acetate	IPPC H4 Threshold	2,410	7,230
Ethyl sulfonyl chloride	-	-	-
Ethylene	-	-	-
Formaldehyde	USEPA Hazard Summary	1,021	3,063
Hexane	USEPA Hazard Summary	458,900	1,376,700
Isopropanol	Haz-Map	3,563	10,690
Isopropyl acetate	Haz-Map	1,495	4,484
Methane	-	-	-
Methanol	AEA Technology	4,000	12,000
Methyl tert-butyl ether	Haz-Map	180	541
Methylamine	Haz-Map	5	14
Methylcyclohexane	Haz-Map	573,620	1,720,859
N,N-Diisopropylethylamine (DIPEA)	-	-	-
N-Acetyl-L-Cysteine	-	-	-
N-Heptane	Haz-Map	49,130	147,391
N-Methylimidazole	-	-	-
Palladium triphenylphosphine	-	-	-
Propane	-	-	-
Propionyl chloride	-	-	-
Pyridine 4-boronic acid	-	-	-
Pyridine-3-sulfonyl chloride (PSC)	-	-	-
Pyrrolidine	-	-	-
THF	Haz-Map	221	664
Toluene	IPPC H4 Threshold	644	1,932
Triethylamine	IPPC H4 Threshold	3	8
Triphenylphosphine	-	-	-

9.2.1.2 Dust Deposition Guidelines

The concern from a health perspective is focused on particles of dust which are less than 10 microns and the EU ambient air quality standards outlined in the previous section have set ambient air quality limit values for PM_{10} and $PM_{2.5}$.

With regard to larger dust particles that can give rise to nuisance dust, there are no statutory guidelines regarding the maximum dust deposition levels that may be

generated during the construction and decommissioning phases of a development in Ireland.

With regard to dust deposition, the German TA-Luft standard for dust deposition (non-hazardous dust) (German VDI, 2002) sets a maximum permissible emission level for dust deposition of 350 mg/(m^2*day) averaged over a one-year period at any receptors outside the site boundary. The TA-Luft standard has been applied for the purpose of this assessment based on recommendations from the EPA in Ireland in the document titled *'Environmental Management Guidelines - Environmental Management in the Extractive Industry (Non-Scheduled Minerals)'* (EPA, 2006). The document recommends that the Bergerhoff limit of 350 mg/(m^2*day) be applied to the site boundary of quarries. This limit value shall be implemented with regard to dust impacts from construction of the Proposed Development.

9.2.1.3 Climate Agreements

Ireland is party to both the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. The Paris Agreement, which entered into force in 2016, is an important milestone in terms of international climate change agreements and includes an aim of limiting global temperature increases to no more than 2°C above pre-industrial levels with efforts to limit this rise to 1.5°C. The aim is to limit global GHG emissions to 40 gigatonnes as soon as possible whilst acknowledging that peaking of GHG emissions will take longer for developing countries. Contributions to GHG emissions will be based on Intended Nationally Determined Contributions (INDCs) which will form the foundation for climate action post 2020. Significant progress was also made in the Paris Agreement on elevating adaption onto the same level as action to cut and curb emissions.

In order to meet the commitments under the Paris Agreement, the EU enacted Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No. 525/2013 (the Regulation). The Regulation aims to deliver, collectively by the EU in the most cost-effective manner possible, reductions in GHG emissions from the Emission Trading Scheme (ETS) and non-ETS sectors amounting to 43% and 30%, respectively, by 2030 compared to 2005. Ireland's obligation under the Regulation is a 30% reduction in non-ETS greenhouse gas emissions by 2030 relative to its 2005 levels.

In 2015, the Climate Action and Low Carbon Development Act 2015 (No. 46 of 2015) (Government of Ireland, 2015) was enacted (the Act). The purpose of the Act was to enable Ireland 'to pursue, and achieve, the transition to a low carbon, climate resilient and environmentally sustainable economy by the end of the year 2050' (3.(1) of No. 46 of 2015). This is referred to in the Act as the 'national transition objective'. The Act made provision for a national mitigation plan, and a national adaptation framework. In addition, the Act provided for the establishment of the Climate Change Advisory Council with the function to advise and make recommendations on the preparation of the national mitigation and adaptation plans and compliance with existing climate obligations.

The Climate Action Plan (CAP) (Government of Ireland, 2019), published in June 2019, outlines the current status across key sectors including Electricity, Transport, Built Environment, Industry and Agriculture and outlines the various broadscale measures required for each sector to achieve ambitious decarbonisation targets. The CAP also details the required governance arrangements for implementation including carbon-proofing of policies, establishment of carbon budgets, a strengthened Climate Change Advisory Council and greater accountability to the Oireachtas. The CAP has

set a built environment sector reduction target of 40 - 45% relative to 2030 pre-NDP (National Development Plan) projections.

Following on from Ireland declaring a climate and biodiversity emergency in May 2019 and the European Parliament approving a resolution declaring a climate and environment emergency in Europe in November 2019, the Government approved the publication of the General Scheme in December 2019 followed by the publication of the Climate Action and Low Carbon Development (Amendment) Bill 2021 (hereafter referred to as the 2021 Climate Bill) in March 2021 (Government of Ireland, 2021a). The 2021 Climate Bill was prepared for the purposes of giving statutory effect to the core objectives stated within the CAP.

The purpose of the 2021 Climate Bill, if enacted, is to provide for the approval of plans 'for the purpose of pursuing the transition to a climate resilient, biodiversity rich and climate neutral economy by no later than the end of the year 2050'. The 2021 Climate Act will also 'provide for carbon budgets and a decarbonisation target range for certain sectors of the economy'. The 2021 Climate Bill defines the carbon budget as *'the total amount of greenhouse gas emissions that are permitted during the budget period'*.

The 2021 Climate Bill removes any reference to a national mitigation plan and instead refers to both the Climate Action Plan, as published in 2019, and a series of National Long Term Climate Action Strategies. In addition, the Environment Minister shall request each local authority to make a 'local authority climate action plan' lasting five years and to specify the mitigation measures and the adaptation measures to be adopted by the local authority.

The Government published the second Climate Action Plan in November 2021 (Government of Ireland, 2021b). The plan aims to set out how Ireland can reduce our greenhouse gas emissions by 51% by 2030 (compared to 2018 levels) which is in line with the EU ambitions, and a longer-term goal of to achieving net-zero emissions no later than 2050.

9.2.2 Construction Phase

9.2.2.1 Air Quality

The current assessment focuses on identifying the existing baseline levels of PM_{10} and $PM_{2.5}$ in the region of the Proposed Development by an assessment of EPA monitoring data. Thereafter, the impact of the construction phase of the development on air quality was determined by a qualitative assessment of the nature and scale of dust generating construction activities associated with the Proposed Development.

The Institute of Air Quality Management in the UK (IAQM) guidelines (2014) outline an assessment method for predicting the impact of dust emissions from demolition, earthworks, construction and haulage activities based on the scale and nature of the works and the sensitivity of the area to dust impacts. The IAQM methodology has been applied to the construction phase of this development in order to predict the likely magnitude of the dust impacts in the absence of mitigation measures.

Construction phase traffic also has the potential to impact air quality and climate. The UK Highways Agency Design Manual for Roads and Bridges (DMRB) guidance (UK Highways Agency, 2019a), states that road links meeting one or more of the following criteria can be defined as being 'affected' by a proposed development and should be included in the local air quality assessment. The use of the UK guidance is recommended by the TII (2011) in the absence of specific Irish guidance, this

approach is considered best practice and can be applied to any development that causes a change in traffic.

- Annual average daily traffic (AADT) changes by 1,000 or more;
- Heavy duty vehicle (HDV) AADT changes by 200 or more;
- A change in speed band; or
- A change in carriageway alignment by 5m or greater.

The construction stage traffic does not meet the above scoping criteria. Therefore, a detailed air quality modelling assessment has been scoped out as there is no potential for significant impacts to air quality during construction as a result of traffic emissions.

9.2.2.2 Climate

The impact of the construction phase of the Proposed Development on climate was determined by a qualitative assessment of the nature and scale of greenhouse gas generating construction activities associated with the Proposed Development.

9.2.3 Operational Phase

9.2.3.1 Air Quality

Air dispersion modelling was carried out by AWN Consulting Ltd. using the United States Environmental Protection Agency's regulated model AERMOD (Version 21112). AERMOD is recommended as an appropriate model for assessing the impact of air emissions from industrial facilities in the EPA Guidance document "Air Dispersion Modelling from Industrial Installations Guidance Note (AG4)" (EPA, 2020a).

The modelling of air emissions from the site was carried out to assess the concentrations of nitrogen dioxide (NO_2) and volatile organic compounds (VOCs) beyond the site boundary and the consequent impact on human health. The assessment was undertaken in order to quantify the impact of the Proposed Development and the existing baseline level of pollutants on ambient air quality concentrations.

To obtain all the meteorological information required for use in the model, data collected during 2017 – 2021 from the Met Éireann meteorological station at Casement Aerodrome has been incorporated into the modelling. The air dispersion modelling input data consisted of information on the physical environment, design details for all emission points on-site and five full years of meteorological data. Using this input data, the model predicted ambient concentrations beyond the site boundary for each hour of the meteorological year. The model post-processed the data to identify the location and maximum of the worst-case ground level concentration. This worst-case concentration was then added to the background concentration to give the worst-case predicted environmental concentration (PEC). The PEC was then compared with the relevant ambient air quality standard to assess the significance of the releases from the site.

Throughout this study a worst-case approach was taken. This will most likely lead to an over-estimation of the levels that will arise in practice. The worst-case assumptions are outlined below:

- Maximum predicted concentrations were reported in this study, even if no residential receptors were near the location of this maximum;

- Worst-case background concentrations were used to assess the baseline levels of substances released from the site;
- The effects of building downwash, due to on-site and any nearby off-site buildings, has been included in the model;
- Worst-case operations for NO_2 and VOCs emissions assumes all emission points were running continuously for a full year;
- Modelling assumed that all emission points were running continuously at the IE Licence emission concentration and maximum volume flow for every hour of the year; and
- Under the bypass scenario, emissions of VOCs were routed from the new TO to the existing VOC abatement system for a worst-case period of 4 hours for every day of the year.

AERMOD is a "new-generation" steady-state Gaussian plume model used to assess pollutant concentrations associated with industrial sources. The model is an enhancement of the Industrial Source Complex-Short Term 3 (ISCST3) model which has been widely used for emissions from industrial sources. Details of the model are given in Appendix 9.1. Fundamentally, the model has made significant advances in simulating the dispersion process in the boundary layer. This will lead to a more accurate reflection of real-world processes and thus considerably enhance the reliability and accuracy of the model particularly under those scenarios which give rise to the highest ambient concentrations.

Due to the proximity to surrounding buildings, the PRIME Building Downwash Program (BPIP Prime) has been incorporated into the model to determine the influence (wake effects) of these buildings on dispersion in each direction considered.

The AERMOD model incorporated the following features:

- Two receptor grids were created at which concentrations would be modelled. Receptors were mapped with sufficient resolution to ensure all localised "hot-spots" were identified without adding unduly to processing time. The receptor grids were based on Cartesian grids with the site at the centre. An outer grid extended to 9000 m^2 with the site at the centre and with concentrations calculated at 300 m intervals. A smaller denser grid extended to 2500 m^2 from the site with concentrations calculated at 50 m intervals. Boundary receptor locations were also placed along the boundary of the site, at 25 m intervals, giving a total of 3,681 calculation points for the model. All receptors have been modelled at 1.5 m to represent breathing height;
- All on-site buildings and significant process structures were mapped into the computer to create a three-dimensional visualisation of the site and its emission points. Buildings and process structures can influence the passage of airflow over the emission stacks and draw plumes down towards the ground (termed building downwash). The stacks themselves can influence airflow in the same way as buildings by causing low pressure regions behind them (termed stack tip downwash). Both building and stack tip downwash were incorporated into the modelling.;
- Detailed terrain has been mapped into the model using SRTM data with 90 m resolution. The site is located in gentle terrain. All terrain features have been mapped in detail into the model using the terrain pre-processor AERMAP (USEPA, 2018);
- Hourly-sequenced meteorological information has been used in the model covering the years 2017 – 2021 from the Met Éireann meteorological station at Casement Aerodrome as shown in Figure 9.1 (www.met.ie). AERMOD incorporates a meteorological pre-processor AERMET which allows AERMOD

to account for changes in the plume behaviour with height using information on the surface characteristics of the site. AERMET calculates hourly boundary layer parameters for use by AERMOD, including friction velocity, Monin-Obukhov length, convective velocity scale, temperature scale, convective boundary layer (CBL) height, stable boundary layer (SBL) height, and surface heat flux (see Appendix 9.2); and

- The source and emission data, including stack dimensions, gas volumes and emission temperatures have been incorporated into the model.

Terrain

The AERMOD air dispersion model has a terrain pre-processor AERMAP (USEPA, 2018) which was used to map the physical environment in detail over the receptor grid. The digital terrain input data used in the AERMAP pre-processor was obtained from SRTM. This data was run to obtain for each receptor point the terrain height and the terrain height scale. The terrain height scale is used in AERMOD to calculate the critical dividing streamline height, Hcrit, for each receptor. The terrain height scale is derived from the Digital Elevation Model (DEM) files in AERMAP by computing the relief height of the DEM point relative to the height of the receptor and determining the slope. If the slope is less than 10%, the program goes to the next DEM point. If the slope is 10% or greater, the controlling hill height is updated if it is higher than the stored hill height.

In areas of complex terrain, AERMOD models the impact of terrain using the concept of the dividing streamline (Hc). As outlined in the AERMOD model formulation (USEPA, 2008) a plume embedded in the flow below Hc tends to remain horizontal; it might go around the hill or impact on it. A plume above Hc will ride over the hill. Associated with this is a tendency for the plume to be depressed toward the terrain surface, for the flow to speed up, and for vertical turbulent intensities to increase.

AERMOD model formulation states that the model "captures the effect of flow above and below the dividing streamline by weighting the plume concentration associated with two possible extreme states of the boundary layer (horizontal plume and terrain-following). The relative weighting of the two states depends on: 1) the degree of atmospheric stability; 2) the wind speed; and 3) the plume height relative to terrain. In stable conditions, the horizontal plume "dominates" and is given greater weight while in neutral and unstable conditions, the plume traveling over the terrain is more heavily weighted" (USEPA, 2021).

Geophysical Considerations

AERMOD simulates the dispersion process using planetary boundary layer (PBL) scaling theory (USEPA, 2021). PBL depth and the dispersion of pollutants within this layer are influenced by specific surface characteristics such as surface roughness, albedo and the availability of surface moisture. Surface roughness is a measure of the aerodynamic roughness of the surface and is related to the height of the roughness element. Albedo is a measure of the reflectivity of the surface whilst the Bowen ratio is a measure of the availability of surface moisture.

AERMOD incorporates a meteorological pre-processor AERMET (EPA, 2020a) to enable the calculation of the appropriate parameters. The AERMET meteorological preprocessor requires the input of surface characteristics, including surface roughness (z0), Bowen Ratio and albedo by sector and season, as well as hourly observations of wind speed, wind direction, cloud cover, and temperature. The values of albedo, Bowen Ratio and surface roughness depend on land-use type (e.g., urban, cultivated land etc) and vary with seasons and wind direction. The assessment of appropriate

land-use type was carried out to a distance of 10km from the meteorological station for Bowen Ratio and albedo and to a distance of 1km for surface roughness in line with USEPA recommendations (USEPA; 2008) as outlined in Appendix 9.2.

In relation to AERMOD, detailed guidance for calculating the relevant surface parameters has been published (ADEC, 2008). The most pertinent features are:

- The surface characteristics should be those of the meteorological site (Casement Aerodrome) rather than the installation;
- Surface roughness should use a default 1km radius upwind of the meteorological tower and should be based on an inverse-distance weighted geometric mean. If land use varies around the site, the land use should be sub-divided by sectors with a minimum sector size of 30°; and
- Bowen ratio and albedo should be based on a 10km grid. The Bowen ratio should be based on an un-weighted geometric mean. The albedo should be based on a simple un-weighted arithmetic mean.

AERMOD has an associated pre-processor, AERSURFACE (USEPA, 2008), which has representative values for these parameters depending on land use type. The AERSURFACE pre-processor currently only accepts NLCD92 land use data which covers the USA. Thus, manual input of surface parameters is necessary when modelling in Ireland. Ordnance survey discovery maps (1:50,000) and digital maps such as those provided by the EPA, National Parks and Wildlife Service (NPWS) and Google Earth® are useful in determining the relevant land use in the region of the meteorological station. The Alaska Department of Environmental Conservation has issued a guidance note for the manual calculation of geometric mean for surface roughness and Bowen ratio for use in AERMET (ADEC, 2008). This approach has been applied to the current site with full details provided in Appendix 9.2.

Building Downwash

When modelling emissions from an industrial installation, stacks which are relatively short can be subjected to additional turbulence due to the presence of nearby buildings. Buildings are considered nearby if they are within five times the lesser of the building height or maximum projected building width (but not greater than 800m).

The USEPA has defined the "Good Engineering Practice" (GEP) stack height as the building height plus 1.5 times the lesser of the building height or maximum projected building width. It is generally considered unlikely that building downwash will occur when stacks are at or greater than GEP (USEPA, 1985).

When stacks are less than this height, building downwash will tend to occur. As the wind approaches a building it is forced upwards and around the building leading to the formation of turbulent eddies. In the lee of the building these eddies will lead to downward mixing (reduced plume centreline and reduced plume rise) and the creation of a cavity zone (near wake) where re-circulation of the air can occur. Plumes released from short stacks may be entrained in this airflow leading to higher ground level concentrations than in the absence of the building.

The Plume Rise Model Enhancements (PRIME) (Paine & Lew, 1997a; Schulman et al., 2000) plume rise and building downwash algorithms, which calculates the impact of buildings on plume rise and dispersion, have been incorporated into AERMOD. The building input processor BPIP-PRIME produces the parameters which are required in order to run PRIME. The model takes into account the position of each stack relative to each relevant building and the projected shape of each building for 36 wind directions (at 10° intervals). The model determines the change in plume centreline

location with downwind distance based on the slope of the mean streamlines and coupled to a numerical plume rise model (Paine & Lew, 1997a).

Given that most stacks onsite are less than 2.5 times the lesser of the building height or maximum projected building width, building downwash will need to be taken into account and the PRIME algorithm run prior to modelling with AERMOD. The dominant building may change as the wind direction changes for each of the 36 wind directions. The dominant building for each relevant stack will vary as a function of wind direction and relative building heights.

9.2.3.2 Climate

The impact of the operational phase of the development on climate was determined by a qualitative assessment of the nature and scale of greenhouse gas generating operational activities associated with the Proposed Development.

9.3 RECEIVING ENVIRONMENT

9.3.1 Meteorological Data

The selection of the appropriate meteorological data has followed the guidance issued by the USEPA (USEPA, 2017). A primary requirement is that the data used should have a data capture of greater than 90% for all parameters. Casement Aerodrome meteorological station, which is located approximately 1.6 km south-east of the site, collects data in the correct format and has a data collection of greater than 90%. Long-term hourly observations at Casement Aerodrome meteorological station provide an indication of the prevailing wind conditions for the region (see Figure 9.1). Results indicate that the prevailing wind direction is from south to north-westerly in direction over the period 2017 - 2021. The mean wind speed is approximately 5.5 m/s over the period 1981-2010. Calm conditions account for only a small fraction of the time in any one year peaking at 70 hours in 2018 (0.8% of the time).

9.3.2 Baseline Air Quality

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent EPA published annual report on air quality "*Air Quality In Ireland 2020*" (EPA, 2021a) details the range and scope of monitoring undertaken throughout Ireland.

As part of the implementation of the Framework Directive on Air Quality (1996/62/EC), four air quality zones have been defined in Ireland for air quality management and assessment purposes as outlined within the EPA document titled 'Air Quality In Ireland 2020' (EPA, 2021a). Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 23 towns with a population of greater than 15,000. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000 is defined as Zone D. In terms of air monitoring, Grangecastle is categorised as Zone A.

9.3.2.1 NO_2

With regard to NO_2, continuous monitoring data from the EPA (EPA, 2021a), at suburban Zone A background locations in Rathmines, Dun Laoghaire, Swords and Ballyfermot show that current levels of NO_2 are below both the annual and 1-hour limit values, with annual average levels ranging from 13 - 22 µg/m^3 over the period 2015 - 2019 (see Table 9.4). Sufficient data is available for the station in Swords to observe

long-term trends since 2015, with annual average results ranging from 13 – 16 µg/m^3, and an average of 14.8 µg/m^3. Based on these results, an estimate of the current background NO_2 concentration in the region of the Proposed Development is 15 µg/m^3.

In 2020 the EPA reported (EPA, 2021a) that Ireland was compliant with EU legal limits at all locations, however this was largely due to the reduction in traffic due to Covid-19 restrictions. The EPA report details the effect that the Covid-19 restrictions had on stations, which included reductions of up to 50% at some monitoring stations which have traffic as a dominant source. The report also notes that CSO figures show that while traffic volumes are still slightly below 2019 levels, they have significantly increased since 2020 levels. 2020 concentrations are therefore predicted to be an exceptional year and not consistent with long-term trends. For this reason, they have not been included in the baseline section.

Table 9.4 Background NO_2 Concentrations In Zone A Locations (µg/m^3)

Station	Averaging Period (Note 1)	Year				
		2015	2016	2017	2018	2019
Ballyfermot	Annual Mean NO_2 (µg/m^3)	16	17	17	17	20
	99.8th%ile 1-hr NO_2 (µg/m^3)	127	90	112	101	101
Dun Laoghaire	Annual Mean NO_2 (µg/m^3)	16	19	17	19	15
	99.8th%ile 1-hr NO_2 (µg/m^3)	91	105	101	91	91
Rathmines	Annual Mean NO_2 (µg/m^3)	18	20	17	20	22
	99.8th%ile 1-hr NO_2 (µg/m^3)	105	88	86	87	102
Swords	Annual Mean NO_2 (µg/m^3)	13	16	14	16	15
	99.8th%ile 1-hr NO_2 (µg/m^3)	93	96	79	85	80

Note 1 Annual average limit value of 40 µg/m^3 and hourly limit value of 200 µg/m^3 (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011)

The Plume Volume Molar Ratio Method (PVMRM) was used to model NO_2 concentrations. The PVMRM is a regulatory option in AERMOD which assumes that the amount of NO converted to NO_2 is proportional to the ambient ozone (O_3) concentration. The PVMRM uses both plume size and O_3 concentration to derive the amount of O_3 available for the reaction between NO and O_3. NO_X moles are determined by emission rate and travel time through the plume segment. The concentration is usually limited by the amount of ambient O_3 that is entrained in the plume. Thus, the ratio of the moles of O_3 to the moles of NO_X gives the ratio of NO_2/NO_X that is formed after the NO_X leaves the stack. In addition, it has been assumed that 5% of the NO_X in the stack gas is already in the form of NO_2 before the gas leaves the stack (Hanrahan, 1999a; Hanrahan, 1999b). The equation used in the algorithm to derive the ratio of NO_2/NO_X is:

$$NO_2/NO_X = (\text{moles } O_3/ \text{ moles } NO_X) + 0.10$$

The ozone concentration used in the PVMRM model runs was 54 µg/m^3 based on the air monitoring stations in Zone A locations over the period 2015 – 2019 (EPA, 2021a).

In terms of predicted environmental concentrations as part of the modelling assessment, the annual average background concentration was added directly to the annual process concentration. In terms of short-term, 1-hour concentrations, a value of twice the annual mean concentration was added to the short-term process concentration.

9.3.2.2 PM_{10}

Continuous PM_{10} monitoring carried out at the suburban background locations of Ballyfermot, Dún Laoghaire, Rathmines and Tallaght showed annual mean concentrations ranging from 11 – 15 µg/m³ in 2019 (see Table 9.5), with at most 2 exceedances (in Rathmines) of the daily limit value of 50 µg/m³ (35 exceedances are permitted per year) (EPA, 2021a). Sufficient data is available for all stations to observe trends over the period 2015 - 2019. Average annual mean PM_{10} concentrations ranged from 9 - 16 µg/m³ over the period of 2015 – 2019, suggesting an upper average concentration of no more than 12.9 µg/m³. PM_{10} results from the urban background location in the Phoenix Park show similarly low levels over the period of 2015 – 2019 with concentrations ranging from 9 – 12 µg/m³. Based on these results, a conservative estimate of the background PM_{10} concentration in the region of the Proposed Development is 15 µg/m³.

Table 9.5 Background PM_{10} Concentrations In Zone A Locations (µg/m³)

Station	Averaging Period (Note 1)	Year				
		2015	2016	2017	2018	2019
Ballyfermot	Annual Mean PM_{10} (µg/m³)	12	11	12	16	14
	24-hr Mean > 50 µg/m³ (days)	3	0	1	0	7
Dun Laoghaire	Annual Mean PM_{10} (µg/m³)	13	13	12	13	12
	24-hr Mean > 50 µg/m³ (days)	3	0	2	0	2
Phoenix Park	Annual Mean PM_{10} (µg/m³)	14	14	12	15	12
	24-hr Mean > 50 µg/m³ (days)	4	0	2	1	3
Rathmines	Annual Mean PM_{10} (µg/m³)	15	15	13	15	15
	24-hr Mean > 50 µg/m³ (days)	5	3	5	2	9
Tallaght	Annual Mean PM_{10} (µg/m³)	12	11	9	11	11
	24-hr Mean > 50 µg/m³ (days)	2	0	1	0	2

Note 1 Annual average limit value of 40 µg/m³ and 24-hour limit value of 50 µg/m³ (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011)

9.3.2.3 $PM_{2.5}$

Continuous $PM_{2.5}$ monitoring carried out at the Zone A location of Rathmines showed an average concentrations ranging from 9 – 10 µg/m³ over the 2015 – 2019 period, with a $PM_{2.5}/PM_{10}$ ratio ranging from 0.60 – 0.68. Based on this information, a conservative ratio of 0.7 was used to generate a background $PM_{2.5}$ concentration in the region of the development of 10.5 µg/m³.

9.3.3 Sensitivity of the Receiving Environment

In line with the UK Institute of Air Quality Management (IAQM) guidance document '*Guidance on the Assessment of Dust from Demolition and Construction*' (2014) prior to assessing the impact of dust from a Proposed Development the sensitivity of the area must first be assessed as outlined below. Both receptor sensitivity and proximity to proposed works areas are taken into consideration. For the purposes of this assessment, high sensitivity receptors are regarded as residential properties where people are likely to spend the majority of their time. Commercial properties and places of work are regarded as medium sensitivity while low sensitivity receptors are places where people are present for short periods or do not expect a high level of amenity.

In terms of receptor sensitivity to dust soiling, there are between 10 and 100 residential properties within 100m of the Proposed Development site. These are considered high

sensitivity receptors in terms of dust soiling. Therefore, the overall sensitivity of the area to dust soiling impacts is considered low based on the IAQM criteria outlined in Table 9.6.

Table 9.6 Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	**Low**	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Source: IAQM (2014) *Guidance on the Assessment of Dust from Demolition and Construction*

In addition to sensitivity to dust soiling, the IAQM guidelines also outline the assessment criteria for determining the sensitivity of the area to human health impacts. The criteria take into consideration the current annual mean PM_{10} concentration, receptor sensitivity based on type (residential receptors are classified as high sensitivity) and the number of receptors affected within various distance bands from the construction works. A conservative estimate of the current annual mean PM_{10} concentration in the vicinity of the Proposed Development 15 $\mu g/m^3$ and there are between 10 and 100 number of high sensitivity residential properties within 100 of the proposed site area. Based on the IAQM criteria outlined in Table 9.7, the worst case sensitivity of the area to human health is considered to be low.

Table 9.7 Sensitivity of the Area **to** Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from source (m)			
			<20	<50	<100	<350
High	< 24 $\mu g/m^3$	>100	Medium	Low	Low	Low
		10-100	Low	Low	**Low**	Low
		1-10	Low	Low	Low	Low
Medium	< 24 $\mu g/m^3$	>10	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Low	< 24 $\mu g/m^3$	>1	Low	Low	Low	Low

Source: IAQM (2014) *Guidance on the Assessment of Dust from Demolition and Construction*

Consideration has also been given to the IAQM document 'A guide to the assessment of air quality on designated conservation sites 2020' (IAQM 2020) with respect to ecologically sensitive receptors.

Dust deposition impacts on ecology can occur due to chemical or physical effects. This includes reduction in photosynthesis due to smothering from dust on the plants and chemical changes such as acidity to soils. Often impacts will be reversible once the works are completed, and dust deposition ceases. Designated sites within 50m of the boundary of the site or within 50m of the route used by construction vehicles on public highways up to a distance of 500m from a construction site entrance can be affected according to the IAQM guidance (IAQM 2016). There are no ecologically sensitive sites within 50m of the site boundary, therefore no significant impacts are predicted.

9.3.4 Climate Baseline

Anthropogenic emissions of greenhouse gases in Ireland included in the EU 2020 strategy are outlined in the most recent review by the EPA which details final emissions

up to 2019 (EPA, 2021b). The data published in 2021 states that Ireland has exceeded its 2019 annual limit set under the EU's Effort Sharing Decision (ESD), 406/2009/EC1 by an estimated 6.85 Mt. For 2019, total national greenhouse gas emissions are 59.78 million tonnes carbon dioxide equivalent (Mt CO_2eq) with 45.58 MtCO_2eq of emissions associated with the ESD sectors for which compliance with the EU targets must be met. Agriculture is the largest contributor in 2019 at 35.3% of the total, with the transport sector accounting for 20.3% of emissions of CO_2.

GHG emissions for 2020 are estimated to be 9.7% lower than those recorded in 2019. Emission reductions have been recorded in 7 of the last 11 years. However, compliance with the annual EU targets has not been met for five years in a row. Emissions from 2016 – 2020 exceeded the annual EU targets by 0.29 MtCO_2eq, 2.94 MtCO_2eq, 5.57 MtCO_2eq, 6.98 MtCO_2eq and 6.73 MtCO_2eq respectively. Agriculture is consistently the largest contributor to emissions with emissions from the transport and energy sectors being the second and third largest contributors respectively in recent years.

The EPA 2021 GHG Emissions Projections Report for 2020 – 2040 (EPA, 2021c) notes that there is a long-term projected decrease in greenhouse gas emissions as a result of inclusion of new climate mitigation policies and measures that formed part of the National Development Plan (NDP) which was published in 2018 and the Climate Action Plan published in 2019. Implementation of these are classed as a "*With Additional Measures scenario*" for future scenarios. A change from generating electricity using coal and peat to wind power and diesel vehicle engines to electric vehicle engines are envisaged under this scenario. While emissions are projected to decrease in these areas, emissions from agriculture are projected to grow steadily due to an increase in animal numbers. However, over the period 2013 to 2020 Ireland is projected to cumulatively exceed its compliance obligations with the EU's Effort Sharing Decision (Decision No. 406/2009/EC) 2020 targets by approximately 12.2MtCO_2eq under the "With Existing Measures" scenario and under the "With Additional Measures" scenario (EPA, 2021c). The projections indicate that Ireland can meet its non-ETS EU targets over the period 2021 – 2030 assuming full implementation of the 2019 Climate Action Plan and the use of the flexibilities available.

9.4 CHARACTERISTICS OF THE DEVELOPMENT

The Proposed Development is described in further detail in Chapter 2 (Description of the Proposed Development). The details of the construction and operation of the development in terms of air quality and climate are discussed below.

9.4.1 Construction Phase

During the construction stage the main source of air quality impacts will be as a result of fugitive dust emissions from site activities. Emissions from construction vehicles and machinery have the potential to impact climate.

9.4.2 Operational Phase

TILGC are currently licensed (IED Licence number P0693-02) to operate three major emission points:

- EP-P1-02 Carbon adsorption system with steam regeneration (existing VOC abatement system);
- EP-P1-03 Carbon absorption system (hydrogenator);

- EP-UT-01 Boiler.

As part of the Proposed Development, one new emission point will become operational. A new TO, EP-P1-04, will be installed. The information used in the dispersion model for the existing and proposed emission point which release either NO_X and VOCs is shown in Tables 9.8 – 9.10.

All VOCs to be released have been modelled at the emission limit value of 20 mg/m^3 for Organic Substances Class I given in the EPA publication "*BAT Guidance Note on Best Available Techniques for the Manufacture of Organic Chemicals*" (EPA, 2008) and in line with the current IE licence. This is the maximum VOC emission concentration expected. The carbon fractions listed in Table 9.10 were then applied to the modelled ambient VOC concentrations in turn for each emitted VOC. It is assumed that where more than one compound is being emitted from any emission point, as a worst-case assumption, the Total VOC (as C) consists of only one compound (in turn) with each compound compared to the 1-hour Environment Assessment Level and annual Environment Assessment Level.

Table 9.8 Emission Point Characteristics Used In The Air Modelling

Stack Reference	Stack Location (UTM)	Height Above Ground Level (m)	Exit Diameter (m)	Cross-Sectional Area (m^2)	Temperature (K)	Max Volume Flow (Nm^3/hr)	Exit Velocity (m/sec actual)
EP-P1-02 (existing VOC abatement system)	669818 E, 5911738 N	11	0.1	0.08	303.15	500	17.68
EP-P1-03 (hydrogenator)	669800 E, 5911826 N	37.4	0.05	0.02	323.15	90	12.73
EP-P1-04 (proposed TO)	669666 E, 5911759 N	12	0.25	0.049	523.15	1,160	6.65
EP-UT-01 (boiler)	669799 E, 5911748 N	15	0.55	0.238	453.15	10,368	12.12

Table 9.9 Process Emissions Used In The Air Modelling

Stack Reference	NO_2 Concentration (mg/Nm^3)	NO_2 Mass Emission (g/s)	VOC (Class I) Concentration (mg/Nm^3) Note 1	VOC (Class I) Mass Emission (g/s) Note 1
EP-P1-02 (existing VOC abatement system)	n/a	n/a	20	0.0025
EP-P1-03 (hydrogenator)	n/a	n/a	20	0.0004
EP-P1-04 (proposed TO)	100	0.0168	20	0.0034
EP-UT-01 (boiler)	150	0.2604	n/a	n/a

Note 1 Applies to both normal and bypass operations

Table 9.10 Emissions Details for VOCs Used In The Air Modelling

Compound	Carbon Weight	Molecular Weight	Carbon Fraction
1-Ethyl-3-(3-dimethylaminopropyl)carbodiimide	96.08	155.24	0.619
2-butanol	48.04	74.12	0.648
Acetic acid	24.02	60.05	0.400
Acetic anhydride	48.04	102.09	0.471
Acetone	36.03	58.08	0.620
Acetonitrile	24.02	41.05	0.585
Acetyl chloride	24.02	78.49	0.306
Chlorobenzene	72.06	112.56	0.640
Cyclopentyl methyl ether	72.06	100.16	0.719
Dichloromethane	12.01	84.93	0.141
Difluorophenylboronic acid	72.06	157.91	0.456
Diisopropylamine	72.06	101.19	0.712
Dimethyl phosphonate	24.02	111.06	0.216
Mimethyl sulfoxide (DMSO)	24.02	78.13	0.307
Dimethylacetamide (DMAC)	48.04	87.12	0.551
Dimethylformamide (DMF)	36.03	73.09	0.493
Ethane	24.02	30.07	0.799
Ethanol	24.02	46.07	0.521
Ethyl acetate	48.04	88.11	0.545
Ethyl sulfonyl chloride	24.02	128.58	0.187
Ethylene	24.02	28.05	0.856
Formaldehyde	12.01	30.03	0.400
Hexane	72.06	86.18	0.836
Isopropanol	36.03	60.10	0.600
Isopropyl acetate	60.05	102.10	0.588
Methane	12.01	16.04	0.749
Methanol	12.01	32.04	0.375
Methyl tert-butyl ether	60.05	88.15	0.681
Methylamine	12.01	31.05	0.387
Methylcyclohexane	84.07	98.19	0.856
N,N-Diisopropylethylamine (DIPEA)	96.08	129.05	0.745
N-Acetyl-L-Cysteine	60.05	163.19	0.368
N-Heptane	84.07	100.21	0.839
N-Methylimidazole	48.04	82.10	0.585
Palladium triphenylphosphine	864.72	1155.56	0.748
Propane	36.03	44.10	0.817
Propionyl chloride	36.03	92.52	0.389
Pyridine 4-boronic acid	60.05	122.92	0.489
Pyridine-3-sulfonyl chloride (PSC)	60.05	177.61	0.338
Pyrrolidine	48.04	71.12	0.675

Compound	Carbon Weight	Molecular Weight	Carbon Fraction
THF	48.04	72.11	0.666
Toluene	84.07	92.14	0.912
Triethylamine	24.02	101.19	0.237
Triphenylphosphine	216.18	262.29	0.824

The modelling was undertaken to assess the impact to ambient air quality from the following operations scenarios.

9.4.2.1 Process Contributions Under Do Nothing Normal Operations

This is based on the normal operations of EP-P1-03, EP-UT-01 and the existing VOC abatement system, EP-P1-02. All emission points were assumed to operate 24 hours per day, 7 days per week as a worst-case scenario.

9.4.2.2 Process Contributions Under Proposed Normal Operations

This is based on the normal operations of EP-P1-03, EP-UT-01 and proposed emission point EP-P1-04. All emission points were assumed to operate 24 hours per day, 7 days per week as a worst-case scenario.

9.4.2.3 Bypass Operations for Process TO

This is based on the bypass operation of the new TO, EP-P1-04. In the event of a system shutdown due to a Critical System Alarm or if Shutdown mode is activated, process emissions from EP-P1-04 will be routed to the existing VOC abatement system, EP-P1-02.

The bypass scenario has been modelled based on the following assumptions:

- It is assumed that bypass events are 4 hours in duration for every day of the year as a worst-case;
- EP-P1-02 is compliant with its licence limit values for VOCs (a test of the bypass function in September 2021 confirmed this, report reference FC/21/13112_WR02); and
- It is assumed that where more than one compound is being emitted from any emission point, as a worst-case assumption, the Total VOC (as C) consists of only one compound (in turn) with each compound compared to the 1-hour Environment Assessment Level.

9.5 POTENTIAL IMPACTS OF THE DEVELOPMENT

9.5.1 Do Nothing Scenario

Under the Do Nothing Scenario no construction works will take place and the identified impacts of fugitive dust and particulate matter emissions and emissions from equipment and machinery will not occur. Impacts from increased traffic volumes and associated air emissions will also not occur.

The ambient air quality at the site will remain as per the baseline and will change in accordance with trends within the wider area (including influences from new developments on the site and in the surrounding area, changes in road traffic, etc.).

9.5.1.1 Process Contributions Under Normal Operations

The NO_2 modelling results are detailed in Table 9.11. The results indicate that the ambient ground level concentrations are below the relevant air quality standards for NO_2. Emissions from the existing emission points lead to an ambient NO_2 concentration (including background) which is 49% of the maximum ambient 1-hour limit value (measured as a 99.8th%ile) and 28% of the annual limit value at the worst-case receptor.

Table 9.11 NO_2 Dispersion Model Results – Process Contributions Under Normal Operations Do Nothing Scenario

Pollutant/ Year	Averaging Period	Process Contribution NO_2 (µg/m^3)	Background Concentration (µg/m^3)	Predicted Environmental Concentration NO_2 (µg/m^3)	Limit Value (µg/m^3)	PEC as a % of Limit Value
NO_2 / 2017	Annual Mean	3.8	16	19.8	40	49%
	99.8th%ile of 1-hr means	23.0	32	55.0	200	28%
NO_2 / 2018	Annual Mean	2.3	16	18.3	40	46%
	99.8th%ile of 1-hr means	23.6	32	55.6	200	28%
NO_2 / 2019	Annual Mean	3.2	16	19.2	40	48%
	99.8th%ile of 1-hr means	23.7	32	55.7	200	28%
NO_2 / 2020	Annual Mean	3.3	16	19.3	40	48%
	99.8th%ile of 1-hr means	24.1	32	56.1	200	28%
NO_2 / 2021	Annual Mean	2.9	16	18.9	40	47%
	99.8th%ile of 1-hr means	23.5	32	55.5	200	28%

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC and S.I. 180 of 2011).

The VOC modelling results are detailed in Table 9.12 and Table 9.13. The results indicate that the ambient ground level concentrations are below the relevant air quality guidelines for individual VOCs even when it is assumed that each emission point is emitting solely the VOC of concern at the IED emission limit for the full year. Emissions from the existing VOC emission points onsite lead to ambient individual VOC concentrations which are no more than 18% of the maximum 1-hour limit value at the worst-case receptor (see Table 9.12) and no more than 17% of the annual mean limit value at the worst-case off-site location (Table 9.13).

Table 9.12 VOCs Dispersion Model Results – Process Contributions Under Normal Operations – Maximum 1-Hour Do Nothing Scenario

Pollutant	1-Hour EAL (µg/Nm^3)	2017 (µg/Nm^3)	2018 (µg/Nm^3)	2019 (µg/Nm^3)	2020 (µg/Nm^3)	2021 (µg/Nm^3)	Max PEC / EAL
1-Ethyl-3-(3-dimethylaminopropyl)carbodiimide	-	5.1	5.4	5.4	5.4	4.9	-
2-butanol	4,500	4.9	5.2	5.1	5.1	4.7	0.1%
Acetic acid	3,700	7.9	8.4	8.3	8.3	7.6	0.2%

Acetic anhydride	40	6.7	7.1	7.0	7.0	6.5	18%
Acetone	362,000	5.1	5.4	5.3	5.3	4.9	0.001 %
Acetonitrile	10,200	5.4	5.7	5.7	5.7	5.2	0.06%
Acetyl chloride	-	10.4	11.0	10.8	10.8	9.9	-
Chlorobenzene	70,200	5.0	5.2	5.2	5.2	4.7	0.01%
Cyclopentyl methyl ether	-	4.4	4.7	4.6	4.6	4.2	-
Dichloromethane	3,000	22.4	23.8	23.5	23.4	21.5	1%
Difluorophenylboronic acid	-	6.9	7.4	7.3	7.3	6.7	-
Diisopropylamine	6,300	4.5	4.7	4.7	4.7	4.3	0.1%
Dimethyl phosphonate	-	14.7	15.5	15.3	15.3	14.0	-
Mimethyl sulfoxide (DMSO)	-	10.3	10.9	10.8	10.8	9.9	-
Dimethylacetamide (DMAC)	7,200	5.8	6.1	6.0	6.0	5.5	0.1%
Dimethylformamide (DMF)	6,100	6.4	6.8	6.7	6.7	6.2	0.1%
Ethane	-	4.0	4.2	4.2	4.1	3.8	-
Ethanol	576,000	6.1	6.4	6.4	6.4	5.8	0.001 %
Ethyl acetate	420,000	5.8	6.2	6.1	6.1	5.6	0.001 %
Ethyl sulfonyl chloride	-	17.0	18.0	17.8	17.7	16.3	-
Ethylene	-	3.7	3.9	3.9	3.9	3.5	-
Formaldehyde	100	7.9	8.4	8.3	8.3	7.6	8%
Hexane	21,600	3.8	4.0	4.0	4.0	3.6	0.02%
Isopropanol	125,000	5.3	5.6	5.5	5.5	5.1	0.004 %
Isopropyl acetate	84,900	5.4	5.7	5.6	5.6	5.2	-
Methane	-	4.2	4.5	4.4	4.4	4.1	-
Methanol	33,300	8.5	9.0	8.8	8.8	8.1	0.03%
Methyl tert-butyl ether	3,670	4.7	4.9	4.9	4.9	4.5	0.1%
Methylamine	3,900	8.2	8.7	8.6	8.6	7.9	0.2%
Methylcyclohexane	160,000	3.7	3.9	3.9	3.9	3.5	0.002 %
N,N-Diisopropylethylamine (DIPEA)	-	4.3	4.5	4.5	4.4	4.1	-
N-Acetyl-L-Cysteine	-	8.6	9.1	9.0	9.0	8.3	-
N-Heptane	62,550	3.8	4.0	4.0	3.9	3.6	0.01%

N-Methylimidazole	-	5.4	5.7	5.7	5.7	5.2	-
Palladium triphenylphosphine	-	4.2	4.5	4.4	4.4	4.1	-
Propane	-	3.9	4.1	4.1	4.1	3.7	-
Propionyl chloride	-	8.1	8.6	8.5	8.5	7.8	-
Pyridine 4-boronic acid	-	6.5	6.9	6.8	6.8	6.2	-
Pyridine-3-sulfonyl chloride (PSC)	-	9.4	9.9	9.8	9.8	9.0	-
Pyrrolidine	-	4.7	5.0	4.9	4.9	4.5	-
THF	59,900	4.8	5.0	5.0	5.0	4.6	0.01%
Toluene	8,000	3.5	3.7	3.6	3.6	3.3	0.05%
Triethylamine	6,300	13.4	14.2	14.0	14.0	12.8	0.2%
Triphenylphosphine	-	3.8	4.1	4.0	4.0	3.7	-

Note 1 Background levels of all VOCs are likely to be well below 1 µg/m^3 in the vicinity of the facility.

Note 2 As a worst-case all VOCs released assumed to consist of each individual VOC in turn for the maximum 1-hour scenario.

Table 9.13 VOCs Dispersion Model Results – Process Contributions Under Normal Operations – Annual Mean Do Nothing Scenario

Pollutant	Annual Mean EAL (µg/Nm^3)	2017 (µg/Nm^3)	20178(µg/Nm^3)	2019 (µg/Nm^3)	2020 (µg/Nm^3)	2021 (µg/Nm^3)	Max PEC / EAL
1-Ethyl-3-(3-dimethylaminopropyl)carbodiimide	-	0.13	0.09	0.12	0.12	0.12	-
2-butanol	30,000	0.12	0.08	0.11	0.11	0.11	0.0004 %
Acetic acid	250	0.20	0.14	0.18	0.18	0.18	0.1%
Acetic anhydride	1	0.17	0.11	0.15	0.16	0.15	17%
Acetone	18,100	0.13	0.09	0.12	0.12	0.12	0.001%
Acetonitrile	680	0.13	0.09	0.12	0.12	0.12	0.02%
Acetyl chloride	-	0.26	0.18	0.23	0.24	0.24	-
Chlorobenzene	2,340	0.12	0.08	0.11	0.11	0.11	0.01%
Cyclopentyl methyl ether	-	0.11	0.08	0.10	0.10	0.10	-
Dichloromethane	700	0.55	0.38	0.51	0.52	0.51	0.1%
Difluorophenylboronic acid	-	0.17	0.12	0.16	0.16	0.16	-
Diisopropylamine	210	0.11	0.08	0.10	0.10	0.10	0.1%
Dimethyl phosphonate	-	0.36	0.25	0.33	0.34	0.33	-
Mimethyl sulfoxide (DMSO)	-	0.26	0.18	0.23	0.24	0.24	-
Dimethylacetamide (DMAC)	360	0.14	0.10	0.13	0.13	0.13	0.04%

Dimethylformamide (DMF)	300	0.16	0.11	0.15	0.15	0.15	0.1%
Ethane	-	0.10	0.07	0.09	0.09	0.09	-
Ethanol	19,200	0.15	0.10	0.14	0.14	0.14	0%
Ethyl acetate	14,600	0.14	0.10	0.13	0.13	0.13	0%
Ethyl sulfonyl chloride	-	0.42	0.29	0.38	0.39	0.39	-
Ethylene	-	0.09	0.06	0.08	0.09	0.08	-
Formaldehyde	5	0.20	0.14	0.18	0.18	0.18	4%
Hexane	720	0.09	0.06	0.09	0.09	0.09	0.01%
Isopropanol	9,990	0.13	0.09	0.12	0.12	0.12	0.001%
Isopropyl acetate	-	0.13	0.09	0.12	0.12	0.12	-
Methane	-	0.10	0.07	0.10	0.10	0.10	-
Methanol	2,660	0.21	0.14	0.19	0.19	0.19	0.01%
Methyl tert-butyl ether	18,350	0.12	0.08	0.11	0.11	0.11	0.001%
Methylamine	130	0.20	0.14	0.19	0.19	0.19	0.2%
Methylcyclohexane	4,800	0.09	0.06	0.08	0.09	0.08	0.002%
N,N-Diisopropylethylamine (DIPEA)	-	0.11	0.07	0.10	0.10	0.10	-
N-Acetyl-L-Cysteine	-	0.21	0.15	0.20	0.20	0.20	-
N-Heptane	20,850	0.09	0.06	0.09	0.09	0.09	0.0004 %
N-Methylimidazole	-	0.13	0.09	0.12	0.12	0.12	-
Palladium triphenylphosphine	-	0.10	0.07	0.10	0.10	0.10	-
Propane	-	0.10	0.07	0.09	0.09	0.09	-
Propionyl chloride	-	0.20	0.14	0.18	0.19	0.19	-
Pyridine 4-boronic acid	-	0.16	0.11	0.15	0.15	0.15	-
Pyridine-3-sulfonyl chloride (PSC)	-	0.23	0.16	0.21	0.22	0.21	-
Pyrrolidine	-	0.12	0.08	0.11	0.11	0.11	-
THF	3,000	0.12	0.08	0.11	0.11	0.11	0.004%
Toluene	19,190	0.09	0.06	0.08	0.08	0.08	0.0004 %
Triethylamine	420	0.33	0.23	0.30	0.31	0.30	0.1%
Triphenylphosphine	-	0.10	0.07	0.09	0.09	0.09	-

Note 1 Background levels of all VOCs are likely to be well below 1 µg/m^3 in the vicinity of the facility.

Note 2 As a worst-case all VOCs released assumed to consist of each individual VOC in turn for the annual mean scenario.

9.5.1.2 Impact of NO_X on Designated Habitat Sites

The impact of emissions of NO_X within 20 km of the existing facility in the Do Nothing scenario on ambient ground level concentrations within the following designated habitat sites was assessed using AERMOD. The 20 km distance was selected based on maximum extent of the impact zone from the air emissions onsite. After 20 km, the ambient air concentration of NO_X due to emissions from the facility are imperceptible.

- **Proposed Natural Heritage Areas (pNHA)** – Ballybetagh Bog pNHA, Booterstown Marsh pNHA, Dodder Valley pNHA, Dolphins, Dublin Docks pNHA, Donadea Wood pNHA, Fitzsimon's Wood pNHA, Glenasmole Valley pNHA, Glencree Valley pNHA, Grand Canal pNHA, Kilteel Wood pNHA, Liffey At Osberstown pNHA, Liffey Valley pNHA, Lugmore Glen pNHA, North Dublin Bay pNHA, Poulaphouca Reservoir pNHA, Red Bog, Kildare pNHA, Royal Canal pNHA, Rye Water Valley/Carton pNHA, Santry Demesne pNHA, Slade Of Saggart And Crooksling Glen pNHA, South Dublin Bay pNHA; and

- **Special Areas of Conservation (SAC)** – Glenasmole Valley SAC, North Dublin Bay SAC, Red Bog, Kildare SAC, Rye Water Valley/Carton SAC, South Dublin Bay SAC and Wicklow Mountains SAC.

An annual limit value of 30 $\mu g/m^3$ for NO_X is specified within EU Directive 2008/50/EC for the protection of ecosystems. The NO_X limit value is applicable only in highly rural areas away from major sources of NO_X such as large conurbations, factories and high road vehicle activity such as a dual carriageway or motorway. Annex III of EU Directive 2008/50/EC identifies that monitoring to demonstrate compliance with the NO_X limit value for the protection of vegetation should be carried out distances greater than:

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

There are sections of designated sites which are near the existing facility that are within an urban setting, so the limit value for NO_X for the protection of ecosystems is not technically applicable at these sites. Regardless, the annual average concentrations for NO_X from all emission points at the existing facility were predicted at receptors within the designated sites for all five years of meteorological data modelled (2017 – 2021). The receptor spacing ranged from 25 m to 100 m with 1,392 discrete receptors modelled in total within the sensitive ecosystems.

The NO_X modelling results are detailed in Table 9.14. Emissions from the facility lead to an ambient NO_X concentration (excluding background) which ranges from 2.6 – 3% of the annual limit value at the worst-case location within the designated sites over the five years of meteorological data modelled. No background value has been added to the results as the background concentration of NO_X exceeds the limit value for the protection of ecosystems at most urban and suburban locations in Dublin based on a review of the EPA NO_X monitoring data (EPA, 2021a). As previously discussed, the NO_X limit value is applicable only in highly rural areas away from major sources of NO_X such as large conurbations, factories and high road vehicle activity such as a dual carriageway or motorway. Therefore, the NO_X limit value is not applicable at Grange Castle due to the urban and industrial nature of the environs of the proposed site. In addition, modelling results based on conservative assumptions indicate that the existing facility in isolation has an imperceptible impact on NO_X concentrations within the sensitive ecosystems contributing at most 3% of the limit value at the worst-case location in the worst-case year modelled.

Table 9.14 NOx Dispersion Model Results at Worst Case Ecological Receptor – Normal Operations in Do Nothing Scenario

Pollutant/ Year	Averaging Period	Process Contribution NO_2 ($\mu g/m^3$)	Limit Value ($\mu g/m^3$)	PEC as a % of Limit Value
NO_2 / 2017	Annual Mean	0.89	30	3%
NO_2 / 2018	Annual Mean	0.89	30	3%
NO_2 / 2019	Annual Mean	0.78	30	3%
NO_2 / 2020	Annual Mean	0.87	30	3%
NO_2 / 2021	Annual Mean	0.86	30	3%

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC and S.I. 180 of 2011).

9.5.2 Construction Phase

9.5.2.1 Air Quality

The greatest potential impact on air quality during the construction phase of the Proposed Development is from construction dust emissions and the potential for nuisance dust. While construction dust tends to be deposited within 350 m of a construction site, the majority of the deposition occurs within the first 50 m. The extent of any dust generation depends on the nature of the dust (soils, peat, sands, gravels, silts etc.) and the nature of the construction activity. In addition, the potential for dust dispersion and deposition depends on local meteorological factors such as rainfall, wind speed and wind direction. Sensitive receptors include residential properties within 100m of the site boundary on the R120 Newcastle Road and Grand Canal Way. A review of Casement Aerodrome meteorological data (see Section 9.3.1) indicates that the prevailing wind direction is westerly to southerly and wind speeds are generally moderate in nature. In addition, dust generation is considered negligible on days where rainfall is greater than 0.2 mm. A review of historical 30 year average data for Casement Aerodrome indicates that on average 183 days per year have rainfall over 0.2 mm (Met Eireann, 2022) and therefore it can be determined that over 50% of the time dust generation will be reduced.

In order to determine the level of dust mitigation required during the proposed works, the potential dust emission magnitude for each dust generating activity needs to be taken into account, in conjunction with the previously established sensitivity of the area (see Section 9.3.3). The major dust generating activities are divided into four types within the IAQM guidance to reflect their different potential impacts. These are:

- Demolition;
- Earthworks;
- Construction; and
- Trackout (movement of heavy vehicles).

Demolition

There is a small amount of demolition required to modify the existing access road, install underground utilities, tie into existing utilities and modify hard landscaping.

Earthworks

Earthworks primarily involve excavating material, loading and unloading of materials, tipping and stockpiling activities. Activities such as levelling the site and landscaping works are also considered under this category. The dust emission magnitude from

earthworks can be classified as small, medium or large based on the definitions from the IAQM guidance as transcribed below:

- **Large**: Total site area > 10,000 m^2, potentially dusty soil type (e.g. clay which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds > 8 m in height, total material moved >100,000 tonnes;
- **Medium**: Total site area 2,500 m^2 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5 - 10 heavy earth moving vehicles active at any one time, formation of bunds 4 – 8 m in height, total material moved 20,000 – 100,000 tonnes;
- **Small**: Total site area < 2,500 m^2, soil type with large grain size (e.g. sand), < 5 heavy earth moving vehicles active at any one time, formation of bunds < 4 m in height, total material moved < 20,000 tonnes, earthworks during wetter months.

The site area of proposed earthworks will be between 2,500 and 10,000 m^2. Therefore the dust emission magnitude for the proposed earthwork activities can be classified as medium.

The sensitivity of the area, as determined in Section 9.3.3, is combined with the dust emission magnitude for each dust generating activity to define the risk of dust impacts in the absence of mitigation. As outlined in Table 9.15, this results in an overall low risk of short-term dust soiling impacts and a low risk of short-term human health impacts as a result of the proposed earthworks activities.

Table 9.15 Risk of Dust Impacts – Earthworks

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	**Low Risk**	Negligible

Construction

Dust emission magnitude from construction can be classified as small, medium or large based on the definitions from the IAQM guidance as transcribed below:

- **Large**: Total building volume > 100,000 m^3, on-site concrete batching, sandblasting;
- **Medium**: Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), on-site concrete batching;
- **Small**: Total building volume < 25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

The dust emission magnitude for the proposed construction activities can be classified as small as the total building volume will be less than 25,000 m^3.

The sensitivity of the area is combined with the dust emission magnitude for each dust generating activity. As outlined in Table 9.16, this results in an overall negligible risk of short-term dust soiling impacts and negligible risk of short-term human health impacts as a result of the proposed construction activities.

Table 9.16 Risk of Dust Impacts – Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	**Negligible**

Trackout

Factors which determine the dust emission magnitude are vehicle size, vehicle speed, number of vehicles, road surface material and duration of movement. Dust emission magnitude from trackout can be classified as small, medium or large based on the definitions from the IAQM guidance as transcribed below:

- **Large**: > 50 HDV (> 3.5 t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length > 100 m;
- **Medium**: 10 - 50 HDV (> 3.5 t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 - 100 m;
- **Small**: < 10 HDV (> 3.5 t) outward movements in any one day, surface material with low potential for dust release, unpaved road length < 50 m.

The dust emission magnitude for the proposed trackout can be classified as small, as at worst-case peak periods there will be less than 10 outward HGV movements per day and there will be no unpaved site roads. As outlined in Table 9.8, this results in an overall negligible risk of short-term dust soiling and negligible risk of short-term human health impacts as a result of the proposed trackout activities.

Table 9.17 Risk of Dust Impacts – Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	**Negligible**

Summary of Dust Emission Risk

The risk of dust impacts as a result of the Proposed Development are summarised in Table 9.18 for each activity. The magnitude of risk determined is used to prescribe the level of site specific mitigation required for each activity in order to prevent significant impacts occurring.

While there is an overall negligible to low risk of dust soiling or human health impacts associated with the Proposed Development, nevertheless best practice dust mitigation measures will be implemented on site in order to ensure that no dust nuisance occurs during the earthworks, construction and trackout activities. In the absence of mitigation there is the potential for short-term, negative, localised, imperceptible dust related impacts to air quality as a result of the Proposed Development.

Table 9.18 Summary of Dust Impact Risk used to Define Site-Specific Mitigation

Potential Impact	Dust Emission Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	n/a	Low Risk	Negligible	Negligible
Human Health	n/a	Low Risk	Negligible	Negligible

There is also the potential for traffic emissions to impact air quality in the short-term over the construction phase. Particularly due to the increase in HGVs accessing the site. The construction stage traffic has been reviewed and a detailed air quality assessment has been scoped out as none of the road links impacted by the Proposed Development satisfy the DMRB assessment criteria in Section 9.2.2.1. It can therefore be determined that the construction stage traffic will have an imperceptible, neutral and short-term impact on air quality.

9.5.2.2 Climate

There is the potential for a number of greenhouse gas emissions to atmosphere during the construction of the development. Construction vehicles, generators etc., may give rise to CO_2 and N_2O emissions. The Institute of Air Quality Management document *Guidance on the Assessment of Dust from Demolition and Construction* (IAQM, 2014) states that site traffic and plant is unlikely to make a significant impact on climate.

9.5.2.3 Human Health

Dust emissions from the construction phase of the Proposed Development have the potential to impact human health through the release of PM_{10} and $PM_{2.5}$ emissions. As per Table 9.7 the surrounding area is considered of low sensitivity to dust related human health impacts. There is an overall worst-case low risk of dust related human health impacts as a result of the construction of the Proposed Development (Table 9.7). Therefore, in the absence of mitigation there is the potential for imperceptible, negative, short-term impacts to human health as a result of the Proposed Development.

9.5.2.4 Sensitive Ecosystems

There are no sensitive ecosystems within 50m of the Proposed Development during the construction phase. Therefore, there is no potential for significant impacts to sensitive ecosystems as a result of the Proposed Development.

9.5.3 Operational Phase

9.5.3.1 Air Quality

The potential impact to air quality during the operational phase of the Proposed Development is a breach of the ambient air quality standards as a result of air emissions from the existing and proposed emission points. However, as outlined in Section 9.6, an iterative stack height determination was undertaken as part of the air dispersion modelling study to ensure that an adequate release height was selected for all emission points to aid dispersion of the plume and ensure compliance with the ambient air quality limit values beyond the site boundary.

Operational phase traffic also has the potential to impact air quality and climate. The UK Highways Agency Design Manual for Roads and Bridges (DMRB) guidance (UK Highways Agency, 2019a), states that road links meeting one or more of the following criteria can be defined as being 'affected' by a proposed development and should be included in the local air quality assessment. The use of the UK guidance is recommended by the TII (2011) in the absence of specific Irish guidance, this approach is considered best practice and can be applied to any development that causes a change in traffic.

- Annual average daily traffic (AADT) changes by 1,000 or more;
- Heavy duty vehicle (HDV) AADT changes by 200 or more;
- A change in speed band; or
- A change in carriageway alignment by 5m or greater.

There is no additional operational phase traffic associated with the Proposed Development. Therefore, a detailed air quality modelling assessment has been scoped out as there is no potential for any impact to air quality during operation as a result of traffic emissions.

9.5.3.2 Climate

Climate change has the potential to alter weather patterns and increase the frequency of rainfall in future years. As a result of this there is the potential for flooding related impacts on site in future years. However, adequate attenuation and drainage have been provided for to account for increased rainfall in future years as part of the design of this development.

In terms of climatic impacts, on-site emissions of greenhouse gases are not expected to be significant. The current CO_2 emission factor for electricity from the National Grid is 296 gCO_2/MWh which is significantly lower than the 2018 emission factor (375 gCO_2/MWh). It is expected that this emission factor will decrease even more over the coming years as Ireland incorporates additional renewables into the market to reduce GHG emissions and meet the EU 2030 targets. The Sustainable Energy Authority of Ireland (SEAI, 2020) state that reducing the carbon intensity of electricity is critical for meeting Ireland's climate change objectives. Thus, the indirect generation of greenhouse gases due to the electricity requirements of the site is likely to decrease in the future.

The UK Highways Agency has published an updated DMRB guidance document in relation to climate impact assessments *LA 114 Climate* (UK Highways Agency 2019b). The following scoping criteria are used to determine whether a detailed climate assessment is required for a proposed project during the operational stage. If any of the road links impacted by the Proposed Development meet or exceed the below criteria, then further assessment is required.

- A change of more than 10% in AADT;
- A change of more than 10% to the number of heavy duty vehicles; and
- A change in daily average speed of more than 20 km/hr.

The Proposed Development will not increase traffic by more than 10% AADT on any nearby road links, therefore, none of the above scoping criteria are met and a detailed climate assessment is not required as there is no potential for significant impacts to climate as a result of traffic emissions.

9.5.3.3 Human Health

Traffic related air emissions have the potential to impact human health if they do not comply with the ambient Air Quality Standards detailed in Table 9.1. However, there is no additional traffic generated by the Proposed Development during the operational phase and therefore there is no potential for significant impacts.

9.5.3.4 Sensitive Ecosystems

The potential impact to sensitive ecosystems during the operational phase of the Proposed Development is a breach of the ambient air quality standards as a result of air emissions from the existing and proposed emission points. However, as outlined in Section 9.6, an iterative stack height determination was undertaken as part of the air dispersion modelling study to ensure that an adequate release height was selected for all emission points to aid dispersion of the plume and ensure compliance with the ambient air quality limit values beyond the site boundary.

9.6 REMEDIAL AND MITIGATION MEASURES

9.6.1 Construction Phase

The objective of dust control at the site is to ensure that no significant nuisance occurs at nearby sensitive receptors. In order to ensure that no dust nuisance occurs a series of measures drawing on will be implemented, 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' (USEPA, 1997); and
- 'Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition' (periodically updated) (USEPA, 1986).

In summary the measures which will be implemented include:

- Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic;
- Any road that has the potential to give rise to fugitive dust shall be regularly watered, as appropriate, during dry and/or windy conditions;
- Vehicles using site roads will have their speed restricted, and this speed restriction must be enforced rigidly. On any un-surfaced site road, this will be 20kph, and on hard surfaced roads as site management dictates;
- Public roads outside the site will be regularly inspected for cleanliness and cleaned as necessary;
- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods; and
- During movement of materials both on and off-site, trucks will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions.

At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust would be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

9.6.2 Operational Phase

The stack height of the proposed TO has been designed to ensure that an adequate height has been selected to aid dispersion of the emissions and achieve compliance with the EU ambient air quality standards beyond the site boundary (including background concentrations). No additional mitigation measures are proposed for the operational phase of the Proposed Development.

9.7 PREDICTED IMPACTS OF THE DEVELOPMENT

9.7.1 Construction Phase

9.7.1.1 Air Quality

When the dust mitigation measures detailed in the mitigation section (section 9.6.1) of this report are implemented, fugitive emissions of dust and particulate matter from the site will be ***negative***, ***temporary*** to ***short-term*** and ***imperceptible*** in nature, posing no nuisance at nearby receptors.

9.7.1.2 Climate

Construction traffic would be expected to be the dominant source of greenhouse gas emissions as a result of the Proposed Development. Construction vehicles and machinery will give rise to CO_2 and N_2O emissions during construction of the Proposed Development. The Institute of Air Quality Management document Guidance on the Assessment of Dust from Demolition and Construction states that site traffic and plant is unlikely to make a significant impact on climate. Therefore, the impact will be ***temporary*** to ***short-term***, ***neutral*** and ***imperceptible***.

9.7.1.3 Human Health

Best practice mitigation measures are proposed for the construction phase of the Proposed Development which will focus on the pro-active control of dust and other air pollutants to minimise generation of emissions at source. The mitigation measures that will be put in place during construction of the Proposed Development will ensure that the impact of the development complies with all EU ambient air quality legislative limit values which are based on the protection of human health. Therefore, the impact of construction of the Proposed Development is likely to be ***neutral***, ***temporary*** to ***short-term*** and ***imperceptible*** with respect to human health.

9.7.1.4 Sensitive Ecosystems

There are no sensitive ecosystems within 50m of the Proposed Development during the construction phase. Therefore, there is no potential for significant impacts to sensitive ecosystems as a result of the Proposed Development.

9.7.2 Operational Phase

9.7.2.1 Air Quality

The potential impact to air quality during the operational phase is a breach of the ambient air quality standards as a result of air emissions from the existing and proposed emission sources. However, the given stack heights ensure an adequate release height for all emission points to aid dispersion of the plume and ensure compliance with the ambient air quality limit values beyond the site boundary.

Process Contributions Under Normal Operations

The NO_2 modelling results are detailed in table 9.19. The results indicate that the ambient ground level concentrations are below the relevant air quality standards for NO_2. Emissions from the existing and proposed emission points lead to an ambient NO_2 concentration (including background) which is 50% of the maximum ambient 1-hour limit value (measured as a 99.8th%ile) and 28% of the annual limit value at the worst-case receptor (see Figure 9.2 and Figure 9.3). Therefore the impacts to air quality are predicted to be ***long-term***, ***negative*** and ***imperceptible***.

Table 9.19 NO_2 Dispersion Model Results – Process Contributions Under Normal Operations

Pollutant/ Year	Averaging Period	Process Contribution NO_2 (µg/m^3)	Background Concentration (µg/m^3)	Predicted Environmental Concentration NO_2 (µg/m^3)	Limit Value (µg/m^3)	PEC as a % of Limit Value
NO_2 / 2017	Annual Mean	3.9	16	19.9	40	50%
	99.8th%ile of 1-hr means	23.0	32	55.0	200	28%
NO_2 / 2018	Annual Mean	3.0	16	19.0	40	48%
	99.8th%ile of 1-hr means	23.6	32	55.6	200	28%
NO_2 / 2019	Annual Mean	3.3	16	19.3	40	48%
	99.8th%ile of 1-hr means	23.7	32	55.7	200	28%
NO_2 / 2020	Annual Mean	3.4	16	19.4	40	48%
	99.8th%ile of 1-hr means	24.1	32	56.1	200	28%
NO_2 / 2021	Annual Mean	3.0	16	19.0	40	47%
	99.8th%ile of 1-hr means	23.5	32	55.5	200	28%

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC and S.I. 180 of 2011).

The VOC modelling results are detailed in Table 9.20 and Table 9.21. The results indicate that the ambient ground level concentrations are below the relevant air quality guidelines for individual VOCs even when it is assumed that each emission point is emitting solely the VOC of concern at the IED emission limit for the full year. Emissions from the proposed TO and other VOC emission point onsite lead to ambient individual VOC concentrations which are no more than 11% of the maximum 1-hour limit value at the worst-case receptor (see Table 9.20 and Figure 9.4) and no more than 17% of the annual mean limit value at the worst-case off-site location (Table 9.21 and Figure 9.5). Therefore the impacts to air quality are predicted to be ***long-term***, ***negative*** and ***imperceptible***.

Table 9.20 VOCs Dispersion Model Results – Process Contributions Under Normal Operations – Maximum 1-Hour Scenario

Pollutant	1-Hour EAL (µg/Nm^3)	2017 (µg/Nm^3)	2018 (µg/Nm^3)	2019 (µg/Nm^3)	2020 (µg/Nm^3)	2021 (µg/Nm^3)	Max PEC / EAL
1-Ethyl-3-(3-dimethylaminopropyl)carbodiimide	-	3.3	3.0	3.3	3.4	3.2	-
2-butanol	4,500	3.2	2.8	3.1	3.2	3.0	0.1%
Acetic acid	3,700	5.2	4.6	5.1	5.2	4.9	0.1%
Acetic anhydride	40	4.4	3.9	4.3	4.4	4.2	11%
Acetone	362,000	3.3	3.0	3.3	3.4	3.2	0.001 %
Acetonitrile	10,200	3.5	3.1	3.5	3.6	3.3	0.03%
Acetyl chloride	-	6.8	6.0	6.7	6.8	6.4	-
Chlorobenzene	70,200	3.2	2.9	3.2	3.3	3.1	0.005 %
Cyclopentyl methyl ether	-	2.9	2.5	2.8	2.9	2.7	-
Dichloromethane	3,000	14.7	13.0	14.4	14.7	13.9	0.5%
Difluorophenylboronic acid	-	4.5	4.0	4.5	4.6	4.3	-
Diisopropylamine	6,300	2.9	2.6	2.9	2.9	2.8	0.05%
Dimethyl phosphonate	-	9.6	8.5	9.4	9.6	9.1	-
Mimethyl sulfoxide (DMSO)	-	6.7	6.0	6.6	6.8	6.4	-
Dimethylacetamide (DMAC)	7,200	3.8	3.3	3.7	3.8	3.6	0.05%
Dimethylformamide (DMF)	6,100	4.2	3.7	4.1	4.2	4.0	0.1%
Ethane	-	2.6	2.3	2.5	2.6	2.5	-
Ethanol	576,000	4.0	3.5	3.9	4.0	3.8	0.001 %
Ethyl acetate	420,000	3.8	3.4	3.7	3.8	3.6	0.001 %
Ethyl sulfonyl chloride	-	11.1	9.8	10.9	11.1	10.5	-
Ethylene	-	2.4	2.1	2.4	2.4	2.3	-
Formaldehyde	100	5.2	4.6	5.1	5.2	4.9	5%
Hexane	21,600	2.5	2.2	2.4	2.5	2.3	0.01%
Isopropanol	125,000	3.5	3.1	3.4	3.5	3.3	0.003 %
Isopropyl acetate	84,900	3.5	3.1	3.5	3.5	3.3	-
Methane	-	2.8	2.4	2.7	2.8	2.6	-
Methanol	33,300	5.5	4.9	5.4	5.6	5.2	0.02%
Methyl tert-butyl ether	3,670	3.0	2.7	3.0	3.1	2.9	0.1%
Methylamine	3,900	5.4	4.7	5.3	5.4	5.1	0.1%
Methylcyclohexane	160,000	2.4	2.1	2.4	2.4	2.3	0.002 %
N,N-Diisopropylethylamine (DIPEA)	-	2.8	2.5	2.7	2.8	2.6	-
N-Acetyl-L-Cysteine	-	5.6	5.0	5.5	5.7	5.3	-
N-Heptane	62,550	2.5	2.2	2.4	2.5	2.3	0.004 %
N-Methylimidazole	-	3.5	3.1	3.5	3.6	3.3	-
Palladium triphenylphosphine	-	2.8	2.4	2.7	2.8	2.6	-

Pollutant	1-Hour EAL (µg/Nm^3)	2017 (µg/Nm^3)	2018 (µg/Nm^3)	2019 (µg/Nm^3)	2020 (µg/Nm^3)	2021 (µg/Nm^3)	Max PEC / EAL
Propane	-	2.5	2.2	2.5	2.5	2.4	-
Propionyl chloride	-	5.3	4.7	5.2	5.3	5.0	-
Pyridine 4-boronic acid	-	4.2	3.8	4.2	4.3	4.0	-
Pyridine-3-sulfonyl chloride (PSC)	-	6.1	5.4	6.0	6.2	5.8	-
Pyrrolidine	-	3.1	2.7	3.0	3.1	2.9	-
THF	59,900	3.1	2.8	3.1	3.1	2.9	0.005 %
Toluene	8,000	2.3	2.0	2.2	2.3	2.1	0.03%
Triethylamine	6,300	8.7	7.7	8.6	8.8	8.3	0.1%
Triphenylphosphine	-	2.5	2.2	2.5	2.5	2.4	-

Note 1 Background levels of all VOCs are likely to be well below 1 µg/m^3 in the vicinity of the facility.

Note 2 As a worst-case all VOCs released assumed to consist of each individual VOC in turn for the maximum 1-hour scenario.

Table 9.21 VOCs Dispersion Model Results – Process Contributions Under Normal Operations – Annual Mean Scenario

Pollutant	Annual Mean EAL (µg/Nm^3)	2017 (µg/Nm^3)	2018 (µg/Nm^3)	2019 (µg/Nm^3)	2020 (µg/Nm^3)	2021 (µg/Nm^3)	Max PEC / EAL
1-Ethyl-3-(3-dimethylaminopropyl)carbodiimide	-	0.12	0.13	0.11	0.10	0.12	-
2-butanol	30,000	0.12	0.12	0.11	0.10	0.12	0.0004 %
Acetic acid	250	0.19	0.19	0.17	0.16	0.19	0.1%
Acetic anhydride	1	0.16	0.17	0.15	0.13	0.16	17%
Acetone	18,100	0.12	0.13	0.11	0.10	0.12	0.001%
Acetonitrile	680	0.13	0.13	0.12	0.11	0.13	0.02%
Acetyl chloride	-	0.24	0.25	0.22	0.20	0.25	-
Chlorobenzene	2,340	0.12	0.12	0.11	0.10	0.12	0.01%
Cyclopentyl methyl ether	-	0.10	0.11	0.10	0.09	0.11	-
Dichloromethane	700	0.53	0.55	0.49	0.44	0.54	0.1%
Difluorophenylboronic acid	-	0.16	0.17	0.15	0.14	0.17	-
Diisopropylamine	210	0.11	0.11	0.10	0.09	0.11	0.05%
Dimethyl phosphonate	-	0.35	0.36	0.32	0.29	0.35	-
Mimethyl sulfoxide (DMSO)	-	0.24	0.25	0.22	0.20	0.25	-
Dimethylacetamide (DMAC)	360	0.14	0.14	0.12	0.11	0.14	0.04%
Dimethylformamide (DMF)	300	0.15	0.16	0.14	0.13	0.16	0.05%
Ethane	-	0.09	0.10	0.09	0.08	0.10	-
Ethanol	19,200	0.14	0.15	0.13	0.12	0.15	0.001%
Ethyl acetate	14,600	0.14	0.14	0.13	0.11	0.14	0.001%
Ethyl sulfonyl chloride	-	0.40	0.42	0.37	0.33	0.41	-
Ethylene	-	0.09	0.09	0.08	0.07	0.09	-

Pollutant	Annual Mean EAL (µg/Nm^3)	2017 (µg/Nm^3)	2018 (µg/Nm^3)	2019 (µg/Nm^3)	2020 (µg/Nm^3)	2021 (µg/Nm^3)	Max PEC / EAL
Formaldehyde	5	0.19	0.19	0.17	0.16	0.19	4%
Hexane	720	0.09	0.09	0.08	0.07	0.09	0.01%
Isopropanol	9,990	0.12	0.13	0.11	0.10	0.13	0.001%
Isopropyl acetate	-	0.13	0.13	0.12	0.11	0.13	-
Methane	-	0.10	0.10	0.09	0.08	0.10	-
Methanol	2,660	0.20	0.21	0.18	0.17	0.20	0.01%
Methyl tert-butyl ether	18,350	0.11	0.11	0.10	0.09	0.11	0.001%
Methylamine	130	0.19	0.20	0.18	0.16	0.20	0.2%
Methylcyclohexane	4,800	0.09	0.09	0.08	0.07	0.09	0.002%
N,N-Diisopropylethylamine (DIPEA)	-	0.10	0.10	0.09	0.08	0.10	-
N-Acetyl-L-Cysteine	-	0.20	0.21	0.19	0.17	0.21	-
N-Heptane	20,850	0.09	0.09	0.08	0.07	0.09	0.0004 %
N-Methylimidazole	-	0.13	0.13	0.12	0.11	0.13	-
Palladium triphenylphosphine	-	0.10	0.10	0.09	0.08	0.10	-
Propane	-	0.09	0.10	0.08	0.08	0.09	-
Propionyl chloride	-	0.19	0.20	0.18	0.16	0.20	-
Pyridine 4-boronic acid	-	0.15	0.16	0.14	0.13	0.16	-
Pyridine-3-sulfonyl chloride (PSC)	-	0.22	0.23	0.20	0.18	0.23	-
Pyrrolidine	-	0.11	0.12	0.10	0.09	0.11	-
THF	3,000	0.11	0.12	0.10	0.09	0.11	0.004%
Toluene	19,190	0.08	0.09	0.08	0.07	0.08	0.0004 %
Triethylamine	420	0.32	0.33	0.29	0.26	0.32	0.1%
Triphenylphosphine	-	0.09	0.09	0.08	0.08	0.09	-

Note 1 Background levels of all VOCs are likely to be well below 1 µg/m^3 in the vicinity of the facility.

Note 2 As a worst-case all VOCs released assumed to consist of each individual VOC in turn for the annual mean scenario.

Bypass Operations

The VOC modelling results during bypass operations are detailed in Table 9.22. The results indicate that under the worst-case scenario, the ambient ground level concentrations are below the relevant air quality guidelines for individual VOCs. Emissions from the existing VOC abatement system which operates during bypass of the proposed TO lead to ambient individual VOC concentrations which are no more than 4% of the maximum 1-hour limit value at the worst-case receptor. Therefore the impacts to air quality are predicted to be ***long-term***, ***negative*** and ***imperceptible***.

Table 9.22 Dispersion Model Results – VOCs During Bypass Operations – Maximum 1-Hour Scenario

Pollutant	1-Hour EAL (µg/Nm^3)	2017 (µg/Nm^3)	2018 (µg/Nm^3)	2019 (µg/Nm^3)	2020 (µg/Nm^3)	2021 (µg/Nm^3)	Max PEC / EAL
1-Ethyl-3-(3-dimethylaminopropyl)carbodiimide	6,301	1.1	0.7	0.7	0.9	0.9	-
2-butanol	4,500	1.0	0.7	0.7	0.8	0.9	0.02%
Acetic acid	3,700	1.7	1.1	1.1	1.4	1.4	0.04%
Acetic anhydride	40	1.4	0.9	1.0	1.2	1.2	4%
Acetone	362,000	1.1	0.7	0.7	0.9	0.9	0.0003 %
Acetonitrile	10,200	1.1	0.7	0.8	0.9	0.9	0.01%
Acetyl chloride	6,302	2.2	1.4	1.5	1.8	1.8	-
Chlorobenzene	70,200	1.0	0.7	0.7	0.8	0.9	0.001%
Cyclopentyl methyl ether	6,303	0.9	0.6	0.6	0.8	0.8	-
Dichloromethane	3,000	4.7	3.0	3.2	3.8	3.9	0.2%
Difluorophenylboronic acid	6,304	1.4	0.9	1.0	1.2	1.2	-
Diisopropylamine	6,300	0.9	0.6	0.6	0.8	0.8	0.01%
Dimethyl phosphonate	6,305	3.1	2.0	2.1	2.5	2.6	-
Mimethyl sulfoxide (DMSO)	6,306	2.2	1.4	1.5	1.8	1.8	-
Dimethylacetamide (DMAC)	7,200	1.2	0.8	0.8	1.0	1.0	0.02%
Dimethylformamide (DMF)	6,100	1.3	0.9	0.9	1.1	1.1	0.02%
Ethane	6,307	0.8	0.5	0.6	0.7	0.7	-
Ethanol	576,000	1.3	0.8	0.9	1.0	1.1	0.0002 %
Ethyl acetate	420,000	1.2	0.8	0.8	1.0	1.0	0.0003 %
Ethyl sulfonyl chloride	6,308	3.5	2.3	2.4	2.9	3.0	-
Ethylene	6,309	0.8	0.5	0.5	0.6	0.6	-
Formaldehyde	100	1.7	1.1	1.1	1.4	1.4	2%
Hexane	21,600	0.8	0.5	0.5	0.7	0.7	0.004%
Isopropanol	125,000	1.1	0.7	0.8	0.9	0.9	0.001%
Isopropyl acetate	84,900	1.1	0.7	0.8	0.9	0.9	0.001%
Methane	6,310	0.9	0.6	0.6	0.7	0.7	-
Methanol	33,300	1.8	1.1	1.2	1.5	1.5	0.01%
Methyl tert-butyl ether	3,670	1.0	0.6	0.7	0.8	0.8	0.03%
Methylamine	3,900	1.7	1.1	1.2	1.4	1.4	0.04%
Methylcyclohexane	160,000	0.8	0.5	0.5	0.6	0.6	0.0005 %
N,N-Diisopropylethylamine (DIPEA)	6,311	0.9	0.6	0.6	0.7	0.7	-
N-Acetyl-L-Cysteine	6,312	1.8	1.2	1.2	1.5	1.5	-
N-Heptane	62,550	0.8	0.5	0.5	0.6	0.7	0.001%
N-Methylimidazole	6,313	1.1	0.7	0.8	0.9	0.9	-
Palladium triphenylphosphine	6,314	0.9	0.6	0.6	0.7	0.7	-
Propane	6,315	0.8	0.5	0.6	0.7	0.7	-

Pollutant	1-Hour EAL (µg/Nm^3)	2017 (µg/Nm^3)	2018 (µg/Nm^3)	2019 (µg/Nm^3)	2020 (µg/Nm^3)	2021 (µg/Nm^3)	Max PEC / EAL
Propionyl chloride	6,316	1.7	1.1	1.2	1.4	1.4	-
Pyridine 4-boronic acid	6,317	1.4	0.9	0.9	1.1	1.1	-
Pyridine-3-sulfonyl chloride (PSC)	6,318	2.0	1.3	1.3	1.6	1.6	-
Pyrrolidine	6,319	1.0	0.6	0.7	0.8	0.8	-
THF	59,900	1.0	0.6	0.7	0.8	0.8	0.002%
Toluene	8,000	0.7	0.5	0.5	0.6	0.6	0.01%
Triethylamine	6,300	2.8	1.8	1.9	2.3	2.3	0.04%
Triphenylphosphine	6,320	0.8	0.5	0.5	0.7	0.7	-

Note 1 Background levels of all VOCs are likely to be well below 1 µg/m^3 in the vicinity of the facility.

Note 2 As a worst-case all VOCs released assumed to consist of each individual VOC in turn for the maximum 1-hour scenario.

The odour modelling results during bypass operations are detailed in Table 9.23 and are compared to the odour nuisance criteria. In line with previous modelling, modelling was initially undertaken using worst-case assumptions. The maximum 1-hour scenario (as a 98th%ile) at the nearest residential receptors was based on the organic compound with the largest VOC (as C) emission rate (acetone) with each compound in turn assumed to be emitted at this mass emission rate. The results indicate that under the worst-case scenario, the ambient ground level concentrations are below the odour nuisance criteria in the worst-case year (see Table 9.23) for all VOCs modelled. Therefore the impacts to air quality are predicted to be ***long-term***, ***negative*** and ***imperceptible***.

Table 9.23 Dispersion Model Results – VOCs During Bypass Operations At Maximum Theoretical Levels – Odour Nuisance Assessment at Nearest Residential Receptor

Pollutant	1-Hour EAL (µg/Nm^3)	2017 (µg/Nm^3)	2018 (µg/Nm^3)	2019 (µg/Nm^3)	2020 (µg/Nm^3)	2021 (µg/Nm^3)	Max PEC / EAL
1-Ethyl-3-(3-dimethylaminopropyl)carbodiimide	-	1.1	0.7	0.7	0.9	0.9	-
2-butanol	9,000	1.0	0.7	0.7	0.8	0.9	0.01%
Acetic acid	129	1.7	1.1	1.1	1.4	1.4	1%
Acetic anhydride	4	1.4	0.9	1.0	1.2	1.2	36%
Acetone	41,700	1.1	0.7	0.7	0.9	0.9	0.003%
Acetonitrile	846,000	1.1	0.7	0.8	0.9	0.9	0.0001%
Acetyl chloride	-	2.2	1.4	1.5	1.8	1.8	-
Chlorobenzene	3,000	1.0	0.7	0.7	0.8	0.9	0.03%
Cyclopentyl methyl ether	-	0.9	0.6	0.6	0.8	0.8	-
Dichloromethane	10,260	4.7	3.0	3.2	3.8	3.9	0.05%
Difluorophenylboronic acid	-	1.4	0.9	1.0	1.2	1.2	-
Diisopropylamine	157	0.9	0.6	0.6	0.8	0.8	0.6%
Dimethyl phosphonate	-	3.1	2.0	2.1	2.5	2.6	-
Mimethyl sulfoxide (DMSO)	-	2.2	1.4	1.5	1.8	1.8	-
Dimethylacetamide (DMAC)	119,100	1.2	0.8	0.8	1.0	1.0	0.001%

Pollutant	1-Hour EAL (µg/Nm^3)	2017 (µg/Nm^3)	2018 (µg/Nm^3)	2019 (µg/Nm^3)	2020 (µg/Nm^3)	2021 (µg/Nm^3)	Max PEC / EAL
Dimethylformamide (DMF)	19,140	1.3	0.9	0.9	1.1	1.1	0.01%
Ethane	-	0.8	0.5	0.6	0.7	0.7	-
Ethanol	840	1.3	0.8	0.9	1.0	1.1	0.2%
Ethyl acetate	7,230	1.2	0.8	0.8	1.0	1.0	0.02%
Ethyl sulfonyl chloride	-	3.5	2.3	2.4	2.9	3.0	-
Ethylene	-	0.8	0.5	0.5	0.6	0.6	-
Formaldehyde	3,063	1.7	1.1	1.1	1.4	1.4	0.1%
Hexane	1,376,700	0.8	0.5	0.5	0.7	0.7	0.0001%
Isopropanol	10,690	1.1	0.7	0.8	0.9	0.9	0.01%
Isopropyl acetate	4,484	1.1	0.7	0.8	0.9	0.9	0.03%
Methane	-	0.9	0.6	0.6	0.7	0.7	-
Methanol	12,000	1.8	1.1	1.2	1.5	1.5	0.01%
Methyl tert-butyl ether	541	1.0	0.6	0.7	0.8	0.8	0.2%
Methylamine	14	1.7	1.1	1.2	1.4	1.4	12%
Methylcyclohexane	1,720,859	0.8	0.5	0.5	0.6	0.6	0.00004 %
N,N-Diisopropylethylamine (DIPEA)	-	0.9	0.6	0.6	0.7	0.7	-
N-Acetyl-L-Cysteine	-	1.8	1.2	1.2	1.5	1.5	-
N-Heptane	147,391	0.8	0.5	0.5	0.6	0.7	0.0005%
N-Methylimidazole	-	1.1	0.7	0.8	0.9	0.9	-
Palladium triphenylphosphine	-	0.9	0.6	0.6	0.7	0.7	-
Propane	-	0.8	0.5	0.6	0.7	0.7	-
Propionyl chloride	-	1.7	1.1	1.2	1.4	1.4	-
Pyridine 4-boronic acid	-	1.4	0.9	0.9	1.1	1.1	-
Pyridine-3-sulfonyl chloride (PSC)	-	2.0	1.3	1.3	1.6	1.6	-
Pyrrolidine	-	1.0	0.6	0.7	0.8	0.8	-
THF	664	1.0	0.6	0.7	0.8	0.8	0.1%
Toluene	1,932	0.7	0.5	0.5	0.6	0.6	0.04%
Triethylamine	8	2.8	1.8	1.9	2.3	2.3	36%
Triphenylphosphine	-	0.8	0.5	0.5	0.7	0.7	-

Note 1 Background levels of all VOCs are likely to be well below 1 µg/m^3 in the vicinity of the facility.

Note 2 As a worst-case all VOCs released assumed to consist of each individual VOC in turn for the maximum 1-hour scenario.

9.7.2.2 Climate

Climate change has the potential to alter weather patterns and increase the frequency of rainfall in future years. As a result of this there is the potential for flooding related impacts on site in future years. However, adequate attenuation and drainage have been provided for to account for increased rainfall in future years as part of the design of this development.

In terms of climatic impacts, on-site emissions of greenhouse gases are not expected to be significant. The current CO_2 emission factor for electricity from the National Grid is 296 gCO_2/MWh which is significantly lower than the 2018 emission factor (375 gCO_2/MWh). It is expected that this emission factor will decrease even more over the coming years as Ireland incorporates additional renewables into the market to reduce GHG emissions and meet the EU 2030 targets. The Sustainable Energy Authority of Ireland (SEAI) state that reducing the carbon intensity of electricity is critical for meeting Ireland's climate change objectives. Thus, the indirect generation of greenhouse gases due to the electricity requirements of the site is likely to decrease in the future.

Therefore, the impact on climate of the Proposed Development will be ***long-term***, ***neutral*** and ***imperceptible***.

9.7.2.3 Human Health

Air dispersion modelling was undertaken to assess the impact of the development with reference to EU ambient air quality standards which are based on the protection of human health. As demonstrated by the dispersion modelling results, pollutant concentrations with the Proposed Development operational are compliant with all National and EU ambient air quality limit values and, therefore, will not result in a significant impact on human health. The air dispersion modelling assessment has considered the ambient air quality impact from the operation of the Proposed Development (the worst-case scenario) and a conservative approach was adopted when making assumptions for the air modelling inputs which over-estimates the actual levels that will arise. In relation to the spatial extent of air quality impacts from the site, ambient concentrations will decrease significantly with distance from the site boundary. The impacts to human health are predicted to be ***long-term***, ***negative*** and ***imperceptible***.

9.7.2.4 Impact of NO_X on Designated Habitat Sites

The impact of emissions of NO_X within 20 km of the Proposed Development and existing emission points on ambient ground level concentrations within the following designated habitat sites was assessed using AERMOD. The 20km distance was selected based on maximum extent of the impact zone from the air emissions onsite. After 20km, the ambient air concentration of NO_X due to emissions from the facility are imperceptible.

- **Proposed Natural Heritage Areas (pNHA)** – Ballybetagh Bog pNHA, Booterstown Marsh pNHA, Dodder Valley pNHA, Dolphins, Dublin Docks pNHA, Donadea Wood pNHA, Fitzsimon's Wood pNHA, Glenasmole Valley pNHA, Glencree Valley pNHA, Grand Canal pNHA, Kilteel Wood pNHA, Liffey At Osberstown pNHA, Liffey Valley pNHA, Lugmore Glen pNHA, North Dublin Bay pNHA, Poulaphouca Reservoir pNHA, Red Bog, Kildare pNHA, Royal Canal pNHA, Rye Water Valley/Carton pNHA, Santry Demesne pNHA, Slade Of Saggart And Crooksling Glen pNHA, South Dublin Bay pNHA; and
- **Special Areas of Conservation (SAC)** – Glenasmole Valley SAC, North Dublin Bay SAC, Red Bog, Kildare SAC, Rye Water Valley/Carton SAC, South Dublin Bay SAC and Wicklow Mountains SAC.

An annual limit value of 30 $\mu g/m^3$ for NO_X is specified within EU Directive 2008/50/EC for the protection of ecosystems. The NO_X limit value is applicable only in highly rural areas away from major sources of NO_X such as large conurbations, factories and high road vehicle activity such as a dual carriageway or motorway. Annex III of EU Directive

2008/50/EC identifies that monitoring to demonstrate compliance with the NO_X limit value for the protection of vegetation should be carried out distances greater than:

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

There are sections of designated sites which are near the Proposed Development that are within an urban setting, so the limit value for NO_X for the protection of ecosystems is not technically applicable at these sites. Regardless, the annual average concentrations for NO_X from all emission points at the Proposed Development were predicted at receptors within the designated sites for all five years of meteorological data modelled (2017 – 2021). The receptor spacing ranged from 25 m to 100 m with 1,392 discrete receptors modelled in total within the sensitive ecosystems.

The NO_X modelling results are detailed in Table 9.24. Emissions from the facility lead to an ambient NO_X concentration (excluding background) which ranges from 2.6 – 3% of the annual limit value at the worst-case location within the designated sites over the five years of meteorological data modelled. No background value has been added to the results as the background concentration of NO_X exceeds the limit value for the protection of ecosystems at most urban and suburban locations in Dublin based on a review of the EPA NO_X monitoring data (EPA, 2021a). As previously discussed, the NO_X limit value is applicable only in highly rural areas away from major sources of NO_X such as large conurbations, factories and high road vehicle activity such as a dual carriageway or motorway. Therefore, the NO_X limit value is not applicable at Grange Castle due to the urban and industrial nature of the environs of the proposed site. In addition, modelling results based on conservative assumptions indicate that the Proposed Development in isolation will have an imperceptible impact on NO_X concentrations within the sensitive ecosystems contributing at most 3% of the limit value at the worst-case location in the worst-case year modelled.

Table 9.24 NOx Dispersion Model Results at Worst Case Ecological Receptor – Process Contributions Under Normal Operations

Pollutant/ Year	Averaging Period	Process Contribution NO_2 ($\mu g/m^3$)	Limit Value ($\mu g/m^3$)	PEC as a % of Limit Value
NO_2 / 2017	Annual Mean	0.91	30	3%
NO_2 / 2018	Annual Mean	0.90	30	3%
NO_2 / 2019	Annual Mean	0.79	30	3%
NO_2 / 2020	Annual Mean	0.89	30	3%
NO_2 / 2021	Annual Mean	0.87	30	3%

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC and S.I. 180 of 2011).

In order to consider the effects of nitrogen deposition owing to emissions from the Proposed Development on the designated habitat sites, the NO_X concentrations determined above in Table 9.24**Error! Reference source not found.** must be converted firstly into a dry deposition flux using the equation below which is taken from UK Environment Agency publication "AGTAG06 – Technical Guidance On Detailed Modelling Approach For An Appropriate Assessment For Emissions To Air" (UKEA, 2014):

Dry deposition flux ($\mu g/m^2/s$) = ground-level concentration ($\mu g/m^3$) x deposition velocity (m/s)

The deposition velocities for NO_X are outlined in AQTAG06 (UKEA, 2014). A deposition velocity of 0.0015 m/s for grassland has been used. The dry deposition flux is then multiplied by a conversion factor of 95.9 (taken from AQTAG06) to convert it to a nitrogen (N) deposition flux (kg/ha/yr).

The N deposition flux for the worst-case year is 0.003 kg/ha/yr and is below the range in worst-case critical loads for the various vegetation types of 5-10 kg/ha/yr (UNECE, 2010). Consultation with the ecologist confirms that the effects of nitrogen deposition on designated sites due to the Proposed Development are not significant.

The impact associated the operational phase of the Proposed Development on designated habitat sites is considered ***long-term***, ***localised***, ***negative*** and ***imperceptible***.

9.8 RESIDUAL IMPACTS

Once the mitigation measures outlined in Section 9.6 are implemented, the residual impacts on air quality, human health or climate from the construction of the Proposed Development will be ***temporary*** to ***short-term*** and ***imperceptible***. In terms of air quality and human health, the emissions from the operational phase of the site will be significantly below the ambient air quality standards and provided the stack for the proposed emission point is built to the modelled height, impacts to air quality and human health are predicted to be ***long-term***, ***negative*** and ***imperceptible***. Impacts to climate as a result of energy usage from the Proposed Development are predicted to be ***long-term*** and ***imperceptible***. In relation to designated habitat sites, the operational phase impacts of the Proposed Development on designated habitat sites is considered ***long-term***, ***localised***, ***negative*** and ***imperceptible***

9.9 CUMULATIVE IMPACTS

9.9.1 Construction Phase

According to the IAQM guidance (2014) should the construction phase of the Proposed Development coincide with the construction phase of any other development within 350m then there is the potential for cumulative construction dust impacts. However, best practice dust mitigation measures will be implemented across the site which will avoid significant dust emissions. Provided these mitigation measures are in place for the duration of the construction phase cumulative dust related impacts to nearby sensitive receptors are not predicted to be significant. Cumulative impacts to air quality will be ***temporary*** to ***short-term***, ***localised***, ***negative*** and ***imperceptible***.

Due to the short-term duration of the construction phase and the low potential for significant CO_2 and N_2O emissions cumulative impacts to climate are considered ***neutral***.

9.9.2 Operational Phase

9.9.2.1 Air Quality

The cumulative impact of NO_2 emissions from proposed normal operations and emissions from Pfizer, the Grange Castle Power Facility, the Centrica Profile Park Power Facility and Vantage Data Centre DUB11 are detailed in Table 9.25 below. The results indicate that the ambient ground level concentrations are below the relevant air quality limit values for NO_2. For the worst-case year, emissions from the sites lead to

an ambient NO_2 concentration (including background) which is 49% of the maximum 1 hour limit value (measured as a 99.8th%ile) and 61% of the annual limit value at the worst-case off-site receptor. The impacts to air quality are predicted to be ***long-term***, ***negative*** and ***imperceptible***.

Table 9.25 NO_2 Dispersion Model Results – Cumulative Assessment

Pollutant/ Year	Averaging Period	Process Contribution NO_2 ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Predicted Environmental Concentration NO_2 ($\mu g/m^3$)	Limit Value ($\mu g/m^3$)	PEC as a % of Limit Value
NO_2 / 2017	Annual Mean	8.5	16	24.5	40	61%
	99.8th%ile of 1-hr means	50.1	32	82.1	200	41%
NO_2 / 2018	Annual Mean	8.1	16	24.1	40	60%
	99.8th%ile of 1-hr means	65.1	32	97.1	200	49%
NO_2 / 2019	Annual Mean	7.3	16	23.3	40	58%
	99.8th%ile of 1-hr means	45.8	32	77.8	200	39%
NO_2 / 2020	Annual Mean	8.2	16	24.2	40	61%
	99.8th%ile of 1-hr means	61.3	32	93.3	200	47%
NO_2 / 2021	Annual Mean	8.5	16	24.5	40	61%
	99.8th%ile of 1-hr means	50.1	32	82.1	200	41%

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC and S.I. 180 of 2011).

A review of licensed facilities in the surrounding area has been conducted and none have been identified with the potential for cumulative impact with VOC emissions from the Proposed Development.

9.9.2.2 Impact of NO_X on Designated Habitat Sites

The cumulative NO_X modelling results are detailed in Table 9.26. Emissions from the facility lead to an ambient NO_X concentration (excluding background) which ranges from 9 – 12% of the annual limit value at the worst-case location within the designated sites over the five years of meteorological data modelled. No background value has been added to the results as the background concentration of NO_X exceeds the limit value for the protection of ecosystems at most urban and suburban locations in Dublin based on a review of the EPA NO_X monitoring data (EPA,2021a). As previously discussed, the NO_X limit value is applicable only in highly rural areas away from major sources of NO_X such as large conurbations, factories and high road vehicle activity such as a dual carriageway or motorway. Therefore, the NO_X limit value is not applicable at Grangecastle due to the urban and industrial nature of the environs of the proposed site. In addition, modelling results based on conservative assumptions indicate that the Proposed Development in isolation will have an imperceptible impact on NO_X concentrations within the sensitive ecosystems contributing at most 12% of the limit value at the worst-case location in the worst-case year modelled.

Table 9.26 NOx Dispersion Model Results at Worst Case Ecological Receptor – Process Contributions Under Normal Operations

Pollutant/ Year	Averaging Period	Process Contribution NO_2 ($\mu g/m^3$)	Limit Value ($\mu g/m^3$)	PEC as a % of Limit Value
NO_2 / 2017	Annual Mean	3.50	30	12%
NO_2 / 2018	Annual Mean	2.98	30	10%
NO_2 / 2019	Annual Mean	3.13	30	10%
NO_2 / 2020	Annual Mean	3.55	30	12%
NO_2 / 2021	Annual Mean	2.71	30	9%

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC and S.I. 180 of 2011).

In order to consider the effects of nitrogen deposition owing to emissions from the Proposed Development on the designated habitat sites, the NO_X concentrations determined above in Table 9.26 must be converted firstly into a dry deposition flux using the equation below which is taken from UK Environment Agency publication "AGTAG06 – Technical Guidance On Detailed Modelling Approach For An Appropriate Assessment For Emissions To Air" (UKEA, 2014):

Dry deposition flux ($\mu g/m^2/s$) = ground-level concentration ($\mu g/m^3$) x deposition velocity (m/s)

The deposition velocities for NO_X are outlined in AQTAG06 (UKEA, 2014). A deposition velocity of 0.0015 m/s for grassland has been used. The dry deposition flux is then multiplied by a conversion factor of 95.9 (taken from AQTAG06) to convert it to a nitrogen (N) deposition flux (kg/ha/yr).

The N deposition flux for the worst-case year is 0.671 kg/ha/yr and is below the range in worst-case critical loads for the various vegetation types of 5-10 kg/ha/yr (UNECE, 2010). Consultation with the ecologist confirms that the effects of nitrogen deposition on designated sites due to the Proposed Development are not significant.

The impact associated the operational phase of the Proposed Development on designated habitat sites is considered ***long-term***, ***localised***, ***negative*** and ***imperceptible***.

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Figures

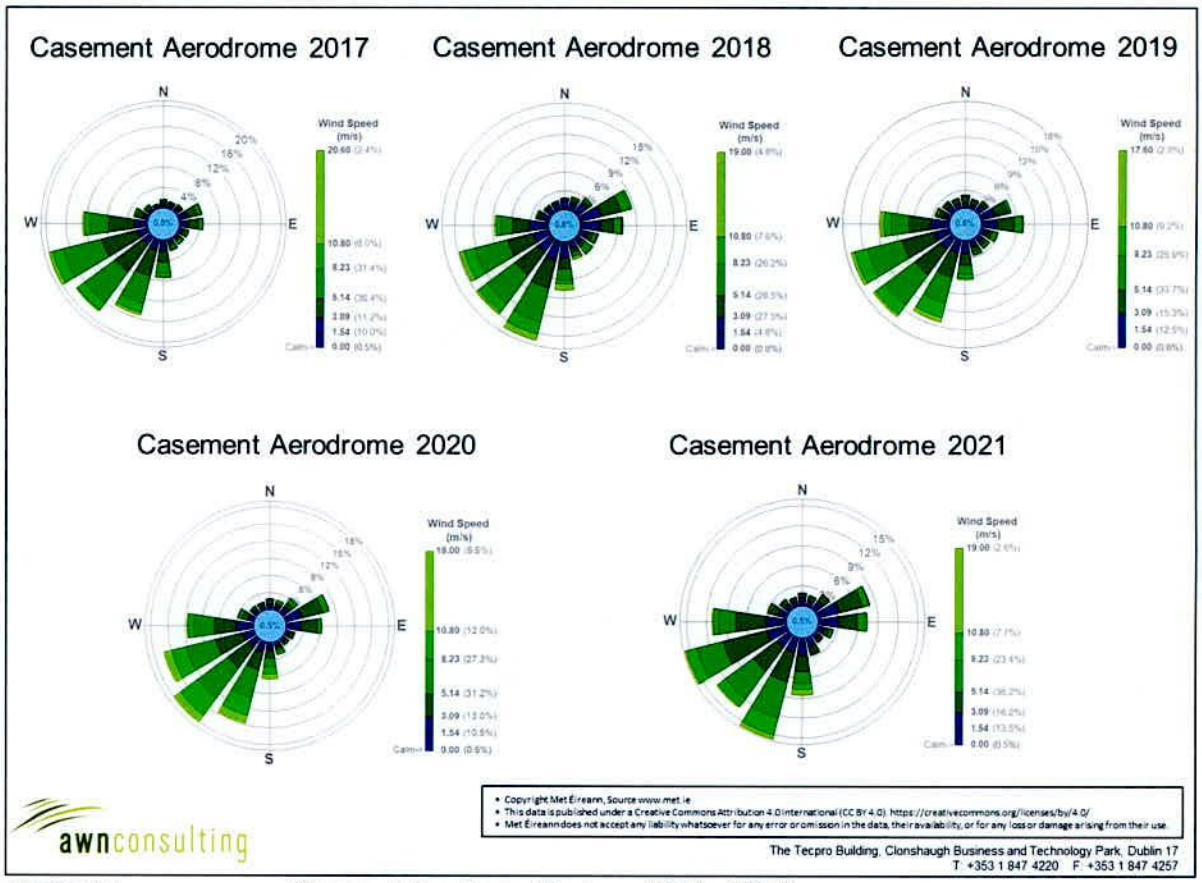

Figure 9.1 Casement Aerodrome Windrose (2017 – 2021)

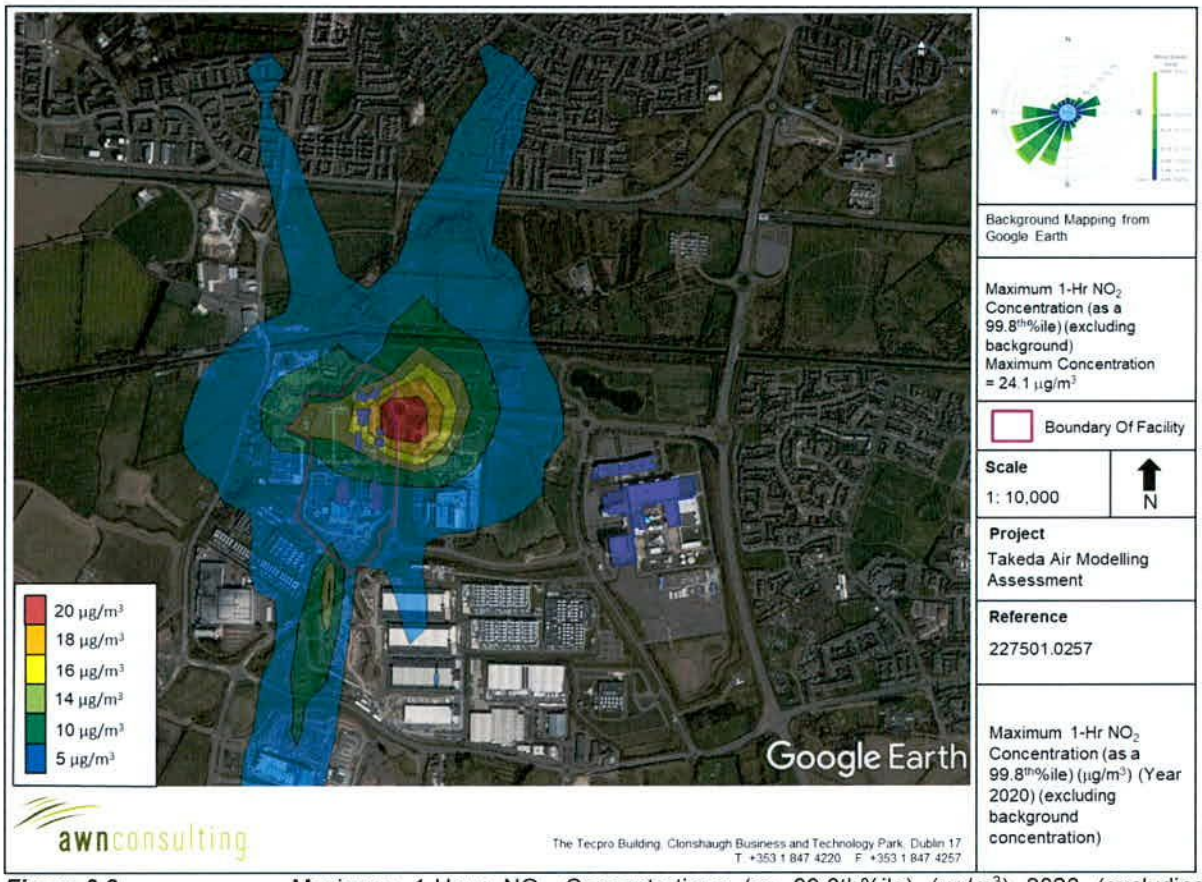

Figure 9.2 Maximum 1-Hour NO_2 Concentrations (as 99.8th%ile) ($\mu g/m^3$) 2020 (excluding background concentrations)

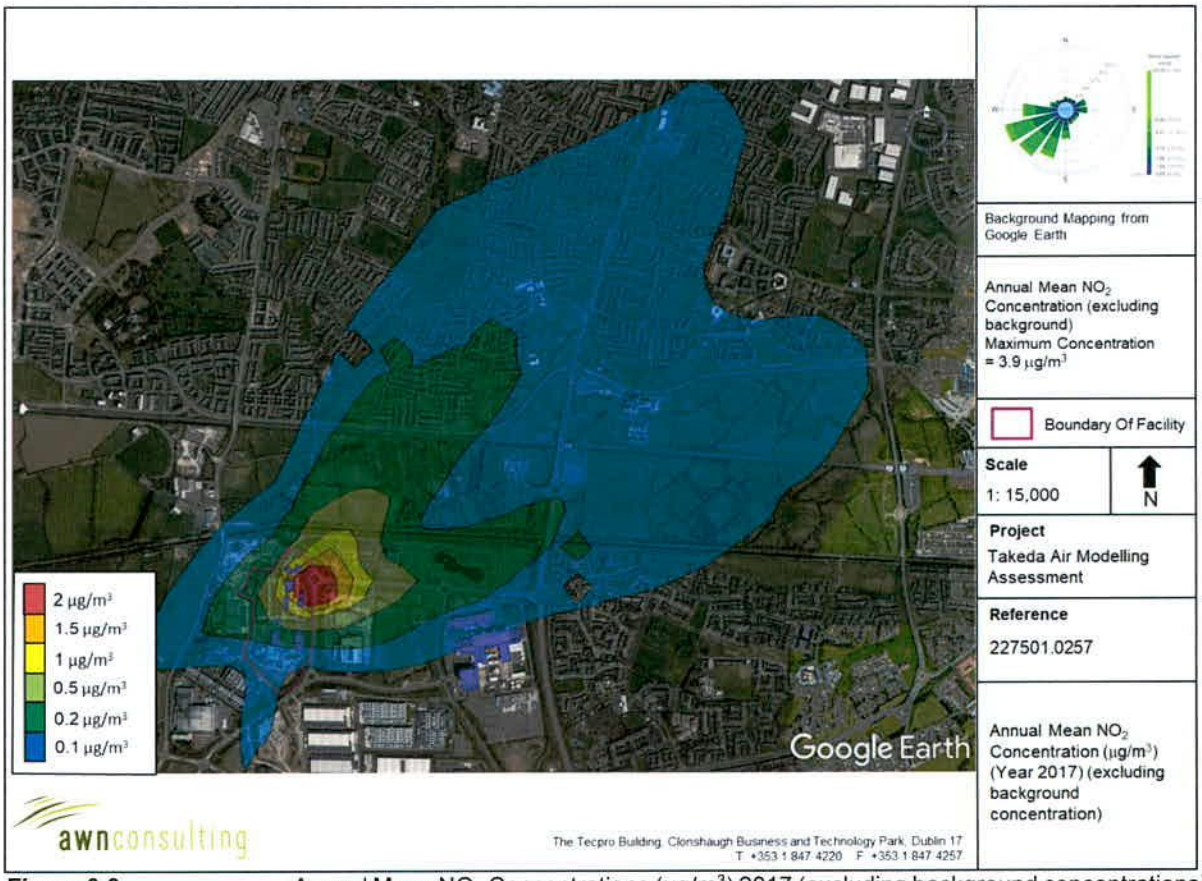

Figure 9.3 Annual Mean NO_2 Concentrations ($\mu g/m^3$) 2017 (excluding background concentrations)

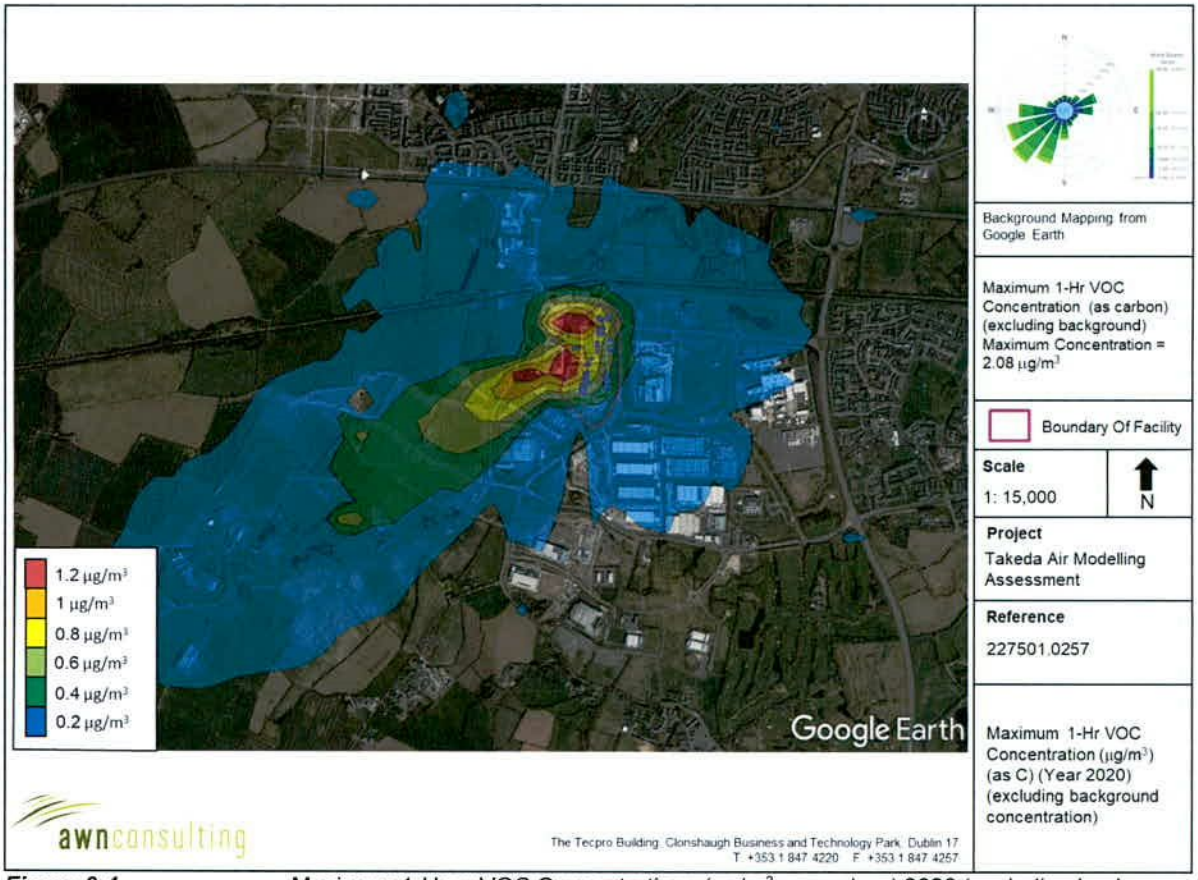

Figure 9.4 Maximum 1-Hour VOC Concentrations (µg/m³, as carbon) 2020 (excluding background concentrations)

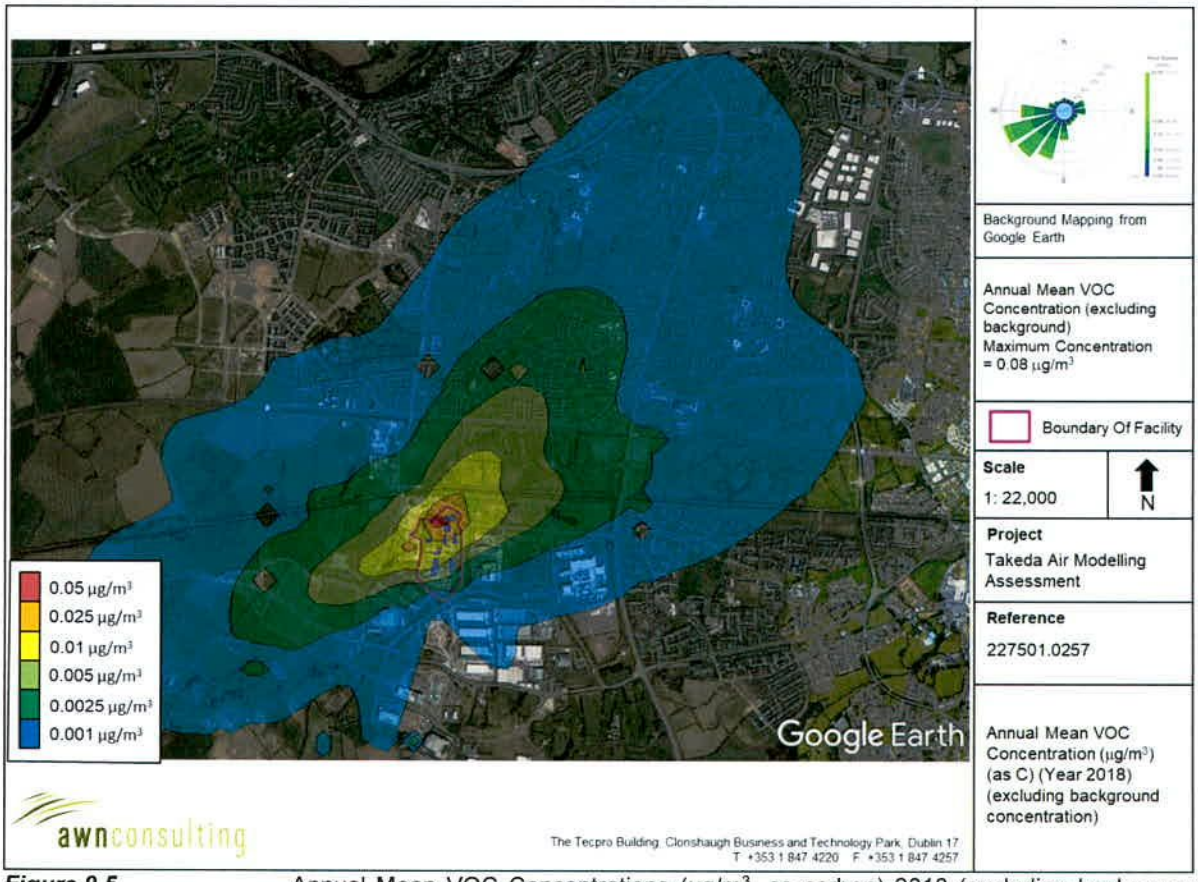

Figure 9.5 Annual Mean VOC Concentrations (µg/m³, as carbon) 2018 (excluding background concentrations)

APPENDIX 9.1

DESCRIPTION OF THE AERMOD MODEL

AWN CONSULTING LTD

The AERMOD dispersion model has been developed in part by the U.S. Environmental Protection Agency (USEPA, 2017, 2018). The model is a steady-state Gaussian model used to assess pollutant concentrations associated with industrial sources. The model is an enhancement on the Industrial Source Complex-Short Term 3 (ISCST3) model which has been widely used for emissions from industrial sources.

Improvements over the ISCST3 model include the treatment of the vertical distribution of concentration within the plume. ISCST3 assumes a Gaussian distribution in both the horizontal and vertical direction under all weather conditions. AERMOD with PRIME, however, treats the vertical distribution as non-Gaussian under convective (unstable) conditions while maintaining a Gaussian distribution in both the horizontal and vertical direction during stable conditions. This treatment reflects the fact that the plume is skewed upwards under convective conditions due to the greater intensity of turbulence above the plume than below. The result is a more accurate portrayal of actual conditions using the AERMOD model. AERMOD also enhances the turbulence of night-time urban boundary layers thus simulating the influence of the urban heat island.

In contrast to ISCST3, AERMOD is widely applicable in all types of terrain. Differentiation of the simple versus complex terrain is unnecessary with AERMOD. In complex terrain, AERMOD employs the dividing-streamline concept in a simplified simulation of the effects of plume-terrain interactions. In the dividing-streamline concept, flow below this height remains horizontal, and flow above this height tends to rise up and over terrain. Extensive validation studies have found that AERMOD (precursor to AERMOD with PRIME) performs better than ISCST3 for many applications and as well or better than CTDMPLUS for several complex terrain data sets (Schulman et al., 2000).

Due to the proximity to surrounding buildings, the PRIME (Plume Rise Model Enhancements) building downwash algorithm has been incorporated into the model to determine the influence (wake effects) of these buildings on dispersion in each direction considered. The PRIME algorithm takes into account the position of the stack relative to the building in calculating building downwash. In the absence of the building, the plume from the stack will rise due to momentum and/or buoyancy forces. Wind streamlines act on the plume leads to the bending over of the plume as it disperses. However, due to the presence of the building, wind streamlines are disrupted leading to a lowering of the plume centreline.

When there are multiple buildings, the building tier leading to the largest cavity height is used to determine building downwash. The cavity height calculation is an empirical formula based on building height, the length scale (which is a factor of building height & width) and the cavity length (which is based on building width, length and height). As the direction of the wind will lead to the identification of differing dominant tiers, calculations are carried out in intervals of 10 degrees.

In PRIME, the nature of the wind streamline disruption as it passes over the dominant building tier is a function of the exact dimensions of the building and the angle at which the wind approaches the building. Once the streamline encounters the zone of influence of the building, two forces act on the plume. Firstly, the disruption caused by the building leads to increased turbulence and enhances horizontal and vertical dispersion. Secondly, the streamline descends in the lee of the building due to the reduced pressure and drags the plume (or part of) nearer to the ground, leading to higher ground level concentrations. The model calculates

the descent of the plume as a function of the building shape and, using a numerical plume rise model, calculates the change in the plume centreline location with distance downwind.

The immediate zone in the lee of the building is termed the cavity or near wake and is characterised by high intensity turbulence and an area of uniform low pressure. Plume mass captured by the cavity region is re-emitted to the far wake as a ground-level volume source. The volume source is located at the base of the lee wall of the building, but is only evaluated near the end of the near wake and beyond. In this region, the disruption caused by the building downwash gradually fades with distance to ambient values downwind of the building.

AERMOD has made substantial improvements in the area of plume growth rates in comparison to ISCST3 (USEPA, 1995, 2000). ISCST3 approximates turbulence using six Pasquill-Gifford-Turner Stability Classes and bases the resulting dispersion curves upon surface release experiments. This treatment, however, cannot explicitly account for turbulence in the formulation. AERMOD is based on the more realistic modern planetary boundary layer (PBL) theory which allows turbulence to vary with height. This use of turbulence-based plume growth with height leads to a substantial advancement over the ISCST3 treatment.

Improvements have also been made in relation to mixing height (USEPA, 1995, 2021). The treatment of mixing height by ISCST3 is based on a single morning upper air sounding each day. AERMOD, however, calculates mixing height on an hourly basis based on the morning upper air sounding and the surface energy balance, accounting for the solar radiation, cloud cover, reflectivity of the ground and the latent heat due to evaporation from the ground cover. This more advanced formulation provides a more realistic sequence of the diurnal mixing height changes.

AERMOD also has the capability of modelling both unstable (convective) conditions and stable (inversion) conditions. The stability of the atmosphere is defined by the sign of the sensible heat flux. Where the sensible heat flux is positive, the atmosphere is unstable whereas when the sensible heat flux is negative the atmosphere is defined as stable. The sensible heat flux is dependent on the net radiation and the available surface moisture (Bowen Ratio). Under stable (inversion) conditions, AERMOD has specific algorithms to account for plume rise under stable conditions, mechanical mixing heights under stable conditions and vertical and lateral dispersion in the stable boundary layer.

AERMOD also contains improved algorithms for dealing with low wind speed (near calm) conditions. As a result, AERMOD can produce model estimates for conditions when the wind speed may be less than 1 m/s, but still greater than the instrument threshold.

APPENDIX 9.2

METEOROLOGICAL DATA- AERMET

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AERMOD incorporates a meteorological pre-processor AERMET (version 16216) (Met Eireann, 2022). AERMET allows AERMOD to account for changes in the plume behaviour with height. AERMET calculates hourly boundary layer parameters for use by AERMOD, including friction velocity, Monin-Obukhov length, convective velocity scale, convective (CBL) and stable boundary layer (SBL) height and surface heat flux. AERMOD uses this information to calculate concentrations in a manner that accounts for changes in dispersion rate with height, allows for a non-Gaussian plume in convective conditions, and accounts for a dispersion rate that is a continuous function of meteorology.

The AERMET meteorological preprocessor requires the input of surface characteristics, including surface roughness (z_0), Bowen Ratio and albedo by sector and season, as well as hourly observations of wind speed, wind direction, cloud cover, and temperature. A morning sounding from a representative upper air station, latitude, longitude, time zone, and wind speed threshold are also required.

Two files are produced by AERMET for input to the AERMOD dispersion model. The surface file contains observed and calculated surface variables, one record per hour. The profile file contains the observations made at each level of a meteorological tower, if available, or the one-level observations taken from other representative data, one record level per hour.

From the surface characteristics (i.e. surface roughness, albedo and amount of moisture available (Bowen Ratio)) AERMET calculates several boundary layer parameters that are important in the evolution of the boundary layer, which, in turn, influences the dispersion of pollutants. These parameters include the surface friction velocity, which is a measure of the vertical transport of horizontal momentum; the sensible heat flux, which is the vertical transport of heat to/from the surface; the Monin-Obukhov length which is a stability parameter relating the surface friction velocity to the sensible heat flux; the daytime mixed layer height; the nocturnal surface layer height and the convective velocity scale which combines the daytime mixed layer height and the sensible heat flux. These parameters all depend on the underlying surface.

The values of albedo, Bowen Ratio and surface roughness depend on land-use type (e.g., urban, cultivated land etc) and vary with seasons and wind direction. The assessment of appropriate land-use types was carried out in line with USEPA recommendations (USEPA, 2017) and using the detailed methodology outlined by the Alaska Department of Environmental Conservation (USEPA, 2008). AERMET has also been updated to allow for an adjustment of the surface friction velocity (u*) for low wind speed stable conditions based on the work of Qian and Venkatram (BLM, 2011). Previously, the model had a tendency to over-predict concentrations produced by near-ground sources in stable conditions.

Surface roughness

Surface roughness length is the height above the ground at which the wind speed goes to zero. Surface roughness length is defined by the individual elements on the landscape such as trees and buildings. In order to determine surface roughness length, the USEPA recommends that a representative length be defined for each sector, based on geometric mean of the inverse distance area-weighted land use within the sector, by using the eight land use categories outlined by the USEPA. The area-weighted surface roughness length derived from the land use classification within a radius of 1 km from Casement Aerodrome is shown in Table A1.

Table A.1 Surface Roughness based on an inverse distance area-weighted average of the land use within a 1 km radius of Casement Aerodrome

Sector	Area Weighted Land Use Classification	Spring	Summer	Autumn	Winter[Note 1]
0-360	100% Grassland	0.050	0.100	0.010	0.010

Note 1 Winter defined as periods when surfaces covered permanently by snow whereas autumn is defined as periods when freezing conditions are common, deciduous trees are leafless and no snow is present (Iqbal (1983)). Thus for the current location autumn more accurately defines "winter" conditions at the proposed facility.

Albedo

Noon-time Albedo is the fraction of the incoming solar radiation that is reflected from the ground when the sun is directly overhead. Albedo is used in calculating the hourly net heat balance at the surface for calculating hourly values of Monin-Obuklov length. The area-weighted arithmetic mean albedo derived from the land use classification over a 10 km x 10 km area centred on Casement Aerodrome is shown in Table A2.

Table A.2 Albedo based on an area-weighted arithmetic mean of the land use over a 10 km x 10 km area centred on Casement Aerodrome

Area Weighted Land Use Classification	Spring	Summer	Autumn	Winter[Note 1]
0.5% Water, 30% Urban, 0.5% Coniferous Forest 38% Grassland, 19% Cultivated Land	0.155	0.180	0.187	0.187

Note 1 For the current location autumn more accurately defines "winter" conditions at the proposed facility.

Bowen Ratio

The Bowen ratio is a measure of the amount of moisture at the surface of the earth. The presence of moisture affects the heat balance resulting from evaporative cooling which, in turn, affects the Monin-Obukhov length which is used in the formulation of the boundary layer. The area-weighted geometric mean Bowen ratio derived from the land use classification over a 10 km x 10 km area centred on Casement Aerodrome is shown in Table A3.

Table A.3 Bowen Ratio based on an area-weighted geometric mean of the land use over a 10 km x 10 km area centred on Casement Aerodrome

Area Weighted Land Use Classification	Spring	Summer	Autumn	Winter[Note 1]
0.5% Water, 30% Urban, 0.5% Coniferous Forest 38% Grassland, 19% Cultivated Land	0.549	1.06	1.202	1.202

Note 1 For the current location autumn more accurately defines "winter" conditions at the proposed facili