Environmental Impact Assessment Report

Project: ART DATACENTRES – ENNIS CAMPUS

Data Storage & Energy Centre Facility and Substation Development

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Volume 2 – EIAR Report

Prepared by: AWN Consulting, June 2022

Prepared for: ART Data Centres Limited

1.0 INTRODUCTION

1.1 PROPOSED DEVELOPMENT

1.1.1 Introduction

This Environmental Impact Assessment (EIA) Report has been prepared on behalf of Art Data Centres Limited (herein referred as 'the Applicant') to accompany an application for permission / approval to An Bord Pleanála (ABP) for an electricity transmission development to serve a data storage facility and energy centre development on lands in the townlands of Tooreen and Cahernalough, Tulla Road, Ennis, Co Clare.

This application to ABP under section 182 of the Act primarily relates to the provision of a new 110 kV Gas Insulated Switchgear (GIS) substation, two 110 kV underground transmission cables connecting to existing 110 kV overhead lines to the north of the proposed substation, and two 110kV underground transmission cables connecting to the existing Ennis 110kV substation, along with associated and ancillary works. The development subject to the electricity transmission application is located within the townlands of Tooreen, Cahernalough, Knockanean, Ballymacahill, Muckinish and Rosslevan to the north east of Ennis, on the Tulla Road (R352), Co. Clare.

This planning application (a new 110 kV Gas Insulated Switchgear (GIS) substation, two 110 kV underground transmission cables connecting to existing 110 kV overhead lines to the north of the proposed substation, and two 110kV underground transmission cables connecting to the existing Ennis 110kV substation, along with associated and ancillary works) forms part of an overall 'project' which also includes the provision of data storage facilities, an energy centre, and associated development. The electricity transmission infrastructure is required to be applied for via a separate application to An Bord Pleanála under section 182 of the Planning and Development Act, as it falls within the meaning of 'transmission' as defined within that section of the Act.

It should be noted that this Environmental Impact Assessment Report has been prepared to provide the information necessary for the competent authority / authorities to undertake Environmental Impact Assessment of both the data storage facility and energy centre application and the substation and associate infrastructure (electricity transmission development applied for under section 182) i.e. "the project". The project boundary Figure 1.1 is shown in all drawings within relevant chapters. Figures 1.2 and Figure 1.3 present the planning application boundaries.

Figure 1.1 The project boundary

Figure 1.2 *The redline boundary for the data storage and energy centre facility application*

Figure 1.3 The redline boundary for the SID application

1.1.2 Summary description of the project.

The project will consist of the following:

- The demolition of an existing farm dwelling house together with a number of farm outbuildings on the overall site;
- The construction of 6 No. two storey data storage facility buildings with three storey plant/office levels and associated ancillary development that will have a combined gross floor area of 118,740 sq.m. These data halls are 86 x 105 x 18m high and will consist of multi levels 9m slab to slab for the data halls and air handling units and 4.5m slab to slab for offices and ancillary plant and support. Each of the six data halls will include data storage rooms, associated electrical and mechanical plant rooms, loading bays, maintenance and storage spaces, office administration areas, pump rooms plus water storage tanks and plant as well as backup (standby) generators for emergency use only (11 per building) situated along one elevation of the building. The diesel generators will have associated 8 m high flues. Each generator will also include a diesel belly tank with a single refuelling area to serve the proposed emergency generators.
- Two single storey buildings used for 20/10 kV switchgear control and ancillary (each approx. 20m x 6m x 6m height)
- A gas powered energy centre and Above Ground Installation (AGI). The energy centre will primarily comprise 18 no. lean-burn natural gas engines. Each generator will have its own flue of 25m height. The energy centre will be on a 110m x 100m plot and buildings within the compound will be 12 m high. The building will house an office and welfare facilities and associated parking.
- A two storey Vertical Farm Building. The vertical farm will be c. 50 x 50 x 12m high. It will comprise c. 60% growing space and 40% office area.

- Solar Panels and Rainwater harvesting included in the development.
- Provision of a proposed Substation and associated electricity transmission line connections, and the undergrounding of two existing overhead 110kv circuits and ancillary development (subject of a separate Strategic Infrastructure Development application).
- Undergrounding of two of the existing overhead 110kv circuits and ancillary development.
- Ancillary site development works, that will include attenuation ponds and the installation and connection to the underground public water supply, foul and storm water drainage network, and installation of utility ducts and cables. Other ancillary site development works will include hard and soft landscaping throughout the site, lighting, fencing, signage, central services road, security gate, 276 No. car parking spaces, and 108 no. bicycle parking spaces. The development will be enclosed with landscaping to all frontages including the retention of an ecological buffer area to the west.
- The development will be accessed from the Tulla Road (R352) with the provision of a new vehicular access road, together with an emergency access/egress road to the south west of the site.

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

The data storage facility will facilitate the secure storage, and distribution of information to individuals, businesses and organisations.

The application for the data storage and energy centre facility is for a ten-year permission for a data storage facility campus. A 10-year permission is sought due to the nature of this specific development. The proposed development will respond to current and future use demands in the area. The logistics of the site and use of the buildings mean that their delivery must be programmed on a phased basis over the duration of a 10-year planning permission.

The planning permission will reinforce the planning objectives of the Variation No.1 to the CCDP 2017-2023. As described in the Variation. The 55ha area at Tooreen was "*identified and zoned as Enterprise (45ha) and Buffer (10ha) with a specific use for a Data Centre Campus due to; its proximity to the electricity sub-station; its proximity to the M18 motorway and adjoining regional road network; the location of the site relative to the Gas Pipeline; the availability of Dark Fibre and the proximity of the site to Shannon International Airport and Ennis Town. This site is zoned to accommodate a Data Centre campus which consists of one or more structure, used primarily for the storage, management and dissemination of data and the provision of associated power electricity connections and energy generating infrastructure*."

These Local Authority ambitions have been captured and incorporated in the submitted documentation.

1.2 CONTEXT

1.2.1 Legislative Requirements

The requirement for EIA for certain types and scales of development is set out in the EIA Directives (2011/92/EU and 2014/52/EU), European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (the bulk of which came into operation in September 2018), the European Communities

(Environmental Impact Assessment) Regulations 1989-2006, Planning and Development Act 2000 (as amended) and the Planning and Development Regulations 2001, as amended. It should be noted that this EIA Report is prepared in accordance with the 2011 EIA Directive (2011/92/EU), as amended by the 2014 EIA Directive.

The EIA Directives list those projects for which an EIA is mandatory (Annex I) and those projects for which an EIA may be required (Annex II). With regard to Annex II projects, Member States can choose to apply thresholds or use case by case examination, or a combination of both, to assess where EIA is required. In Ireland, a combination of both has been applied.

The project proposed is not listed under Annex I of the EIA Directive and it is below the relevant threshold as set out in the Planning and Development Regulations 2001-2019 for Annex II projects. The threshold for "*industrial estate development projects, where the area would exceed 15 hectares"* as set out in Part 2 of Schedule 5 of the Regulations was considered to be the most relevant threshold in the context of the proposed development in the subject location.

1.2.2 Format of the EIA Report

This EIA Report has been developed in accordance with the most relevant guidance, including:

- EIA Directive (2011/92/EU) as amended by EIA Directive (2014/52/EU)
- Planning and Development Act 2000 (as amended)
- Planning and Development Regulations 2001 (as amended)
- *Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment* (Department of Housing, Planning and Local Government, 2018)
- *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* (EPA, 2022)
- *Guidance on the preparation of the Environmental Impact Assessment Report* (European Commission, 2017)
- *Draft Advice Notes for Preparing Environmental Impact Statements* (EPA, 2015)

Using the Grouped Format Structure, the EIA Report examines each environmental aspect in a separate chapter. Each chapter generally covers the following:

- Receiving Environment;
- Characteristics of the Proposed Development;
- Potential Impacts of the Proposed Development;
- Do-Nothing Scenario;
- Remedial and Mitigation Measures;
- Predicted Impacts of the Proposed Development; and
- Cumulative Impacts of the Proposed Development.

A Non-Technical Summary of the findings of the EIA Report is provided as a separate document.

Cumulative impacts for each environmental topic are assessed in each chapter.

Interactions i.e. the interrelationship between each environmental aspect, are assessed as they occur in each chapter. The final chapter of the EIA Report, Chapter 15 shows where interactions have been identified and how they have been addressed.

1.2.3 Need for the Development

The Applicant is seeking to build a significant data storage facility development to meet growing global demand for Cloud Computing space. The digital economy is seen as key by Government and Enterprise for sustained growth from overseas investor in Ireland and there is a strong demand for more data storage facility space to meet demand in Ireland. The digital economy provides high value jobs and the location of this facility in County Clare will provide up to 1200 construction staff phased over a period of 7 years and 450-475 high quality jobs during operation. The vertical farm will provide c. 40 full time jobs.

1.3 CONSULTATION

The Applicant and the project team have liaised with the relevant departments of CCC and ABP in advance of lodgement of this application.

In addition, relevant specialists in the proposed development project team have liaised with statutory bodies (including the Water Services, Roads/Transportation, National Parks and Conservation, Irish Water, Eirgrid, ESB, Bord Gais) by correspondence during the course of the EIA Report preparation.

1.4 REGULATORY CONTROL

Industrial Emissions Directive 2010/75/EU

The Integrated Pollution Prevention and Control (IPPC) Directive was transposed into Irish law by the Protection of the Environment Act, 2003, and the Industrial Emissions Directive 2010/75/EU under the European Union (Industrial Emissions) Regulations 2013, S.I. 138 of 2013.

These Regulations primarily amend the EPA Act 1992 to introduce a system of licensable activities from both the Integrated Pollution Prevention and Control (IPPC) and Industrial Emissions (IE) directives. The First Schedule of EPA Act 1992 lists the activities that require an Industrial Emissions Licence from the EPA.

It has been concluded that the Energy Centre component of the proposed development will require an IE to operate. The proposed Energy Centre will require a licence under *Class 2.1 Combustion of fuels in installations with a total rated thermal input of 50 MW or more.*

The proposed Data Storage facility, emergency backup generators, and all other aspects of the proposed development have been reviewed against the First Schedule, and it is concluded that an IE licence is not required for these activities.

Medium Combustion Plant Directive

The European Union (Medium Combustion Plant) Regulations 2017 were signed into Irish law in December 2017. Their purpose is to limit emissions to atmosphere from boilers and other stationary combustion plants in the 1-50 Megawatt Thermal Input (MWth) range. It covers all fuel types. The Regulations transpose the Medium Combustion Plant (MCP) Directive (EU 2015/2193) which was adopted in 2015.

The stationary combustion plants on site (emergency generators) will exceed 1 MWth, and, accordingly, this plant will be registered in advance of the commissioning phase as required with the Environmental Protection Agency (EPA).

Emissions Trading Directive

The EU is committed to achieving a reduction of greenhouse gas emissions; this is being implemented by the EU Emissions Trading Directive (Directive 2003/87/EC). The EPA has been given the responsibility for implementing the Emissions Trading Directive in Ireland. The Directive establishes an allowance-trading scheme for emissions to promote reductions of greenhouse gases, in particular carbon dioxide.

The trading scheme applies to facilities with:

Combustion installations with a rated thermal input exceeding 20 MW

The rated thermal input of relevant on-site fuel consuming equipment (emergency generators) will exceed 20 MWth; therefore, a Greenhouse Gas (GHG) Permit is required for the operational phase of the proposed development. The GHG permit will be applied for by the operator in advance of the commissioning phase, as and when the site fuel consuming equipment exceeds a rated thermal input of 20 MW.

1.5 CONTRIBUTORS TO THE EIA REPORT

The preparation and co-ordination of this EIA Report has been completed by AWN Consulting and specialist subcontractors. Specialist inputs were provided by the following (Table 1.1).

Table 1.1 *Roles and Responsibilities in the EIA Report*

Role		Company
EIA Project Management		AWN Consulting
Engineering Design		ARC-MC, Clifton Scannell Emerson (CSEA) and Hurley Palmer Flatt
Architectural Design		ARC-MC
Planning Consultant		John Spain Associates
EIA Chapter No.	Chapter Title	Company and Consultant
	Non-Technical Summary	AWN – Input from each specialist
Chapter 1	Introduction	AWN – Teri Hayes
Chapter 2	Description of the Proposed Development	AWN – Teri Hayes
Chapter 3	Planning and Development Context and Alternatives	AWN – Teri Hayes and Jonathan Gauntlett
Chapter 4	Population and Human Health	AWN – Teri Hayes with specialist input from Damian Kelly and Jovanna Arndt
Chapter 5	Land, Soils, Geology & Hydrogeology	AWN Pat Groves and Colm Driver
Chapter 6	Hydrology	AWN – Pat Groves and Colm Driver

Chapter 7	Biodiversity (including AA Screening Report)	Scott Cawley – Siofra Quigley and Kate-Marie O'Connor
Chapter 8	Air Quality & Climate	AWN – Dr Edward Porter and Dr.Jovanna Arndt
Chapter 9	Noise & Vibration	AWN – Damian Kelly
Chapter 10	Landscape and Visual	Nicholas de Jong Associates - Samuel McKeever
Chapter 11	Archaeological, Architectural and Cultural Heritage	IAC Archaeology – Faith Bailey
Chapter 12	Traffic & Transportation	Alan Lipscombe Traffic and Transport Consultants Ltd.
Chapter 13	Material Assets	AWN – Teri Hayes
Chapter 14	Waste Management (including C&D Waste Management Plan)	AWN – Chonaill Bradley
Chapter 15	Interactions-Interrelationship between the Aspects	AWN – Teri Hayes

Project Director, Teri Hayes, BSc MSc PGeo. Teri is a Director with AWN Consulting with 25 years of experience in water resource management and environmental assessment and risk analysis. Teri is a professional member of the International Association of Hydrogeologists (Irish Group) – former president and a professional member of the Institute of Geologists of Ireland She has project managed and contributed to numerous environmental impact assessments and design of appropriate mitigation measures, acted as an expert witness at public hearings, lectured in EIA for post graduate classes and providing expert advice on EIA sections for planning authorities. Teri is experienced in projects with ecological sensitivities having worked on the Ennis Flood Study, Doonbeg golf club and Kildare By-pass. She is also familiar with the design and impacts of datacentre and energy project developments having worked on similar developments for most of the datacentre operators in Ireland.

Land, Soils, Geology, Hydrogeology & Hydrology

Pat Groves (*BSc, HDip EIA HDip Env Eng MSc Env. Hydrogeology*)**.** Pat is a Senior Hydrogeological Consultant with the Water Team at AWN, with over 18 years' experience in the field of environmental sciences including hydrogeology, soils, geology, geotechnical engineering, and impact assessment. His role at AWN includes responsibility for groundwater related projects including groundwater resource management and assessment, aquifer characterisation and source protection plans, groundwater modelling, hydrogeology and geology in EIAR. He is involved in project managing IPPC groundwater monitoring sites, contaminated land assessments, and had an advisory role for the EPA National WFD Groundwater Monitoring Programme in 2012. His experience also includes the provision of hydrogeological conceptual site models (CSM) and ArcGIS mapping. Pat is member of the International Association of Hydrogeologists (Irish Group).

Colm Driver (*BSc MSc MIT*). Colm is an Environmental Consultant (Hydrogeologist) with AWN Consulting with over 5 years' experience in the field of environmental sciences including hydrogeology, soils, geology, geotechnical engineering, and impact assessment. His role at AWN includes responsibility for groundwater related projects including groundwater resource management and assessment, aquifer characterisation and source protection plans, contaminated land assessments, groundwater modelling, hydrogeology and geology in EIAR. His experience also includes the provision of hydrogeological conceptual site models (CSM) and ArcGIS mapping. Colm is a member of the International Association of Hydrogeologists (Irish Group), Irish Brownfield Network and Institute of Geologists Ireland.

Teri Hayes (as above)

Biodiversity/Appropriate Assessment,

Síofra Quigley B.Sc. (Hons) M.Sc. is a Consultant Ecologist with Scott Cawley. She obtained an honours degree in Zoology, from National University of Ireland Galway, and a Masters in Wildlife Biology and Conservation from Edinburgh Napier University. She has four years' professional experience working in the UK on large to small scale infrastructure projects, with governmental and private clients. Síofra is experienced in carrying out field surveys in several protected species, including bat, otter, badger, red squirrel, reptile, pine marten and mountain hare. She has also been involved in radio tracking mountain hares and bats, bat call analysis, badger bait marking, acting as an Ecological Clerk of Works, Phase 1 habitat surveys and reports (JNCC standard), and carrying out desk top studies. Since joining Scott Cawley, Síofra's work involves the preparation of reports, including Ecological Impact Assessment and Appropriate Assessment reports for residential, commercial, and infrastructural projects across Ireland.

Kate-Marie O'Connor B.A. (Hons) M.Sc. MCIEEM is an experienced ecologist with over eight years' experience in professional ecological consultancy. She holds an honours degree in Natural Sciences from Trinity College Dublin, specialising in Botany, and obtained a distinction in her Masters in Environmental Modelling, Monitoring and Reconstruction from the University of Manchester. She also holds an advanced diploma in Planning and Environmental Law from The Honourable Society of King's Inn. She is a Full Member of the CIEEM. Her experience as a principal ecologist has focused on the preparation of ecological assessments, most frequently for EIA and AA, with all the key elements of those processes including planning for and undertaking ecological baseline surveys, desk studies, analysis and presentation of data and results, undertaking assessment of impacts and identifying appropriate mitigation measures. She has worked on a range of public and private sector schemes in the UK and Ireland. Kate-Marie has a specialist interest in botany but is also competent in a range of fauna surveys (*e.g.* mammals including badgers, bats and otters, and newts).

Andrew Speer B.Sc. (Hons) Pg.D. Adv.Dp MCIEEM is a Technical Director at Scott Cawley Ltd. with over 14 years' professional ecological consultancy experience in ecological impact assessment. Andrew is a Full Member of the Chartered Institute of Ecology and Environmental Management (CIEEM) and holds an honours degree in Zoology from NUI Galway, a Postgraduate Diploma in Geographic Information Systems (GIS) from the University of Ulster and an Advanced Diploma in Planning and Environmental Law from Kings Inns. He has extensive experience in the Appropriate Assessment (AA) process and has been the lead author for the preparation of numerous Screening for Appropriate Assessment Reports, Natura Impact Statements (NISs) and Natura Impact Reports (NIRs). Andrew also provides technical review and due diligence of Appropriate Assessment documentation for public and local authorities to aid their decision-making process as well as peer review of AA documentation prior to lodgement of planning applications.

Air Quality & Climate,

Dr. Edward Porter is Director with responsibility for Air Quality with AWN Consulting and has completed Chapter 9. He holds a BSc from the University of Sussex

(Chemistry), has completed a PhD in Environmental Chemistry (Air Quality) in UCD where he graduated in 1997 and is a Full Member of the Royal Society of Chemistry (MRSC CChem), the Institute of Environmental Sciences (MIEnvSc) and the Institute of Air Quality Management (MIAQM). He specialises in the fields of air quality, EIA and air dispersion modelling.

Jovanna Arndt BSc PhD is a Senior Air Quality Consultant with AWN Consulting. Dr. Jovanna Arndt holds a BSc (Hons) in Environmental Science and a PhD in Atmospheric Chemistry from UCC and is a member of the Institute of Air Quality Management. Jovanna has specialised in air quality since 2010 and has extensive knowledge of air dispersion modelling of a variety of infrastructure projects, including power stations, and is experienced in monitoring and managing the associated air quality impacts.

Noise & Vibration, Damian Kelly BSc MSc is a Director and Principal Acoustic Consultant with AWN Consulting. Damian holds a BSc from DCU and an MSc from Queens University Belfast. He has over 18 years' experience as an acoustic consultant. He is a member of the Institute of Acoustics. He has extensive knowledge in the field of noise modelling and prediction, having prepared the largest and most complex examples of road and industrial noise models currently in existence in Ireland. He was also co-author of the EPA document "*Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities" (2012)* and advised in relation to the noise limits applied to commercial developments by the various local authorities in the Dublin region.

Landscape and Visual Impact Assessment, Samuel McKeever MA (Hons) CMLI is a Senior Landscape Architect with Nicholas de Jong Associates with 14 years' experience in the private sector. He is a chartered member of the UK Landscape Institute. Samuel has over 11 years' experience of preparing Landscape and Visual Impact Assessments. These have included projects such as large scale windfarms in Scotland, offshore gas and oil exploration, transmission lines, residential developments and the New Istanbul Airport. Samuel is also highly experienced in Landscape Design having worked on numerous residential and mixed-use developments in Ireland, Northern Ireland, Scotland and England and a number of public realm spaces in Ireland.

Archaeology, Faith Bailey BA is an Associate Director, Project Manager and Senior Archaeologist and Cultural Heritage Consultant with IAC Archaeology. She holds an MA in Cultural Landscape Management (archaeology and built heritage) and a BA in single honours archaeology from the University of Wales, Lampeter. She is a licence eligible archaeologist, a member of the Chartered Institute of for Archaeologists, a member of the Institute of Archaeologists of Ireland and has over 18 years' experience working in the commercial archaeological and cultural heritage sector. As an EIAR Archaeologist and cultural heritage consultant, she has been responsible for the production and delivery of a large number of archaeological and built heritage assessments and EIAR chapters associated with all sectors of development in the Republic and Northern Ireland. She has acted as the cultural heritage expert witness at multiple Oral Hearings, with the most recent examples being the Limerick-Foynes Road Scheme (2021) and Galway Ring Road (2020/21).

Traffic & Transportation, Alan Lipscombe (BAI, BA) is a traffic engineer with ten years' experience in the traffic and transportation field. This section of the EIAR has been prepared by Alan Lipscombe of Alan Lipscombe Traffic and Transport Consultants Ltd. Alan is a competent expert in traffic and transport assessments. In 2007 Alan set up a traffic and transportation consultancy providing advice for a range of clients in the private and public sectors. Prior to this Alan was a founding member of Colin Buchanan's Galway office having moved there as the senior transportation engineer for the Galway Land Use and Transportation Study. Since the completion of that study in 1999, Alan has worked throughout the West of Ireland on a range of projects including: major development schemes, the Galway City Outer Bypass, Limerick Planning Land-Use and Transportation Study, Limerick Southern Ring Road Phase II, cost benefit analyses (COBA) and various studies for the NUI Galway. Before moving to Galway in 1997, Alan was involved in a wide variety of traffic and transport studies for CBP throughout the UK, Malta and Indonesia. He has particular expertise in the assessment of development related traffic and transport modelling, including over 20 wind farm developments, and is an accomplished analyst who has experience of a wide variety of modelling packages and methods.

Waste Management, Chonaill Bradley, BSc (Environmental Science) is an Associate Member of the Institute of Waste Management (AssocCIWM). He is a Senior Environmental Consultant in AWN and has over 7 years' experience in environmental consultancy experience in Waste Management and Environmental Impact Assessment. He has helped coordinated and prepare specialist inputs including the Waste Management Chapters, Operational and C&D Waste Management Plans and Construction environmental Management Plans for numerous EIS/EIA/EIAR's.

1.6 DESCRIPTION OF EFFECTS

The quality, magnitude and duration of potential effects are defined in accordance with the criteria provided in the EPA Draft *'Guidelines on the information to be contained in Environmental Impact Assessment Reports'* (2017) as outlined in Table 1.2.

Table 1.2. *Description of Effects as per EPA Guidelines (Draft, 2017), Table 3.3.*

Effect Characteristic	Term	Description
Quality	Positive	A change which improves the quality of the environment
	Neutral	A change which does not affect the quality of the environment
	Negative	A change which reduces the quality of the environment
Significance	Imperceptible	An impact capable of measurement but without noticeable consequences
	Not significant	An effect which causes noticeable changes in the character of the environment but without noticeable consequences
	Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
	Moderate	An effect that alters the character of the environment in a manner consistent with existing and emerging trends
	Significant	An effect, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
	Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters the majority of a sensitive aspect of the environment.
	Profound	An impact which obliterates sensitive characteristics
Duration of Effects	Momentary Effects	Effects lasting from seconds to minutes
	Brief Effects	Effects lasting less than a day

Effect Characteristic	Term	Description
	Temporary Effects	Effects lasting less than a year
	Short-term Effects	Effects lasting one to seven years.
	Medium-term Effects	Effects lasting seven to fifteen years
	Long-term Effects	Effects lasting fifteen to sixty years
	Permanent Effects	Effects lasting over sixty years
	Reversible Effects	Effects that can be undone, for example through remediation or restoration
Probability of Effects	Likely Effects	The effects that can reasonably be expected to occur as a result of the planned project if all mitigation measures are properly implemented.
	Unlikely Effects	The effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented.
Type of Effects	Indirect Effects	Impacts on the environment, which are not a direct result of the project, often produced away from the project site or because of a complex pathway.
	Cumulative	The addition of many minor or significant effects, including effects of other projects, to create larger, more significant effects.
	'Do Nothing'	The environment as it would be in the future should no development of any kind be carried out
	\`Worst case' Effects	The effects arising from a project in the case where mitigation measures substantially fail
	Indeterminable	When the full consequences of a change in the environment cannot be described
	Irreversible	When the character, distinctiveness, diversity, or reproductive capacity of an environment is permanently lost
	Residual	Degree of environmental change that will occur after the proposed mitigation measures have taken effect
	Synergistic	Where the resultant impact is of greater significance than the sum of its constituents

1.7 ADDITIONAL ASSESSMENTS REQUIRED

This section addresses the additional approvals and assessments required under other EU Directives and legislation, which were undertaken:

- **Appropriate Assessment Screening Report** and **Natura Impact Statement** –has been completed for the Proposed Development, as required under the Habitats and Birds Directive (92/43/EEC and 79/409/EEC) and is appended to Chapter 8 Biodiversity as Appendix 8.1; and
- Flood Risk Assessment - A site specific flood risk assessment has been undertaken by CSEA for the site and is included with the planning documentation.

In addition, the following reports have been prepared::

- **Energy and Sustainability Statement** prepared by Hurley Palmer Flatt
- **Construction Environmental Management Plan** prepared by AWN which includes a **Construction Surface Water Management Plan** prepared by CSEA and **Construction Traffic Management Plan** prepared by Alan Lipscombe Traffic and Transport Consultants Ltd.
- **Landscape Management Plan** – Nicholas de Jong Associates

1.8 FORECASTING METHODS AND DIFFICULTIES IN COMPILING THE SPECIFIED INFORMATION

Forecasting methods and evidence used to identify and assess the effects on the environment for each environmental aspect are set out in each chapter.

Any challenges encountered during the assessment of individual factors are noted within the relevant chapters.

2.0 DESCRIPTION OF THE PROPOSED DEVELOPMENT

2.1 INTRODUCTION

The applicant is proposing to develop six data storage facilities, an energy centre an Above Ground Installation (AGI) building, vertical farm, a substation compound and associated ancillary development on a greenfield site (previously used for agriculture and hosting power transmission infrastructure) in the townlands of Tooreen and Cahernalough, Co Clare. The land is zoned as Enterprise (ENT3) and zoned to accommodate a data centre campus which consists of one or more structures, used primarily for the storage, management and dissemination of data and the provision of associated power electricity connections and energy generating infrastructure (ref Clare County Development Plan 2017-2023).

This chapter presents the description of the project comprising information on the site, design, size and other relevant features of the project as required by the 2011 EIA Directive (2011/92/EU), as amended by the 2014 EIA Directive (2014/52/EU) (herein referred to as the EIA Directive) and the Draft EPA "*Guidelines on the Information to be Contained in Environmental Impact Assessment Reports"* (2017) (herein referred to the as the EPA Guidelines 2017) and the EPA Draft "*Advice Notes for Preparing Environmental Impact Statements"* (2015) (herein referred to as the EPA Advice Notes 2015). The European Commission guidance '*Environmental Impact Assessment of Projects - Guidance on the preparation of the Environmental Impact Assessment Report''* published by the European Union in 2017 was also considered in the preparation of this EIA Report.

This chapter summarises the proposed development and the lifecycle of the facility (construction, operation and decommissioning). The EIAR should be read in conjunction with the planning package that includes complete elevations and floor plans site, layout plans including utilities and building drawings and accompanying reports.

2.2 DEVELOPMENT SITE

The development footprint is c. 60 hectares (ha) and is located to the east of Ennis in the townland of Tooreen and Cahernalough with small sections extending west into the townlands of Ballymacahill and Knockanean. The lands are bordered to the south by the R352 (Tulla Road) and to the west by the M18. The lands are traversed by a gas pipeline and overhead powerlines connecting to the existing Ennis 110kv Substation that adjoins the western boundary.

Figure 2.1 below presents the lands subject to this planning application (red line boundary) and land ownership area (blue dashed line).

The site is currently in predominantly agricultural use and comprises a series of irregularly shaped fields divided by hedgerows and ditches typical of its agricultural setting. The site contains a number of existing dwellings and eight farm outbuildings. A number of these will be retained and some (one house and eight farm buildings) demolished as part of the proposed site redevelopment. Further information is included in the demolition report provided with this planning submission and also addressed in Chapter 13 (Waste) and the Construction Environmental Management plan (CEMP).

The site gradient is quite variable but overall falls from east to west/southwest with elevation c.15 meters ordinance datum (mOD) in the West and 46 mOD in the East Regional surface water drainage comprises the Ballymacahill River to the north/ west of the development site boundary and which flows in a NE to SW direction. The river is also known as the Spancilhill (EPA, 2021) and converges with the River Fergus farther to the SW which ultimately discharges into the Shannon Estuary.

Local drainage within the development boundary is less defined. Surface water features within the site boundary comprise a series of ponds to the north with variable seepage to ground, and Toureen Lough to the south near the R352. Spring discharges have been identified mainly to the west of the site and include a spring to the immediate east of Toureen Lough discharging to this feature, and a spring to the northwest of the lough which, it likely receives groundwater from a known swallow hole located farther east and south of the R352 road. Toureen Lough also discharges into the Ballymacahill River observed at a spring discharge.

2.3 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The development comprises:

- 6 data centres buildings.
- A gas powered energy centre and Above Ground Installation (AGI).
- A new 110kV substation, two drop down masts and underground grid connection.
- Fibre connection,
- Connection and upgrade of foul sewer and mains supply extending along the existing R352.
- Undergrounding of two of the existing overhead 110kv circuits.
- Associated Infrastructure; roads, attenuation pond etc.
- Demolition of a single house and 8 farm buildings

Figure 2.1 presents the site layout for the proposed masterplan. The site layout reserves c. 10 ha of lands as ecological and archaeological buffer zones. The buffer zones were delineated following assessment undertaken as part of the area assessment within the Clare County Development Plan 2017 – 2023 (Variation No. 1). Further assessment has been undertaken by the project ecologist to protect ecology during construction and operation of the proposed development. The redline boundary includes c. 2.1 km of the existing Tulla Road for connection to sewer.

Two of the 110kV overhead circuits which currently traverse the site will be brought underground to the Ennis substation as they come onto the east side of the site.

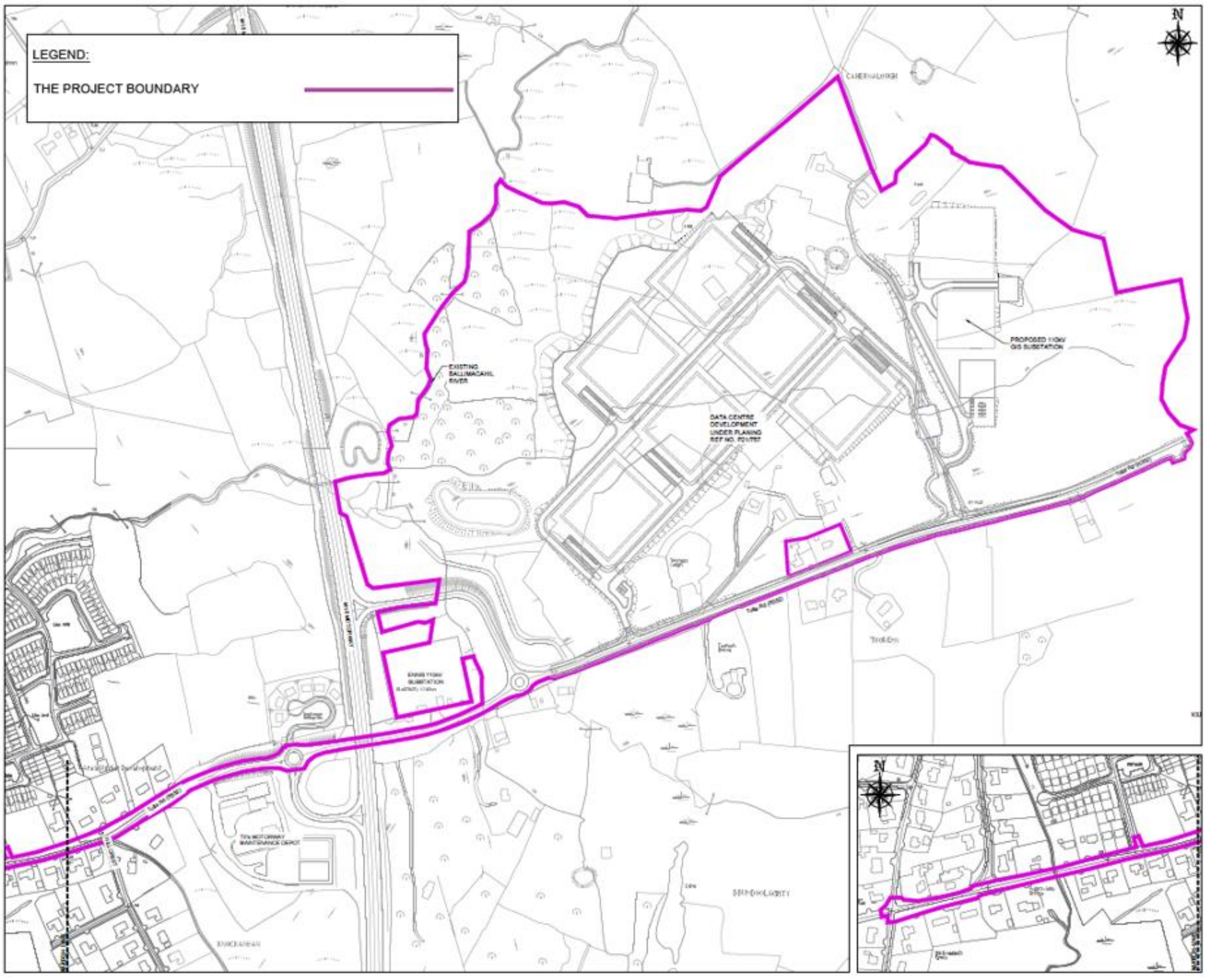


Figure 2.1 *Proposed layout.*

The redline boundary including the works along the Tulla Road required for the sewage and water pipeline upgrade .

<u>*Proposed Development Phasing*</u>

A 10-year permission is sought due to the nature of this specific development and to match market demand over that period. The proposed development will respond to current and future use demands in the area. The logistics of the site and use of the buildings mean that their delivery must be programmed on a phased basis over the duration of a 10-year planning permission. The site will host six data storage facilities with associated energy supply facilities and the commercial reality is that the overall orderly development of the site will take longer than 5 years. Subject to planning approval, construction works are due to commence in June 2023. Three phases of construction are proposed with construction works completing by July 2029. Landscaping is proposed to commence in Oct 2022.

The anticipated phased development is set indicatively in Table 2.1 below.

Table 2.1 *Phasing of the Proposed Development*

Phase	Building Name	Construction Start	Duration (months)	Construction End
1	Primary Infrastructure	June 2023	27	September 2025

	Substation Datacentre 2 & 3.			
2	Energy Centre Vertical Farm Datacentre 4 & 5.	September 2025	25	October 2027
3	Energy Centre (Engines 7-18) Datacentre 1 & 6.	June 2027	25	July 2029

The expected construction phasing is shown in Figure 2.2 below.

Figure 2.3 *Intended Construction Phasing for the proposed Masterplan (ART-ARC-SP-00-DR-A-0003).*

2.3.1 Proposed Data Centre Development

A data storage facility is a centralised hub for the secure storage, management and distribution of electronic information to individual businesses and organisations. With the levels of online activity increasing rapidly this facility will enable the Applicant to meet its clients growing demands. The proposed data storage facilities offer clients the latest in power, and connectivity with hardened security to control access to client information.

Each data storage facility, when completed, will allow the Applicants' clients store their information at a secure and reliable facility off their premises more efficiently than traditional forms of in-house data storage systems. Data storage facilities are typically constructed on a relatively large scale which results in significant benefits in terms of economies of scale and energy efficiency.

Each data storage facility will require up to a maximum of 27 MW IT load (circa 34 MW total load). With 6 data storage facilities operating the total load will be 200 MW.

Data storage facilities have;

- high levels of reliability with built in redundancy systems;
- 24/7 monitoring of the facility and its systems by staff;
- lower network latency and higher bandwidth at lower cost;
- specialist network and facilities engineers typically not viably employed by individuals, businesses or organisations, and;
- high levels of energy efficiency.

Irish climatic conditions generally allow for data storage facilities to be cooled using air cooling however there will be an occasional requirement to use evaporative cooling. Typically, evaporative cooling is required when temperatures exceed 27°C (Approximately 2% of the year). When evaporative cooling is required the average rate of demand for the proposed development is estimated to be less than 1,000m^3 /day for the whole site. It is proposed to store the equivalent of 48 hours of rainwater at each data storage facility for the purpose of supplying the evaporative coolers prior to using the public water supply. Of the water supplied, only 40% will be discharged to the surface water system as the remainder will be lost to evaporation in the cooling process. This results in an average daily discharge of 400m^3/day. The peak rate of discharge for the proposed development will be 205 l/s. As the cooling water will only be required during periods of hot dry weather (i.e. temperature exceeds, 27°C), the discharge to the surface water network will not coincide with any rainfall events

As evidenced by the numerous other data storage facilities recently developed in Ireland, our temperate climate is ideally suited to data storage facilities. The naturally cool ambient temperature means the data halls require less cooling than if the facility were located in regions of the world subject to greater temperature and humidity variation.

A summary of the data storage facility is as follows:

- 6 no data halls. These are 86 x 105 x 18m high and will consist of multi levels 9m slab to slab for the data halls and air handling units and 4.5m slab to slab for offices and ancillary plant and support.
- Data halls are intended to have backup (standby) generators for emergency use only () situated along one elevation of the building. These will provide the necessary power to ensure the data halls operate optimally even in the event of a failure of supply. The diesel generators will have associated 8m high flues to meet air quality standards (Chapter 8 Air & Climate).
- For three of the six data centre storage facilities, fuel oil for the emergency generators is required. Each of these datacentres in their service yard, will have up to 7 bunded above ground bulk storage tanks for fuel oil (440m^3 per data storage facility), distribution pumps, overground delivery pipeline to the belly tanks for diesel fired standby generators within each data storage facility. The service yards are hard stand and located adjacent to the datacentre buildings.
- Storm drainage from the loading area at each service yard will discharge through an oil interceptor.

- Solar Panels and Rainwater harvesting included in the design.
- Warm air emissions partly used within the on site vertical farm.
- Provision of a proposed Substation and associated electricity transmission line connections, and the undergrounding of two existing overhead 110kv circuits and ancillary development (subject of a separate Strategic Infrastructure Development application).
- Admin area – for limited office and support services. These occupied areas will be provided with heating and cooling systems and hot water generation, using air source heat pumps to reduce energy and carbon emissions. If heat recovery can be used from the heat generated in the data halls, then this will be used. In addition, wherever possible natural light will be provided via roof lights or “borrowed light”.

A total of c. 450-475 staff will be employed on site on the completion of the Art Data Centre Campus.

2.3.2 Proposed Substation Development, undergrounding of overhead lines and grid line.

A new substation will be created on the site, partly for extending Eirgrid’s substation (the existing has no additional space) and for transforming down to 10kV / 20kV for distribution to the data centres. Dual feeders will be provided to each data centre via a set of underground ducts that will be created in the service roads. The proposed substation development will comprise two elements, firstly an extension to Eirgrid’s existing Ennis Substation using 110kV Hybrid Gas Insulated Switchgear (GIS) (circa 2,400 square metres and 15 m high) and secondly a 110kV transformer substation compound (circa 3,200 square metres and 6 m high) dedicated to the Art Data Centre site. The two compounds will be separated and have their accesses for the Client and Eirgrid and will be afforded 24/7 access.

In more detail the two compounds will incorporate the following:

New Eirgrid Compound

- 1 no outdoor hybrid Gas Insulated Switchgear (GIS) switchboard with 8 no. 110kV bays and rated for the system voltage of 110 kV;
- Two 110kV underground cables which will connect to a new above ground end tower (termination).These will connect to the existing circuits to Agannygal and Ardnacrusha via
- Two 110kV underground cables for feeding to the Art Data Centre substation
- Internal access roads and turning head;
- A circa 2.6-metre-high palisade fence;
- Drainage infrastructure; and
- All associated and ancillary site development works.
- It is intended that all of the above will be provided and adopted by Eirgrid.

Art Data Centre Compound

- 2 no. Midel oil-filled 100MVA step-down double wound 110/20/10kV power transformers positioned within bunded enclosures; (height circa 6 metres);
- 8 no. lightning protection masts (height circa 15 metres);
- One single storey buildings used for 20/10 kV switchgear control and ancillary (each approx. 70m x 6m x 6m height)
- Internal access roads and turning head

- A circa 2.6-metre-high palisade fence;
- Drainage infrastructure; and
- All associated and ancillary site development works.

The proposed substation development will be supplied from two drop down masts located on the east of the site.

Undergrounding of existing overhead lines

As part of the provision for power, for the development, there will be two overhead cables rerouted underground to the new substation and subsequently routed to the existing Eirgrid substation via the Tulla Road.

New end masts will be built on the north east of the site, breaking into the existing lines and diverting the circuits via underground ducting to Ennis Substation. The route of the proposed grid line is partly within the site and along the Tulla road.

The 110 kV underground cable feeders will comprise 110 kV circuits installed underground in HDPE ducting in a trefoil arrangement. The 110kV cables will be a standard XLPE (cross-linked polyethylene) copper cable. XLPE does not contain oil, therefore there is no risk of migration of oil into ground in the event of a failure. The installation of the HDPE ducting will require the excavation of trenches along the final connection route. The trenches will typically run either side of the roadway along the length of the route, the separation of the 2 circuits will ideally be at least 3m depending on the existing ground conditions and existing underground services. The typical optimum depth of excavation required to facilitate installation of the ducting is 1.25m below ground level (bgl) but may increase to up to c. 3.0m at utility crossings. The typical optimum width of each trench is 0.6m, however this may vary depending on ground conditions and existing services.

Typical cross section of the trench utilising trefoil duct arrangement for the 110 kV cables is illustrated in Figure 2.4.

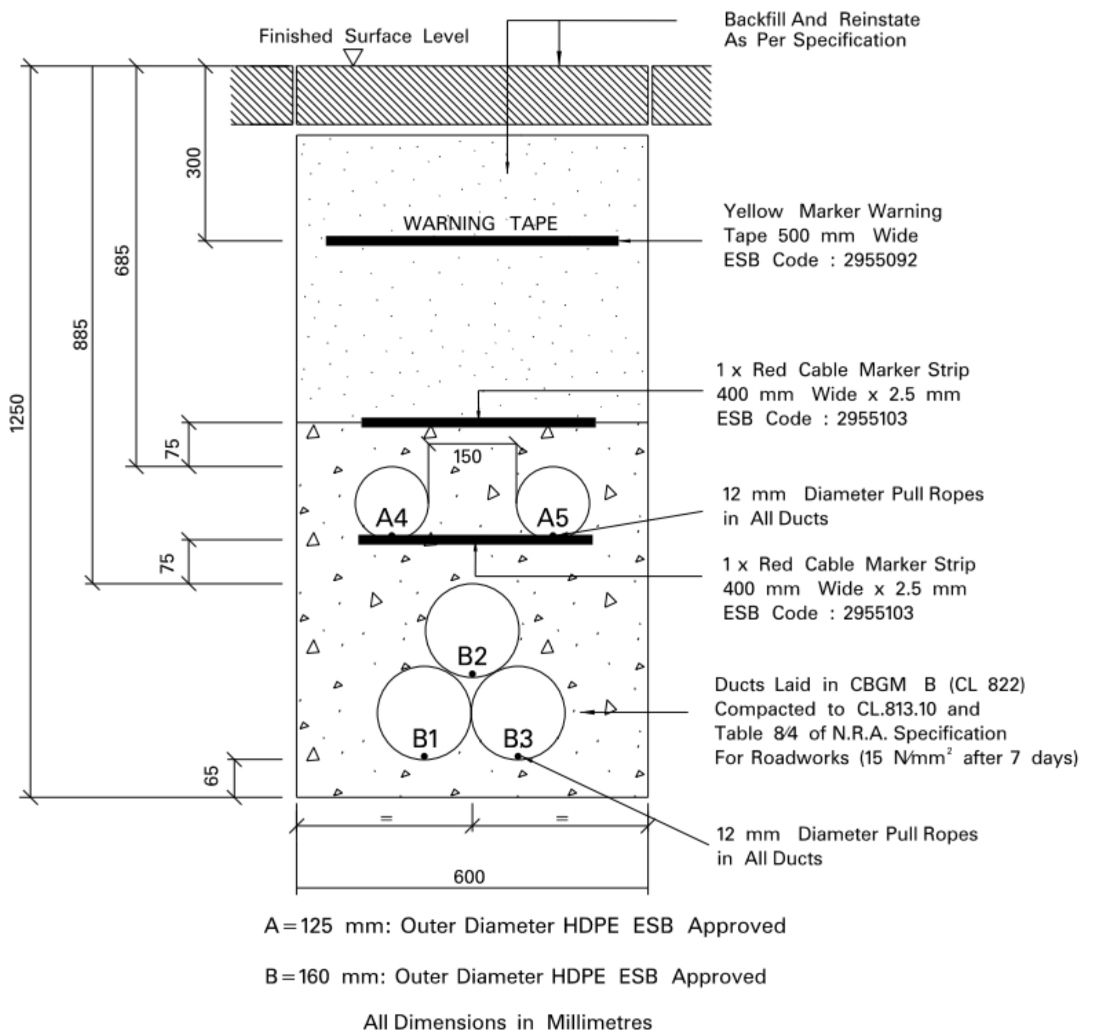


Figure 2.4 *Typical Cross Section of Trench Trefoil Duct Arrangement for 110 kV underground cables*

2.3.3 Proposed Energy Centre and Above Ground Installation Development

The energy centre will primarily comprise 18 no. lean-burn natural gas engines which are the most efficient form of internal combustion engines. Each generator will have its own flue of 25m height. These will be aggregated into 3 groups of flues to meet air quality requirements. Air modelling has been undertaken to confirm the flue discharge will meet air quality standards with selective catalytic reduction (SCR) abatement (Chapter 8 Air & Climate).

The energy centre will be fully self-sufficient in terms of its power and cooling requirements. Cooling is provided through roof mounted attenuated dry air coolers which will be behind a plant screen. The energy centre is to be connected to the adjacent national high pressure gas network. A pressure reduction station is included in the design to reduce the gas pressure for use in the energy centre.

The energy centre will be on a 110m x 100m plot and buildings within the compound will be 8 m high. The building will house an office and welfare facilities and associated parking.

For the energy centre where there will be continuous running generators, fuel oil and urea are the only required bulk chemicals required. The fuel oil will be used as back-up to the normal gas supply for the energy centre and will be located withing the service yard adjacent to the energy centre. Oil will be stored in bunded above ground bulk storage tanks for fuel oil (total of 1,440m^3 of fuel oil), distribution pumps, overground delivery pipeline to the day tanks for dual fuel fired generators. In addition, within the energy centre it is proposed to store up to 18m^3 of urea for use with the SCR mitigation in the exhausts of the generators.

2.3.4 Proposed Vertical Farm Development – Heat Recovery Use

It is proposed to recover the heat from the data halls in the datacentre buildings for use in the "Vertical Farm" for growing high value plants etc. These farms require heating to the water and air used to support the plants to promote growth internally, and so the heat from the data centres would be ideal and would not require the temperatures to be elevated any further, so no additional energy input.

The vertical farm will be c. 50 x 50 x 12m high. It will comprise c. 60% growing space and 40% office area. The farm will provide high value crops such as herbs.

The vertical farm will employ 40 full time roles and 10 additional part time. The farm will operate a single shift. Deliveries of raw materials and removal of product will result in c. 5 HGVs per day with pick up times likely to be 6.30 to 9 am.

2.3.5 Overall Site Design and Landscaping

The buildings have been located on the site to take maximum use of the undulating nature of the land by siting structures at lower levels to take advantage of topography to reduce visual impact of structures. The structures are set back from the Tulla Road and dwellings by c. 100m (closest residence is 107 m) and will be screened by the introduction of new landscaping and woodland. The buildings have also been positioned outside of ecological and environmental protected areas with suitable buffer zones. The site will operate as a "dark site" in order to minimise light spill impacts.

The site perimeter will consist of berming and landscaping incorporating local species discussed further in Chapter 11 (Landscape) and required security infrastructure . Although the proposed development will incur loss of existing hedgerows, the proposed landscaping design, once established, will include new hedgerows planting in the order of three times the current extent. The proposed landscape design will focus on enhancing local biodiversity by incorporating native species and pollinator planting. As outlined in Chapter 10 and the CEMP, landscaping will commence ahead of the main construction works to ensure early establishment.

2.4 SITE UTILITIES AND INFRASTRUCTURE

2.4.1 Electricity

The six data storage facilities will require up to 200 MW load. This requirement will be provided by power from the national grid, an energy centre with gas generators and emergency backup provided by diesel generators.

A power application with Eirgrid for 83.5MVA is in their Pre-planning Stage 1 Process.

The six data storage facilities will be powered by a combination of power from the grid via the existing Ennis Substation adjoining the site and the energy centre, which is proposed to be constructed adjacent to the high pressure gas line that runs through the site. The applicant intends to construct the energy centre to respond to flexibility to the evolving energy market, in particular to ensure there will be sufficient capacity to have the security of supply and also respond to any future grid capacity constraints.

A maximum of three data storage facilities will also have diesel powered back-up generators, as a contingency power measure in the event of a loss of electrical power supply loss from the Ennis primary substation. The likelihood of all of these generators being required to run is extremely low, no more than once in 10 years, however each set will require to be tested typically for up to 2 hours, once a month. Each set will have strict acoustic attenuation to ensure that overall noise levels on the site are not increased. These data storage facilities will have 84 backup generators which will be lined along one elevation of each datacentre building. These will provide the necessary power to ensure the data halls operate optimally even in the event of a failure of supply from the energy centre. The diesel generators will have associated circa 8m high flues to meet air quality standards. Each diesel generator will be served by a double lined belly tank. With the main oil storage within the service yards of each datacentre. An overground fuel line will extend from the bunded fuel storage within the service yard provided for each building.

In the event of the gas supply failing, the three data storage facilities which are provided with power by the gas powered engines will continue to be provided with power resupplied with on-site stored diesel as the engines with have a dual fuel capability. The engines which will typically be of between 5 and 10MW per set, will have flues combined together with an expected height of circa 8m high to meet air quality standards.

2.4.2 Water Demand

A 450 diameter mains runs along the Tulla Road and following a proposed upgrade for connection (within the existing road), has capacity to supply adequate water for the proposed development. Peak daily usage will be 48 l/s and average demand 11.2l/s (Adiabatic Cooling System) during high temperature condition) plus 1.2 l/s for domestic use. On the rare occasions that evaporative cooling is required (temperature of 27^{o}C) the requirement is 1,000 m^3 /day for the whole site.

Consultation with CCC has confirmed that sufficient water capacity is available and a PCE application has been submitted to Irish Water (IW).

2.4.3 Site Drainage

Foul water

A temporary trench excavation along the Tulla road will be undertaken to facilitate pipe laying for connection with the existing pumping station of Gort Na mBlath located approximately 550 m west of the main site. The wastewater ultimately discharges to Ennis North (Clonroadmore) WWTP Reg D0048.

There is no trade effluent proposed for this development. Consultation with CCC has confirmed that sufficient wastewater capacity is available and a pre-connection enquiry PCE application form has been submitted to Irish Water (IW). The designed Dry Weather Flow DWF of the development is 20.9 m^3/day. The proposed foul drainage service will incorporate a foul pumping station and associated rising main which will also include a 24-hour emergency storage tank (in the unlikely event that the proposed foul pump malfunctions).

Surface water

The proposed surface water drainage service to the development comprises various drainage components including positive stormwater networks, attenuation systems and several Sustainable Drainage Systems (SuDS) elements. The proposed surface water drainage was designed in accordance with the SuDS Manual 2015.

The hardstand area of the site is 17.3 ha and attenuation has been designed on site for the 1:100 yr. flood event including consideration of a 20 % allowance for climate change. An over flow sub-surface pipeline will discharge at current discharge rates (greenfield) to the Ballymacahill River. Drainage will be from a single lined attenuation pond.

Rainwater run-off from the roofs of the six datacentres will be collected and will feed water harvesting tanks with any excess overflow into the common road drainage network. This water will be available as cooling water. Other SuDs measures will include permeable paving and swales. These drains and swales will discharge to a surface water attenuation pond where the discharge will be controlled using a “Hydrobrake Optimum” vortex flow control device to limit the maximum discharge to 50 l/s during the 1/100 year storm (the calculated Qbar value attributed to the site is 61l/s). The attenuation pond to be constructed to retain a constant volume of water to promote settling and reduce conveyance of suspended solids and other particles to the receiving waters. An attenuation volume of 9293 m³ is designed as part of the proposed development. A Class (I) bypass separator with a suitable capacity will be installed downstream of the proposed hydrobrake. The function of the separator is to intercept pollutants (any petroleum /oil) and prevent their entry to the Ballymacahill River. As such there is no potential for increase or flooding or impact on water quality as a result of the proposed development. Further details are provided in Chapter 7 of the EIAR and within the CSEA engineering report prepared for planning.

2.4.4 Telecommunications

Fibre will be provided from a number of sources for security of supply. No above ground works are required as internet providers have infrastructure already in place. In addition, as statutory undertakers, such fibre providers do have separate legal powers to extend their networks as required.

Three of these fibre connections are already available for the development; PiPiper in the Tulla Road, Aurora in the Gas line alignment, ESB Telecoms in the substation adjoining the site. These three are presented in Figure 2.1 (above). The minimal works required for connection to these fibre connections are included in the assessment undertaken for construction and operation of infrastructure in relation to the proposed development.

Open Eir and BT have existing infrastructure in the Tulla Road. Provision of these services will require negligible groundworks or any impact on environmental criteria as they utilise existing service ducts along public roadways. As such no further environmental assessment is required. A summary of the fibre route connections is provided below for clarity.

Open Eir have confirmed that they can offer fibre based services delivered from their Ennis Point of Access at Drumbiggle to the site with existing Open Eir networks existing Open Eir duct infrastructure route as highlighted in the drawing below (route in magenta, site highlighted in red). Their existing network runs along the Tulla Road out to the site at Junction 13 and they will insert any new services in the existing ducts on the Tulla Road.

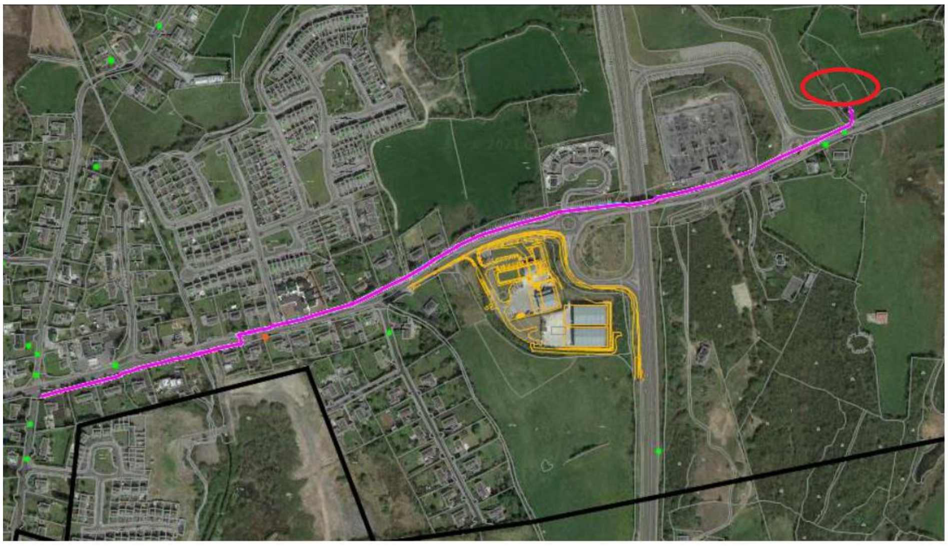


Figure 2.5 *Existing Open Eir Broadband Infrastructure (Source: Open EIR, 2022)*

BT have confirmed that they can access the site over existing roads utilising existing Eircom ducts subject to resolution of issues currently being decided by Courts relating to Com Reg.

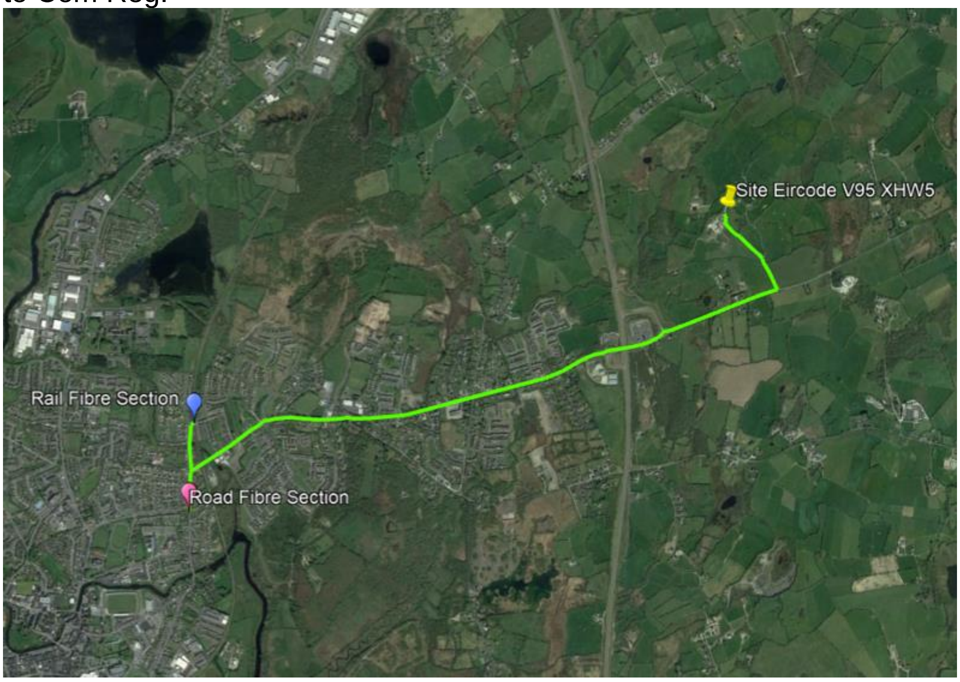


Figure 2.6 *Existing BT accessibility to site (Source: BT, 2022)*

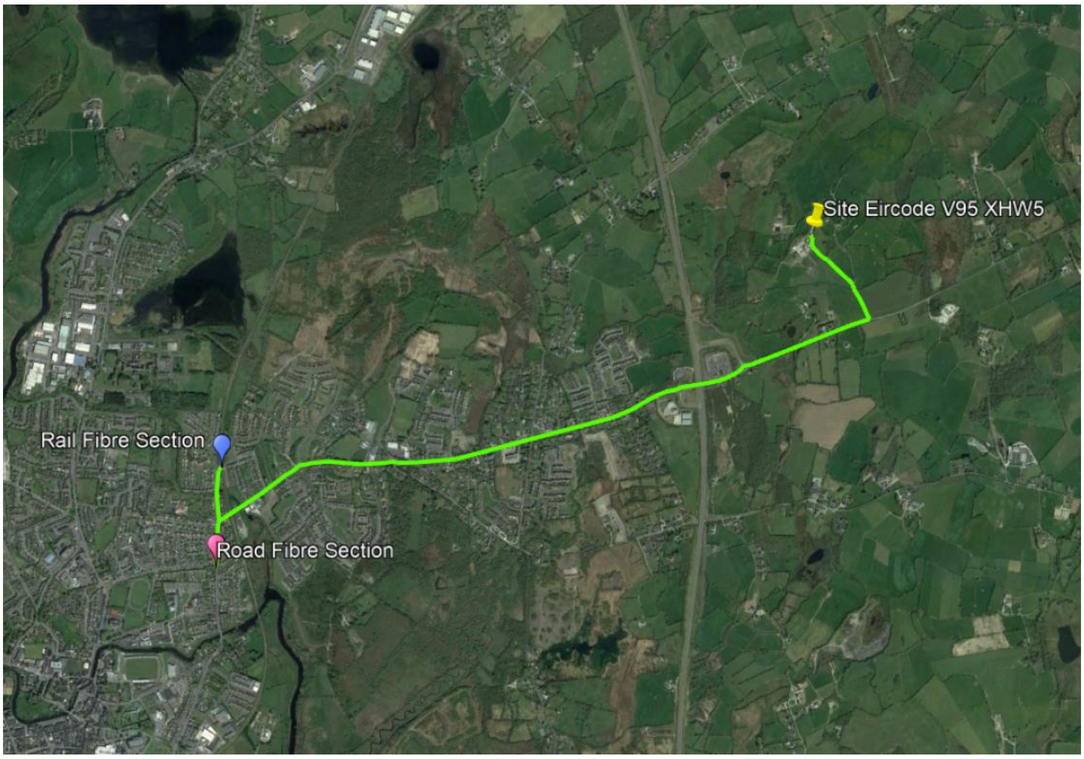


Figure 2.7: *Potential BT accessibility to site (Source: BT,* 2022)

2.4.5 Natural Gas

The site is traversed by a high pressure Gas Networks Ireland gas pipeline. An AGI will be constructed to facilitate supply for the energy centre.

2.4.6 Roads and Site Access Road Infrastructure

The development site is currently accessed from Tulla Road directly to the south. The site has good connection to the M18/N18 national motorway that connects the cities of Limerick and Galway.

The main access to the proposed development site will be off the Tulla Road along the southern boundary, with a secondary access and egress for emergency use only off the Tulla road to the west of the main entrance. These entrances will connect to an internal road network that will serve two purposes public 24/7 access to the Vertical Farm, Sub stations, Energy Centre, and Gas AGI; and to provide a secure private road network circumnavigating the Data Centres for staff access, connection between buildings and for the delivery of equipment and materials.

The proposed access arrangements and potential traffic safety impacts are considered in Chapter 12 (Traffic and Transportation).

Off Site Traffic Movements

The proposed development will result in an increase in traffic owing to staff movements and the delivery of materials to and from the site during construction and the operational phase.

During the construction phase it is estimated that up to a maximum of 115 deliveries will be made to and from the site in any one day, with a daily average of 32 daily HGV trips to and from the site forecast. At any one time it is estimated that up to 800 daily car trips will be generated by construction staff, with an average of approximately 400 forecast for the duration of the construction period. While these trip rates were adopted for the purpose of the assessment, it is intended that a significant proportion of construction staff will travel to the site by buses provided by the contractor, which will form one element of a construction traffic management plan, aimed at minimising traffic impacts during construction.

Data centres have a comparatively low level of traffic e.g. it is forecast that a total of 493 staff members will travel to/from the site each day when fully operational. With staff working shifts throughout the 24-hour period, it is forecast that a maximum of 256 staff will be on site at any one time. When fully operational it is forecast that 32 HGVs will visit the site per day.

The wider area has excellent links to the national primary routes. Further details in relation to the potential impact of the proposed development (construction and operation) in terms of traffic are presented in Chapter 12 Traffic and Transportation.

2.4.7 Fuel Oil

In the event of a loss of power supply, the emergency generators are designed to automatically activate and provide power to the data storage facility. The generators will be supplied by low sulphur diesel.

Fuel oil for the emergency generators is the only required bulk chemical required on site. Three of the six datacentres in their loading bay, will have up to 7 bunded above ground bulk storage tanks for fuel oil (440m^3 for three data storage facilities), distribution pumps, overground delivery pipeline to the belly tanks for diesel fired standby generators within each data storage facility.

All bunds will be capable of containing 110% of the volume of the largest drum/tank within the bund or 25% of the total volume of the substance stored and will designed in accordance with the EPA's guidelines for the storage and transfer of materials for scheduled activities (EPA, 2004). Fuel oil will be delivered to the site by HGV road tankers, with an average of three tankers expected to be travelling to and from the site per month. A dedicated tanker unloading area will be provided at each of these service yards which will be surrounded by a drainage channel to capture any run-off. A class 1 oil-water full retention separator will be installed to capture any oil in the run-off from the pad. Tanks will be fitted with high level alarms to reduce the potential for overfilling.

The energy centre will have back up fuel storage with up to 20 bunded above ground bulk storage tanks for fuel oil (total of 1,440m^3 of fuel oil). The total fuel store will be 2900 m^3 or 2,494 tonnes.

2.4.8 Lighting

External lighting – all of the service roads and pathways will be provided with low illumination levels of downward only lighting for use on an occasional basis, they will not be turned on normally and controlled from the gate house for specific usage. Vehicles coming to the site will use headlights to access the buildings. External plant areas will also be fitted with external lighting and task lighting sockets, but again these will be used for emergency maintenance support. There will also be lighting to the admin areas of each data centre building, so some limited spill of lighting will occur to the admin area facades, but this will be limited and all lighting will be PIR controlled. In terms of security, the whole site will be covered by CCTV cameras but will not require external lighting to be on to operate, instead they will use infra-red coverage to allow the cameras to operate. Lighting is for safety reasons and not operational at night unless in an emergency and for site evacuation. There will be no light spill on any features suitable for bat foraging and commuting

2.5 SUSTAINABILITY MEASURES TO REDUCE ENERGY AND PROMOTE A LOW CARBON MODEL

The measures that are being proposed to reduce energy usage, promote a low carbon model and support sustainability are outlined in the Energy and Sustainability Statement prepared by Hurley Palmer Flatt and provided with planning. A summary is provided below.

<u>*Data Centre Buildings*</u>

- Cooling – the cooling systems are to be based on direct or indirect air handling plants which will maximise the use of external air to cool the internal areas of the data centre. This technique is recognised in the data centre industry as being one of the best and more efficient methods for cooling resulting in low Power Usage Efficiency (PUE) levels of below 1.2. During summer periods, it is recognised that temperatures could increase above allowable internal environmental limits, thereby requiring a peak lopping process using adiabatic cooling. This will require a water supply to each air handling unit, water demand will be dependent on the external wet bulb temperatures, which is only likely to be required for a few weeks in the summer periods. Extensive rainwater storage will be provided adjacent to each data centre building to meet as much of this peak demand, supplemented by town water supplies as required.
- Solar panels – PV panels will be installed on the roofs of each of the data centre buildings. Final proposed layout and quantum are being worked on now, but each system of PV panels will directly feed the electricity being consumed in each building
- Admin areas – each data centre building will have an admin area for limited office and support spaces. These occupied areas will be provided with heating and cooling systems and hot water generation, using air source heat pumps to reduce energy and carbon emissions. If heat recovery can be used from the heat generated in the data halls, then this will be used. In addition, wherever possible natural light will be provide via roof lights or “borrowed light”.

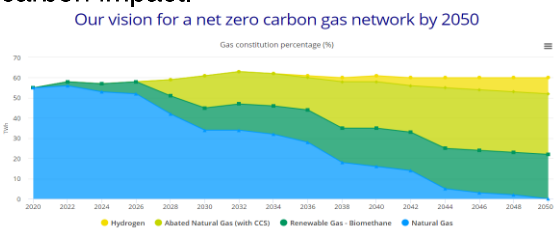
<u>*Site Wide Systems*</u>

- Heat recovery use – this has been considered carefully. Recovery of the heat from the data halls in the data centre buildings is possible but it has to be recognised that the heat is relatively low grade at temperatures of around 30 to 40 degrees C. At these temperatures, transporting the heat any significant any distance (e.g. off-site) would further reduce the quality of the heat. To export heat off-site to say a local district heat network, the temperatures would need to be lifted to at least 60 degrees, this would require water based heat pumps (reverse cycle), but these will require further energy (electrical input) to allow the compressors to run to lift the temperatures. Given that there is no current or proposed use for the heat nearby to the site, alternative uses of the heat have been considered, this includes the inclusion of a “Vertical Farm” for growing high value plants etc. These farms require heating to the water and air used to support the plants to promote growth internally, and so the heat from the data centres would be ideal and would not require the temperatures to be elevated any further, so that no additional energy input is required.

- As outlined in the HDR Energy and Sustainability Statement (section 4.6.2 and 4.6.3), an assessment of the high-grade heat from the gas powered generators has been undertaken. This assessment shows that high grade heat could be exported to a local development such aas residential or other uses in need of heat such as residential or other uses. Given that there are no known exact locations selected for future district heating networks in the vicinity of the proposed development, a connection to a district heat network has not been included in the final proposals. However, what is proposed is to provide a set of flow and return pipes from the Energy Centre to the edge of the Art Data Centre to allow for onward connection by others to either a local user for heat or a future heat network.
- External lighting –Dark site as described above.
- SuDs systems are implemented throughout the site.

Low Carbon Infrastructure

- Initial Energy / Power Source – the site is to be provided with an 80MW+ connection to the existing Ennis Eirgrid substation, this will still leave capacity at the substation for growth of the Ennis town over at least 25 years. To facilitate this connectivity, the substation will be extended onto the data centre site as the existing site has insufficient space to be extended (it is islanded by the road network).
- Hydrogen Usage – the initial provision of generation on site will be based on using Natural Gas from Gas Networks Ireland (GNI). GNI have announced that they are already looking at injecting green or blue hydrogen into their network to improve their carbon impact, as per their Vision 2050. The graph below shows how the use of natural gas will reduce to 0% by 2050. The engines on-site will be specified to work on Natural Gas or Hydrogen or any mix in between in order to future proof the plant and to take the opportunity to reduce the carbon impact.



- Low Carbon Energy – Connecting to the Eirgrid network gives the opportunity to use low carbon energy that is now generated across the island of Ireland through wind generation and photo voltaic solar farms. These renewable sources of energy currently provide up to 40% of the total supply at any one time. This will increase significantly over the next decade or so as more and more renewable capacity is added to the network.
- On Site Generation – the connection to the existing Ennis substation is to be supplemented by gas powered generation in the energy centre to bring the total capacity to circa 200MW. The energy centre will be constructed as the data centre buildings come onstream, with the usage of the first 80MW supply being the priority. All of the gas engines will have SCRs fitted to their exhausts to reduce emissions to very low levels.

2.6 EXISTENCE OF THE PROJECT

Under the current Draft EPA Guidelines on the information to be contained in EIA Reports, the description of the existence of the project is required to define all aspects of the proposed lifecycle of the facility under the following headings:

- Description of Construction;
- Description of Commissioning;
- the Operation of the Project;
- Changes to the Project (including Decommissioning); and
- Description of Other Related Projects.

The following sections present a description of each of these aspects.

2.6.1 Description of Construction

The construction of the data storage facilities will comprise four main stages, namely;

- Site preparation works;
- Building Structure Construction;
- Building Envelop Construction; and
- Internal Fit Out (including Mechanical & Electrical (M&E)) and commissioning.

A brief description of the construction works proposed is set out below.

Working Hours

The construction of the facility will be completed during normal construction hours i.e. 8am to 6pm Monday to Friday. Work outside these hours will only occur in exceptional circumstances for specific tasks and subject to obtaining the agreement of the Planning Authority in that regard.

Staffing and traffic

The construction population on site will be c. 600 staff with an estimated peak of 1200 staff in year 2027 due to the overlap of phases of development. Site staff will include management, engineers, construction crews, supervisors and significant maintenance contractor employment. Based on a modest estimate that the average car occupancy will be 1.5 and no transport by bus, this will result in a maximum number of 800 cars generated by construction staff on site at any one time. It is estimated that 40% and 5% of the daily total will arrive at, and leave from the site during the AM peak hour from 08:00 to 09:00, with the reverse applying to the PM peak hour from 17:00 to 18:00. An Outline Travel Plan is provided with Chapter 12.

For each phase a maximum of 115 HGV trips will be generated to / from the site, with a daily average of 46 trips per day for Phase 1, 13 trips for Phase 2 and 23 trips for Phase 3, as set out in Chapter 12, Table 12.6.

2.6.1.1 Site Preparation Works

The primary activities required during site preparation will be establishment of the contractors' compound and cutting and filling of various parts of the site to provide the necessary base level for construction. It is estimated that this will take approximately

6 months. Landscaping will be undertaken during the initial phase of construction to reduce visual impact.

The contractor compound and car parking for contractors will move as the development proceeds through the different phases. Planned locations are outlined in the CEMP and drawing ART-ARC-SP-00-DR-A-004. No off site parking is required. The compounds will provide office, portable sanitary facilities, equipment storage, parking etc for contractors for the duration of the works. The construction compounds will be fenced off for health and safety reasons so that access is restricted to authorised personnel only. Other works required will include surveying and setting out for structures, rerouting of services, vegetation removal, archaeological recording works and setting up of the construction site with fencing, site compounds etc.

In advance of site preparation, a strategy will be developed in order to efficiently move spoil generated from cutting excavations and soil imported to locations where landscaping is required around the facility Approximately 111,424 m^3 of material will need to be excavated and it is planned that all of the excavated material will be able to be retained and reused onsite for landscaping and fill. Landscaping will occur upon completion of the data centres and will include seeding of the construction car parks and hedgerow planting of the gaps that provided access to the car parks.

The contractor will be required to comply with the CEMP (surface water management and pollution prevention plan) provided with planning. Measures including fencing off and installation of silt fences around ecological buffer zones will be undertaken to prevent any works being undertaken in these areas or the discharge of silty water from works areas.

2.6.1.2 Noise, Vibration and Dust Nuisance Prevention

With regard to construction activities, reference will be made to BS5228: Noise control on construction and open sites, which offers detailed guidance on the control of noise and vibration from demolition and construction activities. Mitigation measures will include the following:

- limiting the hours during which site activities are likely to create high levels of noise are permitted, e.g. soil/rock excavations (if required);
- establishing channels of communication between the contractor/developer, Local Authority and residents;
- appointing a site representative responsible for matters relating to noise, and;
- monitoring typical levels of noise during critical periods and at sensitive locations.

Noise control measures will be employed. These will include:

- selection of plant with low inherent potential for generation of noise;
- erection of barriers as necessary around items such as generators or high duty compressors, and;
- siting of noisy plant as far away from sensitive properties as permitted by site constraints.

The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The majority of dust produced will be deposited close to the generated source.

In order to ensure that no dust nuisance occurs, a series of measures will be implemented.

- Hard surface roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads will be restricted to essential site traffic only.
- If required, any area/road that has the potential to give rise to fugitive dust will 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. Indeed, on any un-surfaced site road, this will be 15-20 kph, and on hard surfaced roads as site management dictates.
- In dry conditions vehicles delivering material with dust potential (soil, aggregates) will be enclosed or covered with tarpaulin at all times to restrict the escape of dust.
- Wheel washing facilities will be provided for vehicles exiting the site in order to ensure that mud and other wastes are not tracked onto public roads.
- Public roads outside the site will be regularly inspected for cleanliness and cleaned as necessary.
- If required, topsoil mounds will be seeded with grass to prevent dust blow off.
- At all times, these procedures will be strictly monitored and assessed. In the event of dust emissions 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.

2.6.1.3 Water Discharges

Welfare facilities will be provided for the contractors on site during the construction works. These facilities may be connected to the existing foul drainage system on site or portable sanitary facilities will be provided with waste collected and disposed of appropriately.

Any surface water run-off collecting in excavations will likely contain a high sediment load. This will be diverted to settlement ponds and will not be allowed to directly discharge directly to open water courses.

2.6.1.4 Material Sourcing, Transportation and Storage

Materials

Key materials will include steel, concrete, glass, composite cladding, piping, electrical cabling, process equipment and architectural finishes. A ‘Just In Time’ delivery system will operate to minimise storage of materials on site.

Sourcing

Where possible it is proposed to source general construction materials from the local area to minimise transportation distances. Specialised data storage facility and energy centre equipment will likely be imported from abroad.

Storage

Aggregate materials such as sands and gravels will be stored in clearly marked receptacles within a secure compound area to prevent contamination. Liquid materials will be stored within temporary bunded areas, doubled skinned tanks or bunded containers (all bunds will conform to standard bunding specifications - BS8007-1987) to prevent spillage.

Transportation

Construction materials will be brought to site by road. Construction materials will be transported in clean vehicles. Lorries/trucks will be properly enclosed or covered during transportation of friable construction materials and spoil to prevent the escape material along the public roadway. A description of likely transport routes is included in Chapter 12 traffic and transportation.

2.6.1.5 Building Construction Works

Once site preparation is completed, building construction and commissioning for construction and commissioning of each data storage facility will take up to 24 months with the total campus being developed based on client requirements over an estimated 7-year construction period.

Foundations and Structure

Following the completion of site preparation, all structures will require shallow spread foundations. The proposed depth of the excavations is anticipated to be 2-5m with piled foundations where required. Building structures will comprise structural steel frames with concrete floors on metal decks.

Cut and Fill

An estimate of the cut and fill requirement are as follows:

Table 2.2 *Cut and Fill*

	Volume (m^3)
Cut	107,376
Fill	211508
Net imported material (granular material, concrete, capping, asphalt, topsoil)	104,131

Much of the excavated material will be re-used for landscaping works. Infill materials for construction will comprise clean inert fill and capping material etc.

Waste Management during Construction

Chapter 14 contains a detailed description of waste management relating to construction of the proposed development. An outline construction and demolition waste management plan is provided with planning. A more detailed Construction and Demolition Waste Management Plan will be prepared prior to construction by the contractor to ensure best practice is followed in the management of waste from the proposed development.

Power Supply

Power supply for the purposes of construction will be provided by a temporary grid feed of 10-15 MVA.

Roads, Services and Landscaping

The internal road system will initially be composed of hard cored material, rolled and compacted sufficiently to support initial construction including civil/structural sub grade works.

An early phase of landscape planting will be undertaken following the initial cut and filling works to include planting of trees in selected sensitive areas. Early growth and development in these areas will promote a good screening of construction works into operational phase.

Planting will be with native species and includes wild flower meadows to maximise opportunities for protecting biodiversity. There will be a loss of some existing hedgerows to facilitate development but the landscaping design will result in replacement of c. three times the existing extent of hedgerows. Details of the landscaping is provided In chapter 10

2.6.1.6 Construction Impacts and Mitigation Measures

Each of the following EIAR chapters (Chapters 3 to 15) include an assessment of the potential impact of construction works on the relevant aspects of the environment and set out the relevant mitigation measures relating to that aspects.

A detailed contractors Construction Environmental Management Plan (CEMP) will be put in place to ensure mitigation outlined in the CEMP and EIAR accompanying the application are implemented by the contractor during construction works. The CEMP will also include emergency response procedures in the event of a spill, leak, fire or other environmental incident related to construction. A copy of the CEMP is included with planning. The CEMP includes a Flood Risk Assessment, a surface water management and pollution prevention plan and a construction traffic management plan.

The primary potential impacts from construction which require mitigation are;

- Management of run-off water in terms of silt;
- Effects on the road network (due to construction workers and other staff attending site during preparation, construction and commissioning phases;
- Impacts on the flora and fauna of the site i.e. changes to site for construction resulting in loss of habitat, and;
- Impacts on human beings in terms of nuisances relating to the air quality of the environs due to dust and other particulate matter generated from excavation works and impacts on the noise environment due to plant and equipment involved in construction.

Mitigation measures to address potential impacts and are included in the CEMP and presented in each individual EIAR chapter.

2.6.2 Description of Commissioning

Once the physical structures are in place, specialist contractors will be mobilised to complete the commissioning of the data storage facility and energy centre. Commissioning is expected to take approximately 4 weeks per 4MW of IT Infrastructure. As the construction phase will be complete prior to commissioning, site construction staff will be demobilised.

2.6.3 Operation of the Project

The majority of this detail is provided in sections 2.3 to 2.5 above.

Once operational, each data storage facility will “go live” and serve data customers on an ongoing basis. The server systems and the supporting infrastructure will be monitored by site staff and faults identified and remedied as required. Staff are primarily required onsite for security, ongoing monitoring and maintenance of electrical equipment.

Vertical Farming

One of the primary outputs from the data centre buildings will be excess warm air which will be removed continually by motorised fans in the AHU system. All fans will have variable speed controls on fan motors. This warm air will be partially used to support the on-site vertical farm. The farm will generate 700 tonnes per year (13 per week) of products – mostly high value crops such as herbs.

Operational Hours and Employment

It is proposed that between 400- 450staff (and maintenance engineers) will be on site each day when the data centre and Energy Centre is fully operational. The vertical farm will have an additional 40 staff.

It is anticipated that the data centre facility will operate on 2 no. 12 hour shift basis (7am to 7pm, 7pm to 7am). Working hours are expected to be 24 hours a day, 7 days a week. The farm will operate on a single shift only.

Waste Generation

Networks of waste collection, treatment, recovery and disposal infrastructure are in place in the region to manage waste efficiently from this type of development. Waste which is not suitable for recycling is typically sent for energy recovery. There are also facilities in the region for segregation of municipal recyclables which is typically exported for conversion into recycled products (e.g. paper mills and glass recycling). A more detailed description is provided in Chapter 14 Waste.

Chapter 14 contains a description of waste management relating to the proposed development. A detailed Operational Waste Management plan will be prepared in advance of the commencement of the activity at the site to ensure best practice is followed in the management of waste from the proposed development.

Noise Generation

Acoustic modelling has been undertaken to ensure compliance with noise guidelines. Mitigation is incorporated in the building structure (Chapter 10, Noise).

Emissions to Air

The Proposed Development (Data Centre and Energy Centre) will have a data centre with a total of 84 no. back-up generators with associated stacks which will be built to a height of 8 m above ground level. The energy centre will have 18 no. lean-burn natural gas engines, with the associated stacks built to a height of 25 m above ground level.

It is anticipated that the back-up diesel generators for the data storage buildings will rarely be used, however they will be maintained for emergency readiness by being tested once a month, two at a time sequentially i.e. each generator will be turned on once per month for one hour to maintain operational readiness when required waste exhaust gases will be vented to air via the stacks along the edge of the buildings. The diesel mode for the energy centre engines will also be tested. Each one will be turned on for a maximum of one hour, once per month.

Air dispersion modelling has been undertaken using the United States Environmental Protection Agency's regulated model AERMOD. The modelling of air emissions from the site was carried out to assess concentrations of pollutants at a variety of locations beyond the site boundary.

A number of modelling scenarios were investigated for the purposes of this assessment. Both normal day-to-day testing operations were considered as well as emergency operations. The assessment of the impact of these emissions and the modelling scenarios is presented in (Chapter 7 Air & Climate).

2.6.4 Changes to the Project (including Decommissioning)

It is intended that the proposed development will have a long lifespan. Regular maintenance and upgrading of the facility over time will enable it to continue to meet future demands.

Upon closure it is anticipated that the facility will be suitable for re-use or sold to a third party as would any other industrial site. All plant and equipment would simply be decommissioned, removed and recycled/disposed as appropriate.

At present, there are no changes anticipated to the proposed development over its expected lifetime.

2.6.5 Description of Other Related Projects

A list of the other developments in the vicinity of the Proposed Development is provided in Chapter 3 (Planning and Development Context) of this EIA Report. There are no identified significant projects which would result in a significant cumulative impact on the receiving environment

2.7 SUSTAINABILITY ENERGY EFFICIENCY & RESOURCE USE

The applicant is committed to running its business in the most environmentally friendly way possible. The proposed development has been designed to take into account these policies with energy efficiency central to the decision-making process, minimising power and water consumption. The measures that are being proposed to reduce energy usage, promote a low carbon model and support sustainability are outlined in the Energy and Sustainability Statement prepared by Hurley Palmer Flatt and provided with planning. A summary is provided above in section 2.4

2.8 HEALTH AND SAFETY

2.8.1 Design and Construction Health and Safety

The facility has been designed in accordance with the Safety Health and Welfare at Act 2005 and the Health and Safety and Welfare at Work (General Application) Regulations SI 299 of 2007 and associated regulations.

The plant has been designed by skilled personnel in accordance with internationally recognised standards, design codes, legislation, good practice and experience.

2.8.2 General Operational Health and Safety

Prior to start up a comprehensive set of operational health and safety procedures will be established (based on those used at other similar facilities). This will ensure a smooth roll out of operations at the facility.

2.9 MAJOR ACCIDENTS/DISASTERS

The 2014 EIA Directive and associated Draft EPA EIA Guidelines requires that the vulnerability of the project to major accidents, and/or natural disasters (such as earthquakes, landslides, flooding, sea level rise etc.) is considered in the EIA Report. The site has been assessed in relation to the following external natural disasters; landslides, seismic activity and volcanic activity and sea level rise/flooding as outlined below. The potential for major accidents to occur at the facility has also been considered with reference to Seveso/COMAH.

Landslides, Seismic Activity and Volcanic Activity

There is a negligible risk of landslides occurring at the site and in the immediate vicinity due to the topography and soil profile of the site and surrounding areas. There is no history of seismic activity in the vicinity of the site. There are no active volcanoes in Ireland so there is no risk of volcanic activity. Further detail is provided in Chapter 6 Land, Soils, Geology & Hydrogeology.

Flooding/Sea Level Rise

The potential risk of flooding on the site was also assessed. A Stage 1 Flood Risk Assessment was carried out and it was concluded that the area proposed for the data centre development is not at risk of flooding. Furthermore, it is not expected that the proposed development would adversely impact on flood risk for other neighbouring properties. Further detail is provided in Chapter 7 Hydrology The Flood Risk Assessment provided with planning (Engineers Report).

Seveso/COMAH

The only substance stored on site controlled under Seveso/COMAH will be diesel for generators. The quantity of diesel which qualifies a given establishment for the application of lower-tier and upper-tier requirements under Directive 2012/18/EU is 2,500t and 25,000t respectively.

The development is proposed to store less than 2500t of diesel at any time and therefore the facility will not be a Seveso/COMAH facility. The only substance stored on site controlled under Seveso/COMAH will be diesel for generators and the amounts proposed do not exceed the relevant thresholds of the Seveso directive. There are no SEVESO sites within the zone of Influence of the proposed development.

An Emergency Response Plan will be developed and implemented at the energy centre in consultation with local emergency services.

Minor Accidents/Leaks

There is a potential impact on the receiving environment as a result of minor accidents/leaks of fuel/oils during the construction and operational phases. However, the implementation of the design and mitigation measures set out in Chapters 6 and 7 and the CEMP will ensure the risk of an accident is low and that the residual effect on the environment is imperceptible.

2.10 POTENTIAL IMPACTS OF THE DEVELOPMENT

The proposed data storage development is to be located on lands zoned for a datacentre development.

The development, when operational, will generate limited additional traffic, air, noise and water emissions, wastes generation from activities etc.

During construction, there is the potential for nuisance impacts from traffic, dust, and noise, if not carefully managed. The Applicant will require contractors to undertake works in compliance with a Construction Environmental Management Plan (CEMP) provided with planning to ensure each of these potential impacts are minimised. The CEMP will include mitigation measures included in this EIAR.

Each chapter of this EIA Report assesses the potential impact of the construction and operation of these developments on the receiving environment. Please refer to each specialist EIA Report chapter respectively

2.10.1 Residual Impacts

The residual impacts of the proposed development following the implementation of mitigation measures have been addressed in each of the chapters.

2.10.2 Do Nothing Scenario

Each of the chapters addresses the Do-Nothing scenario as required in the EPA 2017 guidelines. The Do-Nothing scenario is to retain the site as greenfield and also considers future development due to zoning.

2.11 RELATED DEVELOPMENT AND POTENTIAL CUMULATIVE IMPACTS

The proposed development is for six data storage facilities and single storey energy centre on a greenfield site. These will be built on a phased basis to meet customer demand. On completion, the current site area will be fully built out. In each of the chapters, the impact of the entire planned development has been considered.

Cumulative impacts are those impacts that relate to incremental / additive impacts of the planned development in addition to historical, present or foreseeable future actions. Cumulative impacts can be considered 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.

The EPA guidelines (2017) defines cumulative impacts as "*The addition of many minor or significant effects, including effects of other projects, to create larger, more significant effects".* The guidance is clear this assessment is required because a single activity can have a minor impact on its own, however, when combined with other impacts (minor or significant), it can have a cumulative impact that is collectively significant. It may also be relevant to consider the possible potential environmental loadings resulting from the development of zoned lands in the planned project's immediate vicinity.

European Union guidance (2017) states that *"It is important to consider effects not in isolation, but together; that is, cumulatively.*" Cumulative effects are changes to the environment that are caused by an action in combination with other actions. They can arise from:

- *the interaction between all of the different Projects in the same area; and*
- *the interaction between the various impacts within a single Project*

Each specialist chapter considers the potential cumulative impact of the Proposed Development with the any future development (as far as practically possible) on the site and the cumulative impacts with developments in the locality (including planned and permitted developments). A list of the other developments considered is provided in Chapter 3 (Appendix 3.1) Planning and Development Context.

3.0 PLANNING AND ALTERNATIVES

3.1 INTRODUCTION

3.1.1 Planning and Development Context

This chapter will examine the proposed development within the context of the Clare County Council (CCC) planning policy. The proposed development is described in detail in Chapter 2 (Description of the Proposed Development).

The site for the proposed development is situated within the administrative area of CC. The local planning and development policy framework with which the proposed development complies is defined by the Clare County Development Plan 2017 – 2023 (CCDP) and specifically Variation No.1 (adopted March 2019). Variation No.1 was undertaken to give effect "to the *Government Policy Statement on the Development of Data Centres* in Ireland by identifying in a plan led manner for the preferred location of a Data Centre in County Clare."

The relevant national, regional and local planning policy with which the proposed development complies is defined by the:

- National Planning Framework: Project Ireland 2040 (2018);
- Our Sustainable Future - A Framework for Sustainable Development for Ireland (2012)
- Regional Spatial and Economic Strategy for the Southern Region (came into effect on 31st January 2020).
- Clare County Development Plan 2017-2023, (CCDP) including Variation No. 1 adopted March 11th 2019.
- SEA Environmental Report and Appropriate Assessment-Natura Impact Report that accompanies the Variation (2019)
- Shannon Town and Environs Local Area Plan 2012-2018 as extended.

The following sections describe how the proposed development is in compliance with the stated policies and objectives of CCC with respect to planning and sustainable development. The National and Regional Planning Context has been described further in the Planning Report produced by John Spain Associates (JSA, 2021) and included with the application documentation.

3.1.2 Alternatives

The second half of this chapter will discuss alternatives. The EIA legislation and the prevailing guidelines (as set out in Chapter 2) and best practice require that EIA Reports provide a description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the Applicant, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for selecting the chosen option, taking into account the environmental effects.

This chapter considers the main alternatives examined under each of the following headings and the reasons for the selection of the chosen option including consideration of environmental effects:

- Do Nothing Alternative;
- Alternative Locations;
- Alternative layouts/designs;
- Alternative processes/technologies; and
- Alternative mitigation.

Throughout the design process, the design alterations where undertaken to ensure that the proposed development layout was responsive to the existing site conditions receiving environment.

3.2 DEVELOPMENT CONTEXT

The development footprint is c. 60 hectares (ha) and are located to the east of Ennis in the townland of Tooreen and Cahernalough, Co Clare. The lands are bordered to the south by the R352 (Tulla Road) and to the west by the M18. The lands are traversed by a gas pipeline, overhead powerlines connecting to the existing Ennis 110kv Substation that adjoins the western boundary.

The site is currently in predominantly agricultural use and comprises a series of irregularly shaped fields divided by hedgerows and ditches typical of its agricultural setting.

The site benefits from a strategic location and is accessible from the M18 Motorway via the local road network (R352) at Junction 13 less than 1km from the site. The M18/N18 Motorway / Primary road connects the cities of Limerick and Galway.

The county town of Ennis is located immediately to the west, with Galway city centre 65 km north of the site, and Limerick c. 40 km south. The M18 motorway provides an excellent transport link north and south, and connects to the M6 and M7 Motorways.

The north, east and south of the proposed development site is largely defined by agricultural lands, as well as some once-off developments associated with these agricultural holding. The west of the site is bounded by the M18.

3.3 NATIONAL, REGIONAL AND LOCAL PLANNING CONTEXT

3.3.1 National Planning Framework – Ireland 2040

The National Planning Framework (herein referred to as the NPF) was published in February 2018 and contains policies which are supportive of the development of information and communications technology (ICT) infrastructure, with particular reference to data centres.

National Strategic Outcome 5 of the NPF relates to the creation of *"A Strong Economy Supported by Enterprise, Innovation and Skills"*. This strategic outcome is underpinned by a range of objectives relating to job creation and the fostering of enterprise and innovation. One of the key objectives, relating to ICT infrastructure (including data centres) under National Strategic Outcome 5 is:

"Promotion of Ireland as a sustainable international destination for ICT infrastructures such as data centres and associated economic activities."

The proposed development comprises a data storage facility and associated ancillary development, in a location which is well suited and serviced to accommodate such a use.

The NPF also states under National Strategic Outcome 5:

"Ireland is very attractive in terms of international digital connectivity, climatic factors and current and future renewable energy sources for the development of international digital infrastructures, such as data centres. This sector underpins Ireland's international position as a location for ICT and creates added benefits in relation to establishing a threshold of demand for sustained development of renewable energy sources."

The NPF notes that the data centre sector underpins Ireland's international position as a location for ICT and creates added economic benefits by establishing 'a threshold of demand for sustained development of renewable energy sources". The proposed development will have a flexibility in supply during its lifeline which will allow for flexibility in sourcing of power including renewable sources where feasible.

In summary, the NPF encourages the location of ICT infrastructure in Ireland, and the proposed development, which comprises such ICT infrastructure, is therefore considered to be wholly in accordance with this key body of national planning policy.

3.3.2 Government Statement on The Role of Data Centres in Ireland's Enterprise Strategy 2018

The Government Statement on The Role of Data Centres in Ireland's Enterprise Strategy Prepared by the Department of Business, Enterprise and Innovation (June 2018). This statement highlights the fact that Ireland plays a significant role in the ICT sector, and emphasises the importance of data centres as they directly contribute to job creation and significant added economic benefits.

The strategic approach aims to:

- *Drive Ireland's ambition in the digital economy as a location of choice for investment and a seed-bed for technology entrepreneurship across a range of sectors and activities;*
- *Contribute to regional development, deliver associated economic activities and support the creation of high quality, sustainable jobs;*
- *align enterprise electricity demand with generation capacity and transmission planning; and*
- *ensure that potential downside costs are minimised and that economic impact is optimised.*

Data Centre developments such as that proposed provide a range of services to other firms that undertake production, research and development, marketing, sales, service, and support activities in locations with no physical/geographic connection to the data centre.

The statement recognises that a large proportion of existing and planned data centres are located within the Dublin Region. This presents unique challenges for future planning and maintenance of a renewable power grid. To address this, upcoming policy documents will propose a variety of policies to support regional opportunities for data centre investment, thus reducing the need for additional grid infrastructure in Dublin.

The increased renewable electricity requirement linked to data centres will be mainly delivered by the development of the new Renewable Energy Support Scheme (RESS) which will also reflect falling costs across a range of renewable technologies and an ambition to increase community and citizen participation in renewable energy projects.

3.3.3 Regional Spatial and Economic Strategy for the Southern Region

The Regional Spatial and Economic Strategy for the Southern Region came into effect on 31st January 2020. The Regional Spatial and Economic Strategy (RSES) includes a policy objective which *supports the national objective to promote Ireland as a sustainable international destination for ICT infrastructure.*

The proposed development site forms part of a consolidation and expansion of an existing block of zoned land and is designated for a range of uses including data centre development. An important strategic role is envisaged for it in reinforcing the region and Ireland as a destination for ICT and the development of data centres.

3.3.4 Clare County Development Plans

The Clare County Development Plan (CCDP) 2017-2023 sets out a coherent spatial planning framework for the County within the context of national and regional policies.

The aim is to drive the present-day evolution of the county and to establish a framework for the coordinated and sustainable economic, social, cultural and environmental development of County Clare.

The relevant policies and objectives of the CCDP in relation to Water, Drainage, Environmental Services, Transport, Waste, Cultural Heritage, Natural Assets, Environment have been addressed in the relevant chapters of this EIA Report.

Variation No.1 to the CCDP

The members of Clare Co. Co. adopted Variation No.1 to the CCDP 2017-2023 on 11th March 2019 and a summary of the relevant aspects of the CCDP as varied is provided below.

Zoning

The zoning objective for the lands currently identified in the Ennis Settlement plan were amended from Industrial (IND1) to Enterprise (ENT3) at Tooreen and extends the Enterprise ENT3 zoning objective to 45ha, onto lands currently identified as being in the open countryside. The amended map is shown as Figure 3.1 below.

The Variation state that the 55ha area site at Tooreen was "*identified and zoned as Enterprise (45ha) and Buffer (10ha) with a specific use for a Data Centre Campus due to; its proximity to the electricity sub-station; its proximity to the M18 motorway and adjoining regional road network; the location of the site relative to the Gas Pipeline; the availability of Dark Fibre and the proximity of the site to Shannon International Airport and Ennis Town.*

This site is zoned to accommodate a Data Centre campus which consists of one or more structures, used primarily for the storage, management and dissemination of data and the provision of associated power electricity connections and energy generating infrastructure."

The Variation states that "lands zoned *enterprise* shall be taken to include the use and development of land for high end research and development, business science and technology-based industry, financial services, call centres/telemarketing, software development, datacentres, enterprise and incubator units, small/medium manufacturing or corporate office in high quality campus/park type development".

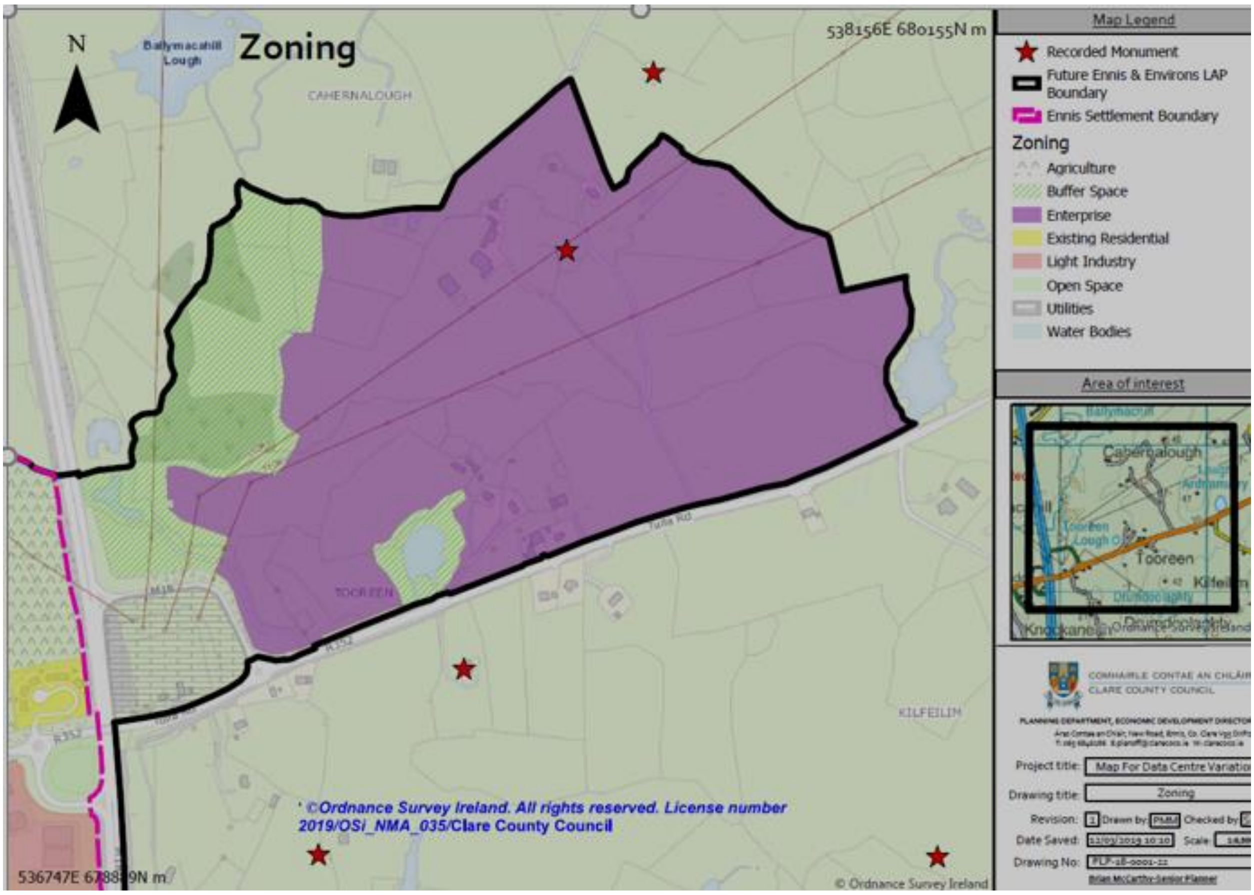


Figure 3.1 *Zoning Map showing the site of the Proposed Development zoned for Enterprise (purple) and buffer zones (hatched green) (Source: Clare County Development Plan 2017 – 2023 Variation 1 ; Maps Ennis Settlement Plan zoning map March 2019))*

A Strategic Environmental Assessment (SEA) and Flood Study was undertaken as part of the assessment of the Variation. Specific mitigation measures arising from the SEA, Habitats Directive Assessment and Strategic Flood Risk Assessment would need to be provided with any development proposal for the Toureen Area zoned as ENT3. The Variation incorporated additional text to section 2.13.5 Toureen Area, specifically identifying assessments which would be required for any development proposal. These are presented in Table 3.1 below with a summary of where they are fully addressed in this EIAR application and the planning submission.

Table 3.1 Requirements for Development Proposals as outlined in the CCC Development Plan Variation 1.

Assessment	ART Datacentres Ennis Campus Development
A traffic management plan for the construction and operation phase of development	An outline Construction traffic management plan has been included as part of the Construction Environmental Management Plan (CEMP)

	produced by AWN and included with the planning documentation.
Any proposed development shall adopt sustainable practice in terms of building design, materials, construction and practice.	The design incorporates a wide range of measures such as sustainable drainage systems, harvesting of rainwater, solar panels and reuse of waste heat within the proposed onsite-vertical farm. The proposed site layout has minimised the requirement for off-site disposal of soil . For additional information on sustainability within the design refer to the Energy and Sustainability report provided with Planning and Chapter 2 (Description of Proposed Development.).
A hydrological assessment to determine the effects of the development on groundwaters and groundwater quality	A hydrological assessment of the proposed development is included as part of Chapter 5 (Soils, Geology and Hydrogeology) of this EIAR.
At the southern end of the site is a mesotrophic lake, which will require protection through the provision of a buffer incorporating the dense clump of trees to the west of the lake and shall be included in the overall Landscape Management Plan for the site.	The proposed development design has incorporated suitable buffers around Toureen Lough and other identified ecological areas. See Landscape Management Plan provided with planning and Chapter 8 (Biodiverstiy) and Chapter 10 (Landscape and Visual Impact) of this EIAR
A Construction and Environmental Management Plan shall be submitted as part of the development proposals on the site. This shall include a Flood Risk Assessment, a Surface Water Management Plan for the construction and operation of the development, a Pollution Prevention Plan and shall incorporate principles of Sustainable Urban Drainage Systems. During the construction phase of developments on site where applicable all relevant best practice guidelines shall be adhered to.	A Construction and Environmental Management Plan (CEMP) has been submitted as part of the planning application. The CEMP incorporates a; Flood Risk Assessment; a Surface Water Management Plan for the construction and operation of the development , a Pollution Prevention Plan. Further details and an impact assessment is included within Chapter 6 (Hydrology) of this EIAR. Further details of Surface Water Management Plan for the operation of the development and SuDs design are included in the Engineering report prepared by CSEA.
An Air Quality Impact Assessment with reference to potential impacts on European Sites and the surrounding area within the zone of influence of the proposed development shall be submitted, this shall inform an Appropriate Assessment Screening and/Natura Impact Report.	An Air Quality Impact Assessment with reference to potential impacts on European Sites is included in Chapter 8 (Air Quality and Climate) of this EIAR. An Natura Impact Statement (NIS) is submitted with the planning submission and also discussed in Chapter 7 (Biodiversity) of this EIAR.
The hedgerows and scrub area on this site provide a foraging and commuting area for wildlife including Lesser Horseshoe bats. Future development proposals must be informed by a series of bat surveys to record the known usage of the site by in particular Lesser Horseshow bats and ensure that there is no net loss of supporting habitat. The surveys must include a full light spill modelling study. Any habitat loss must be offset by additional landscape planting to ensure connectivity across the landscape.	Chapter 7 (Biodiversity) of this EIAR includes relevant bat surveys and assessments. The proposed development has been designed to minimise habitat loss. The development will require loss of hedgerows low ecological value, however additional landscaping will provide a greater density of habitat for improved biodiversity on the site. The site is designed to be a dark site and a light spill modelling study is included in the planning submission.
Impact of development of the site on conservation interest bird species of surrounding SPAs and breeding birds should be avoided, through protection and retention of breeding bird habitat in accordance with the Wildlife Acts. Development proposals for the site shall be accompanied by bird surveys (to include winter bird survey) to assess the use	Chapter 7(Biodiversity) of this EIAR includes relevant Bird surveys and assessments of habitats. The development will require loss of existing hedgerows however, the overall landscape plan will incorporate approximately three times of the extent of existing hedgerows on site (see Chapter 10). No

of the site by bird species and where disturbance and /or displacement is predicted appropriate mitigation measures shall be identified. Hedgerow and treeline pruning or removal shall be conducted outside the breeding bird season (March 01st through August 31st).	pruning or removal will be conducted in the breeding bird season.
An Ecological Impact Assessment (designed by an appropriately qualified landscape architect and ecologist) and a Habitat Survey shall form part of development proposals for the site.	Chapter 7 (Biodiversty) and 10 (Landscape and Visual Impact Assessment) of the EIAR includes a habitat survey and Landscape plan. These are prepared by appropriately qualified ecologists and landscape architects.
A Landscape and Biodiversity Management plan shall be submitted to provide landscape, visual and environmental screening and enhancement measures through planting and design.	The planning submission includes a Landscape and Biodiversity Management Plan. This includes considerable screening and enhancement measures.
An Invasive Species Survey and Management plan (if required) shall accompany development proposal for the site.	The Ecological surveys on site included a survey of invasive species. No invasive species were identified by the ecologist and therefore no Management Plan is provided.
Development proposal shall also include an Otter Use Survey of the site, and where disturbance and/or displacement are predicted appropriate mitigation measures shall be identified.	An Otter Use Survey and appropriate mitigation is included in Chapter 7 of the EIAR
A buffer will be required to be provided with regard to the location of a National Monument (CL-034-007) on site.	The proposed layout includes a buffer zone around the Recorded Monument on site. Relevant mitigation measures are outlined in Chapter 11 of the EIAR.
Adequate wastewater treatment and disposal measures shall accompany development proposals for this site to ensure that there is no impact on water quality in the area.	Wastewater will be discharged in compliance with Irish Water requirements. Details are provided in the Engineering report prepared by CSEA and Chapter 13 of the EIAR.

3.4 SUSTAINABLE DEVELOPMENT

An Energy and Sustainability Statement prepared by Hurley Palmer Flatt is provided with the planning submission. The document presents relevant national and local planning policy and guidance in relation to sustainability. All of these aspects will be integral considerations in the operation of the proposed development on a day-to-day basis and are addressed within this EIA Report and the Energy and Sustainability report.

The project is compliant with national policy and guidance:

- Project Ireland 2040 – National Planning Framework which sets out the strategic importance of data centres in Irelands Enterprise Strategy,
- National Climate Change Adaptation Framework (DECLG 2012),
- Government Policy Statement on the Development of Data Centres in Ireland (2018),
- The National Climate Action Plan (CAP) 2019-2024,
- IS 399:2014 " Energy Efficient Design Management- Requirements with Guidance for Use" written by Sustainable Energy Authority of Ireland (SEAI) and the National Standards Authority of Ireland (NSAI),
- Sustainability Ireland's Framework for Sustainable Development 'Our Sustainable Future' (launched 2012 with subsequent progress report in 2015),

by the Department of the Environment, Community and Local Government. It provides a framework to ensure that development is undertaken in a sustainable manner.

'Our Sustainable Future' aims to ensure that development is carried out sustainably and in an environmentally sound manner which includes optimisation of natural resources, minimisation of waste, safe and sparing use of chemicals and the application of clean technology.

Table 3.2 sets out relevant guidance relating to energy and sustainability within the CCC development plan., The proposed development meets these objectives through efficiencies in design as outlined in Chapter 2 and the Energy and Sustainability Statement prepared by Hurley Palmer Flatt provided with the planning submission.

Table 3.2 CCDP Energy Efficiency and Sustainability, Relevant Objectives and Policies

CDP OBJ 17.3	Sustainable Developments To require all new developments to maximise energy efficiency and conservation and to ensure that they embrace the concept of sustainable design, achieve excellence in sting and design and promote the use of low carbon materials.
CDP OBJ 17.4	Design and Built Environment To encourage and facilitate excellence in the siting and design of new buildings in the county and particularly through contemporary and innovative architectural solutions; To encourage and facilitate high standards of energy efficiency; To facilitate and promote the use of appropriate low carbon materials in all future developments and embrace the principles of sustainable design; To run a Design Scheme to encourage excellence in the built environment.
CDP OBJ 18.3	Development of a Low Carbon Economy To promote County Clare as a Low Carbon County as a means of attracting Inward Investment to the County and Mid-West region; To facilitate measures to establish a low carbon economy and society by 2020; To facilitate the development of energy sources which will achieve low carbon outputs; To support sustainable modes of transport such as walking and cycling through promotional strategies and the provision of infrastructure where required; To work to Implement the provisions of *Ireland's Transition to a low carbon Energy Future 2015 – 2030* as they relate to County Clare.
CDP OBJ 18.4	Energy Efficiency To assist in reducing the County's dependence on imported fossil fuels and to develop a low carbon economy by; Promoting innovative new building design that demonstrates a high level of energy efficiency and the use of renewable energy resources, in accordance with national regulations and policy requirements; Promoting the development and use of alternative energy vehicles in line with the concept of smarter Travel and to encourage and facilitate the development of ancillary infrastructure; Promoting energy conservation, energy efficiency and use of renewable sources in the production of all goods and services in accordance with national, regional and County regulations and policy requirements; Facilitating the provision of installations for powering the electric vehicles at convenient locations across the County

CDP OBJ 18.5	Distributed Heat To support and encourage the development of Distributed (District) Heating, in compliance with the objectives set out in chapter 14, as a means of facilitating; The increased use of heat generated from indigenous, low carbon, renewable resources (bioenergy, solar, geothermal etc.); The utilisation and distribution of useful waste heat from large thermal processes; The utilisation and distribution of useful heat from combined heat and power (CHP) Plant, where such a plant’s primary energy is met by indigenous, low carbon, renewable resources (bio energy, solar, geothermal etc.).

3.5 PLANNING PERMISSIONS

As part of the assessment of the impact of the proposed development, account has been taken of developments that are currently permitted, or under construction and substantial projects for which planning has been submitted within the surrounding areas.

The CCC Planning Department website was consulted in order to generate a list of granted planning permissions from the surrounding areas of the Proposed Development within the previous five years. The outcome of the planning search is presented in Appendix 3.1 (planning permissions within 2 km of the proposed development) and Appendix 3.2 (Regional planning search). The developments listed in Appendices 3.1 and 3.2 have been considered where appropriate throughout the EIA Report, and in the cumulative impact assessment within each chapter.

3.6 CONSULTATION WITH CLARE COUNTY COUNCIL PLANNING DEPARTMENT

AWN, the Applicant and the project team have liaised with the relevant departments of CCC in advance of lodgement of this application. A number of pre-planning consultations took place with CCC including 24th June 2020, 3rd March 2021 (site walkover),25th March 2021, 30th April 2021(consultation with CCC Water Services and Road Design), May 21st and June 8th 2021 (follow up consultation re Road and Water Services)AWN and the other respective EIA contributors/authors have incorporated advice and comments received from individual consultation with members of CCC into the relevant chapters of this EIA Report.

3.7 PLANNING CONCLUSIONS

The proposed development will be in keeping with all of the aspects of the relevant policy documents as described in Section 3.2 and 3.3 above. The proposed development will be situated on lands specifically zoned for a datacentre and energy generation type development as outlined in CCC Development Plan Variation no 1.

In conclusion, it can be stated that the proposed development complies fully with the policies and objectives of CCC regarding the conservation, protection and enhancement of environmental resources and assets of the region and will deliver a key piece of infrastructure in support of the economic development of the mid-west region.

3.8 ALTERNATIVES

3.8.1 Do Nothing Alternatives

The site is currently predominantly greenfield but zoned for development. The 'do nothing alternative' would result in no development occurring on site, and the site remaining greenfield until such time as an alternative development consistent with the land use zoning is granted permission and constructed. Located in lands zoned *enterprise,* it is likely that the lands would be developed for a similar enterprise development rather than remaining greenfield. The Do-Nothing scenario has been considered in each chapter of the EIA Report.

3.8.2 Alternative Locations

The applicant has considered two main components to assess alternative project locations:

- (i) Selection of preferred country

Ireland is considered the most optimal location for datacentre developments based on the following:

"In general, Ireland is a suitable location for data centre developments due to the moderate climate, which means that data storage facilities here can be cooled primarily using outside air (via roof mounted air handling units). This reduces the need for additional, more energy intensive forms of cooling, which often can be required elsewhere around the world. This also benefits the facilities sustainability as data storage facilities in Ireland require far less air conditioning and temperature control systems, which means substantially less power and water demand requirements. This has the effect of reduced air and noise emissions compared with countries with a warmer climate.

Additionally, Ireland has a skilled workforce, a stable political and regulatory system, and government policies that enable large-scale renewable power projects. Certain advantages of locating data centres in Ireland are detailed in recent reports such as *A Study of the Economic Benefits of Data Centre Investment in Ireland,* May 2018 commissioned by the IDA Ireland and the Government Statement on *The Role of Data Centres in Ireland's Enterprise Strategy* prepared by The Department of Business, Enterprise and Innovation."

- (ii) Selection of preferred site location

Alternative locations were considered under the SEA completed for Variation No 1 (adopted March 2019), of the Clare County (CCC) Development Plan 2017 – 2023 (CCDP). Section 7.3 of the SEA outlines the site selection process and assessment of alternative sites (Section 7.3 Tables 10 and 11). Seven sites were identified by CCC and at strategic level met a number of criteria for potential data centres including high speed broadband in the vicinity, proximity to motorway and national route infrastructure and proper planning and sustainable development such as zoning of the site. 16 additional sites (provided following an expression of interest) were assessed similarly on land use. Section 7.4 of the SEA concluded " from the above evaluation, the lands at Toureen emerged as the preferred lands for a potential data centre development. This site is the preferred area at strategic level, in terms of balancing the objectives of the Proposed Variation with environmental considerations including proper planning and sustainable development".

The EIA team has reviewed the criteria used in this assessment and concur with the evaluation given. It can be seen from the evaluation that based on the land use and zoning information available that the likely environmental effects are similar for most sites and could be mitigated at site level following additional assessment and mitigation.

In addition, an alternative site assessment has been completed by the EIA team

The applicant had undertaken due diligence of four locations:

1) Ballymaley Business Park Ennis-
2) Quinn Road Business Park
3) Roche Ireland
4) Toureen

An explanation of the criteria used in the evaluation is given in Table 3.2 below.

Table 3.3 Criteria for the evaluation of risk.

Environmental Criteria	
Human Health and Population • Health Impacts – Higher density population has higher risk of dust and noise during construction • Economic Impact	Land, Soils, Geology & Hydrogeology • Geological Heritage • Presence of contaminated land • Economic reserve and land use • Aquifer resource and impact on existing water supply • Aquifer vulnerability and water quality
Water & Hydrology • Natural hydrological regime and water quality • Flood risk	Biodiversity • Potential impact on habitats of high ecological value • Potential impact on protected and designated habitats/sites
Landscape & Visual Impact • Desktop review of development Plan landscape and visual sensitivity • Identification of likely visual receptors (higher population)	Archaeology, Architecture & Cultural Heritage • Review of Department of Arts, Heritage, Regional and Rural and Gaeltacht Affairs Archaeological Survey database.
Traffic & Transportation • Status of current road network and Potential for sustainable modes for workforce	Material Assets • Ownership and Access • Availability of utilities

Table 2 below presents a comparison of assessed risk to environmental criteria for each of these alternative sites based on a desk top assessment using available information. The sites are given a **low (green) medium (orange) or high** (Red) environmental risk rating for each environmental criteria.

Table 3.3 Evaluation of risk for environmental criteria for alternative locations.

Criteria	Ballmaley Business Park	Quin Road	Roche Ireland	Toureen
Human Health & Population (air, dust, noise vibration impacts)	Medium population density resulting in medium sensitivity environment for dust noise vibration and human health impacts during construction	Medium population density resulting in medium sensitivity environment for dust noise vibration and human health impacts during construction	Medium population density resulting in medium sensitivity environment for dust noise vibration and human health impacts during construction	Low population density resulting in low sensitivity environment for dust noise vibration and human health impacts during construction
Land soils geology hydrogeology	Medium -The site is underlain by a Regionally Important Aquifer - Karstified (conduit) with a medium to extreme aquifer vulnerability - There are no licensed landfills or section 22 illegal landfills within 500m of the site	Medium -The site is underlain by a Regionally Important Aquifer - Karstified (conduit) with a medium to extreme aquifer vulnerability - There are no licensed landfills or section 22 illegal landfills within 500m of the site	High -landfill on site undergoing remediation -High Aquifer vulnerability) Regionally Important Aquifer - Karstified (conduit)	Medium -The site is underlain by a Regionally Important Aquifer - Karstified (conduit) with a medium to extreme aquifer vulnerability - There are no licensed landfills or section 22 illegal landfills within 500m of the site
Water and Hydrology	Low -no open water onsite - No identified flood zones present on site	High -Direct hydrological connectivity to Lower River Shannon SAC (within 25m) - Within River and Coastal Low probability flooding zones (0.1% AEP)	Medium - River Shannon and River Fergus Estuaries APA and Fergus Estuary and Inner Shannon, North Shore pNHA (within 15 m) - No identified flood zones present on site	Medium - Direct hydrological connectivity to Ballymacahill river - no risk of flooding affecting the site from fluvial or coastal sources, site lies within Flood Zone C (i.e., where the probability of flooding from rivers is less than 0.1% or 1 in 1000).
Ecology	Low -No direct connection to the River Shannon SAC or known	High -Direct hydrological connection to Lower River Shannon SAC (within 25 m)	High -Direct hydrological connection to River Shannon and River Fergus Estuaries SPA	Medium -Hydrological pathway to the River Shannon SAC is > 2 km from the site

	areas of designated habitat. Closest protected habita is Ballyallia Lake SAC/SPA/pNHA.	- no known areas of designated habitat on site.	and Fergus Estuary and Inner Shannon, North Shore pNHA (within 15 m) - no known areas of designated habitat on site.	-Areas of designated habitat on site which require mitigation
Traffic and Transport	Low – Good access to national and regional road network Medium - Potential for sustainable modes for workforce	Medium – less well connected to national and regional network Medium - Potential for sustainable modes for workforce	Low – Good access to national and regional road network Medium – Potential for sustainable modes for workforce	Low – Good access to national and regional road network Medium - Potential for sustainable modes for workforce
Landscape Character	Medium – Lands not located in area of high amenity or in area designated as heritage landscape -little potential for reducing visual impact with landscaping	Medium -Site Within Ennis town urban landscape -not located in area designated as heritage landscape -little potential for reducing visual impact with landscaping	Low - lands not located in area of high amenity, -heritage landscape to south of site	Low – lands not located in area of high amenity area or designated as heritage landscape -Natural topography low, facilitates the scale of the development within the landscape and good opportunity for reducing visual impact with landscaping,
Archaeology & Cultural Heritage	Low -No recorded monuments on or adjacent to site) -Not located in heritage protection area.	Low -No recorded monuments on or adjacent to site)	Low – No recorded monument on site, Burial ground adjacent)	Medium -Ringfort located on site which requires local mitigation.
Material Assets	High -required landbank not available for datacentre and energy centre -limitations to electrical and gas	High -required landbank not available for datacentre and energy centre -limitations to electrical and gas supply (medium to	Medium – lands not currently available as undergoing remedial works and licence surrender and limitation on area for expansion and landscaping	Low -Lands available and good access -Direct access to electrical substation and high pressure gas pipeline

	supply (medium to high pressure gas mains) - currently sufficient waste management capacity within the surrounding area	high pressure gas mains) -currently sufficient waste management capacity within the surrounding area	-limitations to electrical and gas supply (medium to high pressure gas mains) - currently sufficient waste management capacity within the surrounding area	-Currently sufficient waste management capacity within the surrounding area

It can be seen that the sites are similar for many environmental considerations. Quin Road site has high risk for three criteria: hydrological connectivity within close proximity to the SAC, absence of medium to high pressure gas and available landbank. The Roche site similarly has hydrological connectivity within close proximity to the SAC, absence of medium to high pressure gas and due to the remedial works required on site is not currently available for redevelopment. The Ballmaley Business Park does not have access to medium to high pressure gas and does not have available land bank for the proposed development.

In summary, on the basis of material asset considerations i.e availability of the necessary land bank (within the proposed timeline for the project) and proximity to necessary power (electrical and high pressure gas) for the proposed development of a datacentre and energy centre, the site at Toureen was chosen as the preferred site. Assessment of the environmental constraints identified at Toureen show that these can be easily managed by excluding development from ecological and archaeological buffer zones and lands identified as prone to localised flooding with standard good practice mitigation during construction and operation.

3.8.3 Alternative Layouts/Designs

In the preparation for Proposed Development, a number of alternative arrangements and configurations for the Proposed Development, roadways and parking arrangements were considered.

Alternatives for the datacentre building layout is limited due to:

- the need to take advantage of the lower topographical area of the site, in order to minimise visual impact,

-to fit the buildings and associated development within the available area of the site outside of ecological and archaeological buffer zones, i.e to reduce potential for environmental and cultural heritage impact,

- the necessary wayleave for the fort and buffer zones

- adherence to other minimum distances between different components, e.g. between residences and data halls, data halls and substation buildings and the gas line.

Alternative locations for the energy building have been considered as illustrated in Figure 3.1-3.3.

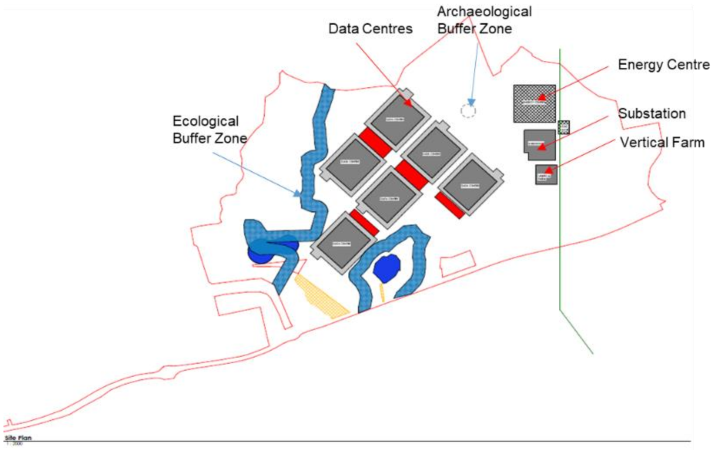


Figure 3.2 *Proposed Layout (Layout 1 –"the proposed layout")*

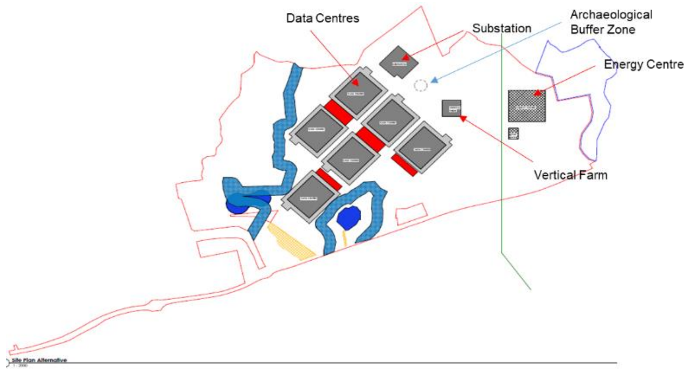


Figure 3.3 *Proposed Layout (Layout 2) Alternative location of Substation and Vertical farm*

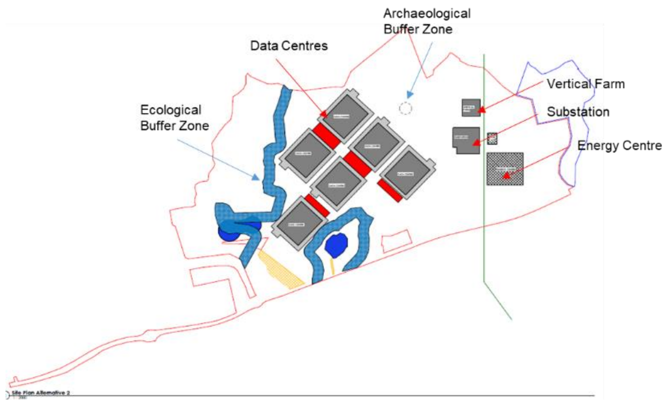


Figure 3.4 *Proposed Layout (Layout 3) Energy centre located further south than Option1 (Proposed Development)*

The environmental sensitivities associated with each surrounding land use were considered i.e. the proximity to the buffer zones for ecology and archaeology, ecological habitats for bats and occupied residences along the Tulla road.

There were no perceptible differences identified between the three options in terms of the potential for impacts on cultural heritage or air during construction and operation with mitigation in place. Regardless of the option selected, the air quality modelling was able to establish the appropriate stack height (see assessment in Chapter8 and Table 3.1 below) to ensure adequate air dispersion and therefore compliance with all National and EU ambient air quality limit values and, therefore, none of the options would result in a significant impact on air quality or human health once operational. In regard to archaeology all options have similar potential impacts pre and post mitigation requirements.

Layout 2 would have a lower fill requirement than Layout 1. Layout 3 would result in a requirement for a significant additional soil and rock excavation and which in turn would result in a greater impact on construction traffic, soils and geology, material assets and waste management. The Waste Management Hierarchy states that the preferred option for waste management is prevention and minimisation of waste, followed by preparing for reuse and recycling/recovery, energy recovery (i.e. incineration) and, least favoured of all, disposal. With respect to traffic impact, the additional subsoil removal would result in additional traffic movements to remove the soil from the site. The additional subsoil removal would result in additional heavy goods vehicle movements to and from the site. It would also result in additional noise and dust generation from the excavations at the site.

During operation all three options have similar impacts. However, layout 3 would have the most impact in terms of visual impact from the Tulla road. Layout 3 would also require more significant mitigation to minimise noise impact outside the site boundary. Layout 2 would result in the destruction of a brown long-eared bat roost, and would be within the 30m disturbance free zone of a pipistrelle bat roost. Layout 2 would also disrupt the normal commuting range of roosting bats within the site to areas used for commuting and foraging.

Layout 1 was selected as the preferred option for the proposed development. Other than the environmental considerations summarised above, the preferred site layout was determined based on the following factors:

- Orientation of the data storage facility buildings to optimise the use of the space available and location in the lowest area of the site, furthest away from the Tulla road to minimise visual impact.
- Maximises opportunities to reinforce the existing landscape and vegetation and promoting biodiversity.
- All bat roosts within the proposed development are maintained and protected from development with a 30m no disturbance zone in place.
- Commuting and foraging corridors for bat species along hedgerows and treelines are retained and/or enhanced to ensure the site maintains suitability for local bat species throughout; along the boundaries of the site, from east to west, and north to south.
- Minimises the cut and fill requirement.
- Establishes a simple, regular road layout on the site with the buildings occupying the central part of the site, avoiding pinch points and creating space for ancillary elements (construction compound, attenuation, sprinkler compound etc.).

3.8.4 Alternative Processes and Technologies

Alternative technologies have been considered by the project design team based on many factors including technical feasibility, environmental impact, efficiency, security, reliability and cost.

The *Energy and Sustainability Statement* which accompanies the planning application details the assessment process and estimated CO_2 savings achieved through the integration of passive design, energy efficiency measures and Low and Zero Carbon

(LZC) technologies. It also sets out how the Irish Building Regulations technical Guidance Document Part L 2017 and the CCC Development Plan planning policies regarding energy and CO_2 emissions have been addressed.

Energy Efficiency

A number of alternative energy efficiency measures have been considered to achieve overall CO_2 reduction targets in the final design. These are summarized below and in more detail within the *Energy and Sustainability Statement* (section 4.4.4) provided with planning.

Consideration of alternative use of waste heat

As outlined in the HDR Energy and Sustainability Statement (section 4.6.2 and 4.6.3), an assessment of the high-grade heat from the gas powered generators has been undertaken. This assessment shows that high grade heat could be exported to a local development in need of heat such as residential or other uses. Given that there are no known exact locations selected for future district heating networks in the vicinity of the proposed development, a connection to a district heat network has not been included in the final proposals. However, what is proposed is to provide a set of flow and return pipes form the Energy Centre to the edge of the Art Data Centre to allow for onward connection by others to either a local requirement for heat or a future heat network.

The opportunity to export wase heat from the data halls to an on site vertical farm is proposed as both are 24/7 requirements

Consideration of Alternative Renewable Energy Sources

As set out in the *Energy and Sustainability Statement* (section 4.7), the following localised energy generation technologies are considered viable for the site: Electric heat pumps and Photovoltaics. The following localised renewable energy technologies have been considered as non-viable for the site due to space requirements and cost: solar thermal, wind turbines, biomass heating scheme, biofuel combined heat and power and fuel cells. The feasibility assessment considered technical feasibility followed by assessment based on economic and local planning feasibility.

Consideration of Alternative Cooling Systems

The data halls are intended to be air cooled by free fresh air, using air handling units with the facility for having adiabatic cooling during unusual high temperature periods (temperatures typically greater than 27°C). The adiabatic water requirement will vary with the seasons and as the water is used for an adiabatic process, the discharge of waste water will be minimal.

The alternatives to free air cooling considered by the Operator were as follows:

1. Air cooling by chiller and CRAC (computer room air conditioning)
2. Air cooling by indirect air-cooling AHU (air handling unit)
3. Chilled-water cooling derived from free-cooling, hybrid cooling towers with chiller assist

Air cooling by chiller and CRAC: This chilled-water solution serves Crac downflow units typically serving cold air to the data storage hall white space through a floor void. Crac units normally include humidification elements to control the static electricity and all hot air is redirected back into the Crac to remove the heat for redistribution into the white space. The source of the cooling water is via a traditional refrigeration chiller located externally, usually on the roof. This is the traditional tried and tested cooling method. However, experience on other datacentre developments has shown it can create hot spots where cooling is not adequate and inefficiencies and does not allow for free cooling.

Air cooling by indirect air-cooling (IAC) AHU: This 'all air'-based cooling solution incorporates air handling plant mounted externally to the white space. Treated air is distributed to the white space via ductwork or through a plenum. Air is supplied at a relatively low velocity to the cold aisle, giving more control than traditional floor-void distribution. The hot air is returned to the IAC via ductwork and is cooled by the outdoor ambient air at a plate heat exchanger. To assist the cooling process during warm months, the ambient air is adiabatically cooled (water evaporation), which then cools the warm air at the plate heat exchanger in the IAC unit. The water used for adiabatic cooling is bulk-stored in the event of a mains supply outage. The process water is distributed from a central pump plantroom to the IAC units. This is a proven, cost effective technology but it can result in acoustic challenges (elevated external noise emissions) in comparison to the other alternatives.

Chilled-water cooling derived from free-cooling, hybrid cooling towers with chiller assist: This chilled-water solution serves Crac downflow units typically supplying cold air to the white space through a floor void. The source of the cooling water is via 'free cooling' cooling towers located externally, usually on the roof. Ambient air is used to cool the warm return water from the Crac units, with adiabatic cooling added during the warmer months. At peak times, when approaching the towers' cooling-load limits, refrigeration chillers are used to run in parallel with the cooling towers. This requires large plant space, there is increased risk of water leaks and higher maintenance costs than the previous two alternatives.

Other than a difference in water and power consumption requirements and acoustic performance (noise emissions to the atmosphere), there were no perceptible differences identified between the three alternatives options for the other environmental aspects.

Free air cooling, which is the system proposed, requires a high capital investment but lower operating costs and results in lower water and power consumption and lower noise emission than the alternatives considered.

Emissions Treatment Technologies

The use of selective catalytic reduction (SCR) was considered for the proposed development. SCR is an exhaust after-treatment technology which abates NOx emissions. The SCR technology involves injecting a urea-water solution into the exhaust gas stream in combination with a special catalyst unit. The advantage of SCR is the reduction in NOx emissions. The disadvantages include the space required for the catalyst, the high capital and operating costs and the potential for urea slip and deposit formation (however, it is noted that the latter two potential disadvantages can be mitigated). Air dispersion modelling of emissions from the proposed generators (without SCR technology) was undertaken at the proposed stack heights in order to determine if SCR technology was required to achieve compliance with the EU ambient air quality standards. The results of the modelling indicated that the emissions will be compliant with the EU ambient air quality standards at all off-site locations (including background concentrations), refer to Chapter 8. On the basis that the SCR technology was not necessary to achieve compliance with the air quality standards, it was decided not to incorporate the SCR technology within the data centre development. Whilst SCR abatement is incorporated for the energy center to ensure air quality emissions meet required air standards.

Table 3.4 Assessment of alternative stack heights

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 / 8 m stacks	Annual mean	22.7	14	36.7	40	92%
	99.8th%ile of 1-hr Means	111.5	28	139.5	200	70%
NO_2 / 12 m stacks	Annual mean	22.2	14	36.2	40	91%
	99.8th%ile of 1-hr Means	105.5	28	133.5	200	67%
NO_2 / 15 m stacks	Annual mean	21.9	14	35.9	40	90%
	99.8th%ile of 1-hr Means	103.2	28	131.2	200	66%
NO_2 / 20 m stacks	Annual mean	21.6	14	35.6	40	89%
	99.8th%ile of 1-hr Means	98.6	28	126.6	200	63%
NO_2 / 25 m stacks	Annual mean	21.2	14	35.2	40	88%
	99.8th%ile of 1-hr Means	92.5	28	120.5	200	60%
	99.8th%ile of 1-hr Means	20.8	14	34.8	40	87%
NO_2 / 30 m stacks	Annual mean	86.1	28	114.1	200	57%
	99.8th%ile of 1-hr Means	22.7	14	36.7	40	92%

.

<u>*Water Management*</u>

It is proposed to install a rainwater harvesting system to offset water demand from the public watermains. The alternative proposal considered was that the all the water requirements for the proposed development would be met from the public watermains. While the public watermains has sufficient capacity to cater for the predicted water demand for the proposed development, the installation of the rainwater harvesting system will reduce the demand on the public watermains. The rainwater harvesting system will also reduce the volume of surface water runoff discharged to the existing storm water system. Other than potential impacts on materials assets and surface water drainage, there were no perceptible differences identified between the two options in terms of the other environmental aspects. Use of mains alone would require treated water to be used while rainwater minimises this requirement.

<u>*Power*</u>

Both electrical power and gas-generated power were considered for the proposed development. The chosen design allows for either, or a combination of both, to be utilised allowing for flexibility in sourcing cost effective and sustainable supplies now and in the future as growth in renewable sources become available through the Eirgrid and Gas Networks Ireland (GNI) network.

4.0 HUMAN HEALTH AND POPULATION

4.1 INTRODUCTION

This chapter has been prepared to assess the likely impacts associated with Human Health and Population for the proposed development. In accordance with the *Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* (EPA, 2017), *Draft Advice Notes for Preparing Environmental Impact Statements* (EPA, 2015), and European Commission (EC), *Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report* (EU, 2017) this chapter has considered the *"existence, activities and health of people"* with respect to *"topics which are manifested in the environment such as employment and housing areas, amenities, extended infrastructure or resource utilisation and associated emissions"*.

- Population and Demographics;
- Socioeconomics;
- Population Health;
- Natural Resources;
- Tourism;
- Social Infrastructure;
- Health and Safety.

Impacts on humans from other issues such as natural hazards, soils, geology and hydrogeology, water, air quality, noise and vibration, traffic and landscape are discussed in their respective EIAR chapters:

- Chapter 6 - Soils, Geology and Hydrogeology;
- Chapter 7 –Hydrology;
- Chapter 9 –Air Quality and Climate;
- Chapter 10 –Noise and Vibration;
- Chapter 11 –Landscape and Visual Impact; and
- Chapter 13 – Traffic and Transportation.

Where these topics are dealt with in further detail elsewhere in this EIA Report, the relevant chapters have been cross referenced in this chapter.

4.2 METHODOLOGY

As per Article 3 of Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment, as amended by Directive 2014/52/EU:

"*1. The environmental impact assessment shall identify, describe, and assess in an appropriate manner, in the light of each individual case, the direct and indirect significant effects of a project on the following factors:*

(a) population and human health;

(b) biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC;

(c) land, soil, water, air and climate;

(d) material assets, cultural heritage and the landscape;

(e) the interaction between the factors referred to in points (a) to (d).

2. The effects referred to in paragraph 1 on the factors set out therein shall include the expected effects deriving from the vulnerability of the project to risks of major accidents and/or disasters that are relevant to the project concerned."

A 2017 publication by the European Commission, *Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report*, considered that:

"*Human health is a very broad factor that would be highly Project dependent. The notion of human health should be considered in the context of the other factors in Article 3(1) of the EIA Directive and thus environmentally related health issues (such as health effects caused by the release of toxic substances to the environment, health risks arising from major hazards associated with the Project, effects caused by changes in disease vectors caused by the Project, changes in living conditions, effects on vulnerable groups, exposure to traffic noise or air pollutants) are obvious aspects to study. In addition, these would concern the commissioning, operation, and decommissioning of a Project in relation to workers on the Project and surrounding population*."

This chapter will follow these EC guidelines, and will examine the health effects relevant to the Proposed Development as they relate to a relevant, defined study area. The effects of the Proposed Development on the population and human health are analysed in compliance with the requirements of the EPA Draft EIA Report Guidelines 2017.

4.2.1 Assessment of Significance & Sensitivity

The assessment of significance of is a professional appraisal based on the sensitivity of the receptor and the magnitude of effect.

Within any area, the sensitivity of individuals in a population will vary. As such, it would be neither representative of the population, nor a fair representation of the range of sensitivities in a population, were an overall sensitivity classification assigned to the population in question. As such, the precautionary principle has been adopted for this assessment, which assumes that the population within the study area is of a uniformly high sensitivity.

4.2.2 Magnitude of Impact

The magnitude of predicted impacts has been quantified in this assessment using the terms outlined in Table 4.1 below.

Table 4.1 *Description of magnitude of predicted impacts*

Magnitude	Description of Magnitude
High	Change in an environmental and/or socio-economic factor(s) as a result of the Proposed Development which would result in a major change to existing baseline conditions (adverse or beneficial)

Medium	Change in an environmental and/or socio-economic factor(s) as a result of the Proposed Development which would result in a moderate change to existing baseline conditions (adverse or beneficial)
Low	Change in an environmental and/or socio-economic factor(s) as a result of the Proposed Development which would result in a minor change to existing baseline conditions (adverse or beneficial)
Negligible	Change in an environmental and/or socio-economic factor(s) as a result of the Proposed Development which would not result in change to existing baseline conditions at a population level, but may still result in an individual impact (adverse or beneficial)
No change	No change would occur as a result of the Proposed Development which would alter the exiting baseline conditions (adverse or beneficial)

4.2.3 Significance of Effects

The assessment of significance of effects in this assessment is a professional appraisal and has been based on the relationship between the magnitude of effects (Section 4.2.2) and the sensitivity of the receptor. Table 4.2 below provides a matrix on the measure of the significance of effects based on these parameters.

Table 4.2 *Matrix illustrating the significance of effects as determined by the relationship between the magnitude of impact and the sensitivity of receptors*

		Magnitude of Impact			
		Negligible	Low	Medium	High
Sensitivity of Receptor	Negligible	Negligible	Negligible or minor	Negligible or minor	Minor
	Low	Negligible or minor	Negligible or minor	Minor	Minor or moderate
	Medium	Negligible or minor	Minor	Moderate	Moderate or major
	High	Minor	Minor or moderate	Moderate or major	Major

4.3 RECEIVING ENVIRONMENT

The Proposed Development is to be located on a primarily greenfield site (60 hectares) located on lands at Tooreen Ennis (Refer to Figure 1.1). The site includes areas of local environmental sensitivity and buffer zones have been incorporated in the Proposed Development to protect these habitats during construction and operation.

The area is primarily rural with a number of individual residents located along the surrounding roadways. The closest residents are along the southern boundary (R352).The M18 Motorway is located to the west of the site.

The surrounding area is described in further detail in Chapter 2 (Description of the Proposed Development).

4.4 EXISTING BASELINE CONDITIONS

The most recent census of population was carried out by the CSO on the 24th April 2016. The previous census was completed on the 10th of April 2011 and before that on 23rd April 2006. The census compiles data for the whole state as well as smaller individual areas including counties, cities, towns and electoral divisions. Taking into consideration the location of the Proposed Development, the census information on population, age profile, employment and social class, has been analysed in relation to the Clare County Council Region.

4.4.1 Population and Demographics

The latest census data shows that the population in the Clare County Council (CCC) area grew by only 1.3% between the years 2011 and 2016 compared with 3.8% nationally. Spancelhill, the electoral division (ED) for the site, saw a decline with a decrease of 0.8% (Table 4.3). Ennis Rural (ED), which is most significant population centre in the area grew the most by 2% and highlights the expansion of the town beyond the urban quarter. Projections for the national and the County populations are predicted to continue this trend of moderate to high population growth into the short-term future.

Table 4.3 *Population change at National, primary and secondary hinterland level from 2011 – 2016 (Source: www.cso.ie)*

Area	2011	2016	% Change 2011-2016
State	4,588,252	4,761,865	+ 3.8%
County Clare	117,196	118,817	+ 1.3%
Spancelhill (ED)	694	688	- 0.8%
Ennis Rural (ED)	17,359	17,709	+ 2%
Ennis Urban No. 1 - 4 (EDs)	4,965	4,962	- 0.06%

Age Profile

The age profile of the population in the area is an important parameter as it provides a good insight into the potential labour force, the demand for schools, amenities, other facilities and the future housing demand. Table 4.4 shows the age profiles Nationally and in Clare County for 2016.

Table 4.4 *Age profile at National and County level 2016 (Source: www.cso.ie)*

Area	0-14	15-24	25-44	45-64	65+	Total Persons
State	21%	12%	30%	24%	13%	4,761,865
County Clare	21.5%	11.5%	26.2%	26%	14.8%	118,817

This table shows that both Nationally and in the CCC area, the dominant age grouping is 25-44 at 30% and 26.2% of the total population, respectively, indicating a respectable young working age population in the area which is just below the national level. While older age groups 45-64 and 65+ are just above the national average.

The overall labour force population (15-64 age group) in CCC is 63.7% which is only 2.3% below the National level of 66%.

4.4.2 Socioeconomics

Employment

Table 4.5presents the employment statistics in 2016 compared with 2011. The data shows that unemployment decreased significantly in the County, as well as nationally, reflecting the economic recovery in recent years.

Table 4.5 *Employment statistics Nationally and at County level in 2011 and 2016 (Source: www.cso.ie)*

	At Work	Looking for first regular job	Unemployed having lost or given up previous job	Total in labour force	% Unemployment
2011 Labour Force					
State	1,807,360	34,166	390,677	2,232,203	19
Clare County	45,606	737	9,805	91,115	11.6
2016 Labour Force					
State	2,006,641	31,434	265,962	2,304,037	12.9
Clare County	49,511	666	6,352	93,245	7.5

The 2016 census data shows that the majority of people in employment in the CCC area are in ‘Managerial and Technical’ employment (28.4%) with the least represented social class being ‘Unskilled’ workers at (3.3%).

At a local level, the dominant social class in the Spancelhill area is ‘Managerial and technical’ labour (39.2%) with ‘Unskilled Workers’ being the least representative (3.1%).

Education

Census data presenting the highest level of education completed by people living in the Spancelhill community and CCC is presented in Table 4.6 (*Note the table presents key milestone education levels and excludes lower secondary, technical or vocational qualification, advanced certificate/completed apprenticeship, higher certificate, ordinary bachelor degree/national diploma, Ph.D./higher or where information was not stated*).

Table 4.6 *Highest level of education completed locally and at County level in 2016 for key educational levels. (Source: www.cso.ie)*

Area	No formal education	Primary education	Upper secondary	Honours Bachelor’s Degree, Professional qualification or both	Postgraduate Diploma or Degree	Total Persons
Spancelhill	0.6%	5.9%	19.4%	9.5%	10.4%	456
Clare County	1.4%	9.9%	20.3%	9.6%	7.8%	77,762

Labour Force Survey

The Labour Force Survey (LFS) is a large-scale, nationwide survey of households in Ireland carried out every three months. It generates labour force estimates which include the official measure of employment and unemployment for the state.

The results Nationally for Q4 2018 showed that there were 2,281,300 people employed in the State with 128,800 registered as unemployed. This represents a 2.3% increase in employment since the start of 2018 and an increase of 3.1% compared to the start of 2017 to Q4 in 2017.

In both Q4 2017 and 2018, the majority of people were employed in the wholesale and retail trade and repair of motor vehicles and motorcycles sectors, with industry, and human health and social work activities following closely.

Income

The below data, obtained from CSO Statbank (CIA01), demonstrate that the levels of total income per person County Clare are marginally lower than that within the State.

Table 4.7 *Total Income per Person (Euro) for Clare and the State (Source: CSO Statbank CIA01)*

	2010	2011	2012	2013	2014	2015
Clare County	23,743	22,347	22,926	22,086	22,275	23,386
State	24,840	24,596	25,273	24,910	25,388	26,698

A similar pattern of income distribution is observed in data on disposable income per person, where in the Clare County Local Authority district the disposable income per person was significantly lower than that of in the State in 2015.

Table 4.8 *Total Disposable Income per Person (Euro) for Clare and the State (Source: CSO Statbank CIA01)*

	2010	2011	2012	2013	2014	2015
Clare County	18,949	17,387	17,887	17,060	17,234	18,082
State	19,558	18,889	19,429	18,898	19,265	20,334

Deprivation

Deprivation in small areas is mapped using the Pobal HP Deprivation Index. This Index draws on data from censuses and combines three dimensions of relative affluence and deprivation: Demographic Profile, Social Class Composition and Labour Market Situation. Figure 4.1 below shows graphical representation of how the concepts of Demographic Growth, Social Class Composition and Labour Market Situation are measured by ten key socio-economic indicators from the Census of Population. In this EIA Report, the Relative Index Score is considered as the measure for deprivation, as these Relative Index Scores are rescaled such that the mean is 0 and standard deviation is 10 at each census wave. This allows for the provision of descriptive labels with the scores, which are grouped by standard deviation as seen in Table 4.7 below.

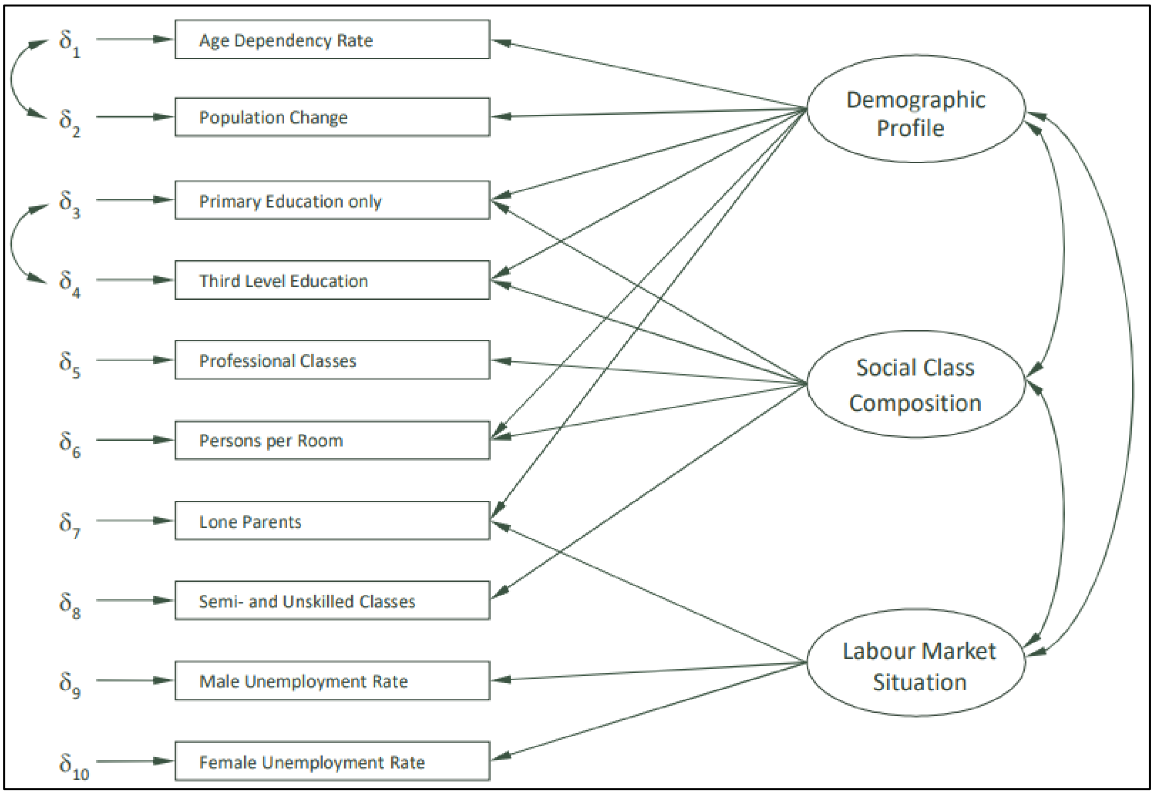


Figure 4.1 *Graphical representation of how the concepts of Demographic Growth, Social Class Composition and Labour Market Situation are measured by ten key socio-economic indicators from the Census of Population.*

Table 4.9 *Pobal HP Index Relevant Index Score labels (Source: Pobal HP Deprivation Index)*

Relative Index Score	Standard Deviation	Label
> 30	> 3	Extremely affluent
20 – 30	2 – 3	Very affluent
10 – 20	1 – 2	Affluent
0 – 10	0 – 1	Marginally above average
0 – -10	0 – -1	Marginally below average
-10 – -20	-1 – -2	Disadvantaged
-20 – -30	-2 – -3	Very disadvantaged
< -30	< -3	Extremely disadvantaged

The data in Table 4.10 show that the population living within the electoral division for the site, are generally classified as 'Marginally above average', with a Relative Index Score of 7.3

Table 4.8 *Pobal HP Index Relevant Index Score Figures at a local and County level (Source: Pobal HP Deprivation Index)*

	Relative Index Score	Pobal HP Description 2016
Clare County	-0.22	Marginally below average
Spancelhill (ED)	7.3	Marginally above average

4.4.3 Social Infrastructure

Residential Dwellings

The lands are currently used for agricultural purposes. The south and west of the site are bounded by the R352 (Tulla Road) and the M18 motorway. Ennis town and surrounding areas of urban fabric are located to the West, with small commercial and light industrial developments to the West and Northwest of the site. Agricultural land to the North, South and East are representative of the typical rural landscape in the area. The light industrial and commercial developments to the West comprise the Liffey mills, Hogan Motors, Breens Farm Machinery and Cummins Car centre/Dealership. Circle K, Topaz & O'Keeffes petrol stations, and O'Connors bakery and Liddys Eurospar shop which are located on the R352 west of the M18 overpass. The site is bound to the North and East by privately owned lands. The extent of these privately-owned lands are undeveloped farmlands and domestic properties. A halting site with 6 No. houses is located on the opposite side of the M18 motorway c. 200m West of the site.

Schools

There are a number of primary and secondary schools in the vicinity of the Proposed Development including:

- Knockanean National School in Knockanean, Ennis. c. 650m south of the site.
- An Daingin National School in Rosslevan c 1.5km West of the Site.

The closest third level institution in the area is Limerick Institute of Technology's Ennis campus located c. 3.5km to the southwest of the site.

Health

The nearest hospital to the site is Ennis General Hospital located c. 3.2km to the southwest of the site. The Ennis Medical Centre is also located c. 3.25 km southwest of the site along Francis street.

Security

There is a Garda station located on Abbey Street in Ennis c. 3.3km southwest of the site and a fire station on New road in Ennis (c. 2.9km to the southwest).

4.4.4 Landscape, Amenity and Tourism

In terms of landscape amenity of the Proposed Development site, there are no listed or scenic views, or tree preservation orders ~~protected trees~~ pertaining to the site, and no protected structures. The site is located within the 'Working Landscape' designation of the Clare County Development Plan 2017–2023 and outside of the 'Heritage Landscapes' designation. Working Landscapes are described in the Development Plan as…*intensively settled and developed areas within Settled Landscapes or areas with a unique natural resource*. There is also one Recorded Monument and Place (RMP) within the site, a 'Ringfort – Cashel' (SMR No. CL-034-007) in the northeast of the site as described in Chapter 12 Cultural Heritage and Archaeology of this EIA Report.

The primary areas of landscape amenity in the immediate vicinity of the Proposed Development site are located within the settlement of Ennis on the opposite side of the M18 motorway from the site. These are mainly small amenity greenspaces within the various housing developments that comprise the settlement. The Oysterman's Marsh Natural Heritage Area (NHA) is located just over 5km away from the site.

The Landscape and Visual Impact Assessment (LVIA), Chapter 10 of this EIAR, did not identify any significant impacts upon the landscape or visual receptors as a result of the proposed development. As stated in Chapter 3, the lands are appropriately zoned in the Clare County Development Plan 2017–2023 Variation No.1 (11th March 2019) as ENT3 with the aim to …*"accommodate a Data Centre campus which consists of one or more structures, used primarily for the storage, management and dissemination of data and the provision of associated power electricity connections and energy generating infrastructure."* The buildings have been located within the landform in such a way as to minimise as far as possible any potential visual impact. Potential visual impacts have been further minimised by proposed berms and large extents of structure planting which will largely contain views of the proposed buildings to the area within the site. Further discussion is presented in Chapter 11 (Landscape and Visual).

Tourism is a major industry in the immediate environs of the Proposed Development site. The town of Ennis is seen as a gateway town to the west coast of Clare with attractions such as the Burren National Park and Cliffs of Moher accessible via a short drive. As a 'Gaelic medieval' town Ennis also hosts many significant historic features and attractions itself. Coupled with its narrow streets, collection of independent retailers, cafes, bars, landmark hotels, and a strong tradition of Irish Music the town has a lot to offer visitors as well as the surrounding communities.

The closest shopping centres include the Roslevan Shopping Centre c. 1.5km west-south-west of the site and the Ennis Shopping Centre c. 3km south west of the site. Several major hotels are located in Ennis town centre such as the 'Queens Hotel', 'Ashford Court' and 'Old Ground Hotel', as well as many other smaller accommodation providers located closer to the site such as 'Newpark House' located c. 1.6km west-south-west of the site.

4.4.5 Natural Resources

Natural resources and land use in the hinterland of the Proposed Development have also been considered as they may have implications for the development of the lands.

The site itself was previously in agricultural use. Historical Ordnance Survey (OS) maps indicate that much of the surrounding land has been in agricultural and fallow use for 20-30 years. The construction of the M18 motorway which was completed in 2007 is one development that has negatively impacted the natural resources of the surrounding area. Regardless of the M18, much of the agricultural resources in the surrounding area has been left intact over recent decades.

Data from the Geological Survey of Ireland indicates that there are no areas of geological heritage within the vicinity of the proposed site. In terms of extractive industries, the closest active quarries are the Quinn Limestone Quarry in Carrowmeer (c. 5.3km South of the site) and the Whelans Limestone Quarry at Fountain Cross (c. 6km west of the site). There are no anticipated impacts on these facilities from the Proposed Development. Further detail on extractive industries is presented in Chapter 5 (Land, Soils, Geology and Hydrogeology).

4.5 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

The impact of construction, commissioning, operation and decommissioning of the Proposed Development are considered below.

4.5.1 Potential Impacts on Businesses and Residences

The main potential impacts on local businesses and residences associated with the Proposed Development will be in relation to air quality, noise, visual impact and traffic. The potential impacts and mitigation measures to address them are dealt with within the corresponding chapters of this EIA Report as follows:

- Chapter 8– Air Quality and Climate
- Chapter 9 – Noise and Vibration
- Chapter 10 – Landscape and Visual Impact
- Chapter 11 – Traffic and Transportation

It is predicted that there will be a slight positive impact on local business activity during the construction phase with the increased presence of an average of 600 construction workers using local facilities with a peak construction number of 1,200 construction workers. The positive impact during the operational phase will be c. 400-450 employees and contractors anticipated for the datacentre and energy centre (staff will be present on a shift basis, numbers will vary throughout the day). The development of the on site vertical farm will generate employment of c. 40 staff.

During operation, there will be potential additional housing demand in the wider commuter area as a result of increased employment provided by the Proposed Development. It is also anticipated that the Proposed Development will have indirect positive effects on employment in terms of construction material manufacture, maintenance contracts, equipment supply, landscaping etc.

The potential increase in the temporary population of the area during construction as a result of the employment of workers from outside the wider Clare area that may choose to reside in the immediate and wider local area is likely to amount to only a small percentage of the workforce employed during the construction phase but will result in some additional trade for local accommodation and services. It is expected that the majority of the work force will travel from existing places of residence to the construction site rather than reside in the immediate environs of the site. However, some local employment from within the wider local area is expected.

Construction will have an indirect positive effect on support industries such as builder suppliers, construction material manufacture, maintenance contracts, equipment supply, landscaping and other local services. There will also be a need to bring in specialist workers on a regular basis that may increase the above estimated working population at times. Specialists are only likely to stay for shorter periods depending on the nature of the work. The construction phase therefore is considered to have the potential to have a moderate short to medium term positive impact on the economy and employment of the local and wider area.

The completed development will also have a positive impact in the provision of additional capacity in cloud computing and data storage, the demand for which remains high. The operator offers a broad set of global computer, storage, database, analytics, application and deployment services that help organisations (both locally, nationally and internationally) operate faster, lower ICT costs and scale applications. The provision of these services will also improve individual's online experience and accessibility.

4.5.2 Potential Impacts on Human Health from Air Quality

As outlined in Chapter 8 of this EIA Report (Air Quality and Climate), National and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or "Air Quality Standards" are based on the protection of the environment as well as the protection of human health. Additional factors such as natural background levels, environmental conditions and socio-economic factors are also considered in the limit values which are set (see Chapter 8, Table 8.1). The ambient air quality standards established are designed to minimise harmful effects to health.

4.5.2.1 Construction Phase

As detailed in Chapter 8 (Air Quality & Climate), 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. The impact of construction and commissioning phase of the Proposed Development is likely to be *short-term* and *imperceptible* with respect to human health. Similar mitigation measures and impacts exist for decommissioning.

4.5.2.2 Operational Phase

As detailed in Chapter 8 (Air Quality & Climate), air dispersion modelling was undertaken to assess the impact of the Proposed 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, emissions from the site, assuming scheduled testing as well as emergency operation of the data centre back-up generators and the energy centre engines, are compliant with all National and EU ambient air quality limit values and, therefore, will not result in a significant impact on human health. Conservative assumptions were made when determining the input data for the air modelling assessment and the approach used in the study leads to an over-estimation of 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 stack heights for the proposed back-up generators have been modelled in an iterative fashion (i.e. with incremental increases in stack heights modelled) to ensure that an adequate height was selected to aid dispersion of the emissions and achieve compliance with the EU ambient air quality standards at all off-site locations (including background concentrations). Further details of the air dispersion modelling assessment can be found in Chapter 8. The impact of the operation phase of the Proposed Development is likely to be *long-term* and *imperceptible* with respect to human health.

4.5.3 Potential Impacts on Human Health from Noise & Vibration

Noise and vibration impacts associated with the Proposed Development have been fully considered within Chapter 9 of this EIA Report. Commentary on the impact assessment and related noise levels are summarised below with respect to potential environmental health impacts.

4.5.3.1 *Construction Phase*

As detailed in Chapter 9 (Noise and Vibration), there will be some impact on nearby noise sensitive properties due to noise emissions from site activity and traffic. The application of noise limits and limits on the hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration impact is kept to a minimum. The noise impact is assessed to *be short-term* in duration with a *slight to moderate* significance considering the existing background low level of noise in this rural location. As reported, the noise impact will reduce to *slight* as construction moves above ground. Due to the distance between the site and the nearest sensitive locations, vibration impacts generated during construction are expected to be *short term* duration and *imperceptible* significance.

4.5.3.2 Operational Phase

As detailed in Chapter 9, noise modelling was undertaken to assess the impact of the Proposed Development of the site. As demonstrated by the modelling results, the predicted noise emissions associated with the Proposed Development of the site during the operational phases are within the relevant noise criteria considered suitable for the development considering the guidance outlined in EPA: *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4 – 2016)*. These guidelines consider impacts on human health. As such the modelling has due consideration to human health, and has shown that although there will be an increase in noise as a result of the operation of the facility, this is not considered to have a significant impact on human health.

The Proposed Development will not generate any perceptible levels of vibration during operation and therefore there will be no impact from vibrations on human health.

4.5.4 Potential Impacts on Local Amenities and Tourism

In terms of landscape amenity of the Proposed Development site, there are no listed or scenic views, or protected trees pertaining to the site, and no protected structures. The site is located within the 'Working Landscape' designation of the Clare County Development Plan 2017–2023 and outside of the 'Heritage Landscapes' designation. Working Landscapes are described in the Development Plan as…*intensively settled and developed areas within Settled Landscapes or areas with a unique natural resource*. There is also one Site and Monument Record (SMR) within the site, a 'Ringfort – Cashel' (RMP No. CL-034-007) in the northeast of the site as described in Chapter 11 of this EIA Report.

The primary areas of landscape amenity in the immediate vicinity of the Proposed Development site are located within the settlement of Ennis on the opposite side of the M18 motorway from the site. These are mainly small amenity greenspaces within the various housing developments that comprise the settlement. The Oysterman's Marsh Natural Heritage Area (NHA) is located just over 5km away from the site.

The Proposed Development site is not considered to be significant or sensitive from a landscape and visual aspect. As stated in Chapter 3, the lands are appropriately zoned in the Clare County Development Plan 2017–2023 Variation No.1 (11th March 2019) as ENT3 with the aim to …*"accommodate a Data Centre campus which consists of one or more structures, used primarily for the storage, management and dissemination* *of data and the provision of associated power electricity connections and energy generating infrastructure.”* The buildings have been located within the landform in such a way as to minimise as far as possible any potential visual impact. Potential visual impacts have been further minimised by proposed berms and large extents of structure planting which will largely contain views of the proposed buildings to the area within the site. Further discussion is presented in Chapter 11 (Landscape and Visual).

Tourism is not a major industry in the immediate environs of the Proposed Development site. As such it will have a negligible impact on tourism in the area.

4.5.5 Potential Impacts on Material Assets

The Proposed Development will require electrical power supply and gas supply from the national grid and the requirements for these supplies have been detailed in Chapter 14 (Material Assets) of this EIA Report.

4.5.6 Potential Impacts from Additional Traffic

An assessment of the additional traffic movements associated with the Proposed Development during the construction and operational phases is presented in Chapter 12 (Traffic and Transportation).

The increase in traffic volumes associated with the construction (see Section 12) and operational phases of development will not have any adverse transport-related environmental effects in terms of noise, air quality, vibrations, etc.

The traffic assessment shows that the additional traffic movements associated with the Proposed Development were found to be *short-term, negative* and *slight* for the construction phase and *long-term, negative* and *slight* for the operational phase.

The Stage 1 Road Safety Audit undertaken for the proposed development includes information on traffic collisions over the most recent 12 year period in the vicinity of the site. Based on the collision data analysis, it can be concluded that there are no accident black spots or notable accident patterns that would indicate a road safety design flaw on the road infrastructure surrounding the site. All minor issues identified in the Stage 1 Road Safety Audit relating to the infrastructure proposed as part of the development have been addressed.

4.5.7 Unplanned Events/Impacts on Health and Safety

The Proposed Development has been designed in accordance with the Safety, Health and Welfare at Work Act 2005 (S.I. 10 of 2005) as amended and the Safety, Health and Welfare at Work (General Application) Regulations 2007 (S.I. 299 of 2007) as amended and associated regulations. The plant has been designed by skilled personnel in accordance with internationally recognised standards, design codes, legislation, good practice and experience based on a number of similar existing facilities operated by the operator.

The Proposed Development has the potential for an impact on the health and safety of workers employed on the site, particularly during the construction phase. The activities of contractors during the construction phase will be carried out in accordance with the Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. No. 291 of 2013) as amended to minimise the likelihood of any impacts on worker’s health and safety. The health and safety planning for the construction phase of the Proposed

Development will consider any appropriate measures to safeguard workers' health and safety with regards to Covid-19.

During the operational phase of the development, the operator will implement an Environmental Safety and Health (EH&S) Management System and associated procedures at the facility. Full training in the EH&S Management System and relevant procedures will be provided to all employees. The Operator will also implement any appropriate health and safety measures to safeguard workers' health and safety with regards to Covid-19.

The EIA Directive and associated EPA Guidance (2017) require that the vulnerability of the project to major accidents and/or natural disasters (such as earthquakes, landslides, flooding, sea level rise etc.) is considered in the EIA Report.

The site has been assessed in relation to the following external natural disasters; landslides, seismic activity, volcanic activity and sea level rise/flooding as outlined below. The potential for major accidents to occur at the facility has also been considered with reference to Seveso/Control of Major Accident Hazards (COMAH) Regulations.

There is a negligible risk of landslides occurring at the site and in the immediate vicinity due to the topography and soil profile of the site and surrounding areas. There is no history of seismic activity in the vicinity of the site. There are no active volcanoes in Ireland so there is no risk of volcanic activity.

The potential risk of flooding on the site was also assessed. A site-specific flood risk assessment was carried out by the project engineers, Clifton Scannell Emerson (CSEA) and localised flood zones have been identified relating to natural features on the site. These locations are within buffer zones proposed as part of the Proposed Development and will not impinge on any buildings or services. The Proposed Development design has adequate attenuation to ensure there is no potential impact on flood risk for other neighbouring properties. This is further discussed in Chapter 6 (Hydrology). The Proposed Development will not be a Seveso/COMAH facility. The only substance stored on site controlled under Seveso/COMAH will be diesel for generators and the amounts proposed do not exceed the relevant thresholds of the Seveso Directive. The Proposed Development site is not located within the consultation distance of any COMAH establishment that is notified to the HSA.

There is a potential impact on the receiving environment as a result of minor accidents/leaks of fuel/oils during the construction and operational phases. However, the implementation of the mitigation measures set out in Chapter 5 (Land, Soils, Geology and Hydrogeology) and Chapter 6 (Hydrology) of the EIA Report and in the pollution prevention Plan outlined in the Construction environmental Management plan (CEMP) will ensure the risk of a minor/accident is low and that the residual effect on the environment is imperceptible.

4.6 REMEDIAL AND MITIGATION MEASURES

The impacts on the local population in terms of residents and businesses are considered to be mainly positive in the sense of creating direct employment opportunities and indirect additional business, both during the construction and operational phases.

Mitigation measures proposed to minimise the potential impacts on human health in terms of air quality and climate and noise and vibration are discussed in the relevant sections of Chapters 8 and 9, respectively.

Chapter 12 Traffic and Transportation addresses mitigation measures proposed to reduce the impact of additional traffic movements to and from the development.

Chapter 13 Material Assets addresses the impact of the Proposed Development on material assets and mitigation measures in place.

4.7 CUMULATIVE IMPACTS

Construction Phase

Due to the phasing of the project, there is a possibility that multiple developments in the area could run concurrently or overlap in the construction phase and contribute to additional impacts in terms of traffic, dust and noise. However, the mitigation measures highlighted above and included in the individual chapters of this EIAR along with the fact that any other significant construction project in the area would require an EIAR and consideration of the same/ similar mitigation measures would reduce the cumulative impact to receptors in the area. The construction phase of the proposed development together with any/all relevant other planned or permitted developments would have a positive impact in terms of employment. Contractors for the proposed development will be contractually required to operate in compliance with a project-specific Construction Environmental Management Plan (CEMP) which will include the mitigation measures outlined in this EIAR. It is considered that there would be no cumulative effects on human health.

The overall cumulative effect during construction is therefore concluded as *neutral imperceptible*, and *short-term* with respect to human health.

Operational Phase

The air, noise and traffic assessments indicate that the proposed development is not likely to result in significant adverse impacts either alone or in combination with any likely future projects. There are no significant cumulative impacts predicted for Human Health and Populations during the operational phase of the proposed development. The cumulative impact is predicted to be *long-term* and *imperceptible* with regards to human health.

4.8 RESIDUAL IMPACTS

It is expected that the Proposed Development will have a positive and long-term impact on the immediate hinterland through continued employment opportunities and the associated economic and social benefits.

There will be a loss of private agricultural land due to the Proposed Development but this land is zoned for development. As such there is no predicted adverse impacts with respect to socio-economic factors, land-use or the amenity value and tourism potential of the area.

All other environmental aspects relating to the human environment which have the potential to impact on the local population such as air quality and climate, noise and vibration, traffic and material assets are addressed in Section 4.8 and in more detail in the relevant chapters of this EIA Report.

Measures outlined in Section 4.5.7 will be put in place to ensure the health and safety of all site personnel during both construction and operational phases.

5.0 LAND, SOILS, GEOLOGY AND HYDROGEOLOGY

5.1 INTRODUCTION

This chapter assesses and evaluates the potential impacts of the development on the land, soil, geological and hydrogeological aspects of the proposed development site and the 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 environmental effects.

5.2 METHODOLOGY

5.2.1 Criteria for rating of effects

This chapter evaluates the effects, if any, which the development will have on Land, Soils, Geology and Hydrogeology as defined in the Environmental Protection Agency (EPA) '*Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports'* (EPA, 2017) 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). The Draft EPA document entitled '*Advice Notes for Preparing Environmental Impact Statements'* (EPA, 2015) is also followed in this geological and hydrogeological 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). Finally, 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) formerly National Roads Authority (NRA) (TII, 2009) is referenced where the methodology for assessment of impact is appropriate.

The rating of potential environmental effects on the land, soil, geological and hydrogeological environment is based on the standard EIAR 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 Draft EPA Guidelines (2017) publication).

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 TII (2009) criteria for rating the magnitude and significance of impacts on the geological related attributes and the importance of hydrogeological attributes at the site during the EIA stage are also relevant in assessing the impact and are presented in Tables 1-5 in Appendix 5.1.

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

- Geological heritage sites within the vicinity of/ within the perimeter of the proposed development site;
- Landfills, industrial sites in the vicinity of the site and the potential risk of encountering contaminated ground;
- The quality, drainage characteristics and range of agricultural use(s) of subsoil around the site;
- Quarries or mines in the vicinity and the potential implications (if any) for existing activities and extractable reserves;
- The extent of topsoil and subsoil cover and the potential use of this material on site as well as any requirement to remove it off-site as waste for disposal (D) or recovery (R) options;
- High-yielding water supply wells/ springs in the vicinity of/ within the site boundary to within a 2km radius and the potential for increased risk presented by the proposed development;
- Classification (regionally important, locally important etc.) and extent of aquifers underlying the site boundary area;
- Increased risks presented to the groundwater bodies by the proposed development associated with aspects such as, for example, the removal of subsoil cover, removal of aquifer (in whole or part thereof), spatial drawdown in water levels, alteration in established flow regimes, and changes in local/ regional groundwater quality;
- Natural hydrogeological/ karst features in the area and potential for increased risk presented by the activities at the site; and
- Groundwater-fed ecosystems and the increased risk presented by operations both spatially and temporally.

5.2.2 Sources of Information

Desk-based geological information on the substrata (both Quaternary deposits and bedrock geology) underlying the extent of the site was obtained through accessing databases and other public archives where available. Data was sourced from the following:

- Geological Survey of Ireland (GSI) - on-line mapping, Geo-hazard Database, Geological Heritage Sites & Sites of Special Scientific Interest, Bedrock Memoirs and 1: 100,000 mapping;
- Teagasc soil and subsoil database;
- Ordnance Survey Ireland - aerial photographs and historical mapping;
- Environmental Protection Agency (EPA) – website mapping and database information;
- National Parks and Wildlife Services (NPWS) – Protected Site Register; and
- Clare County Council - illegal landfill information.

Site-specific data was derived from the following sources:

- *Ground Investigation Report, Art Datacentre, Lands East of Ennis Town Co. Clare*. Ground Investigation Ireland (GII) (May 2021);
- *Report on the Geophysical Investigation for the Project Art Data Centre, Ennis, Co*. Clare. Apex Geophysics (Apex). Report Reference – AGP21033_Phase III_01. (January 2022).
- *Engineering Planning Report – Drainage and Water Services* - Art Data Centre. Clifton Scannell Emerson Associates, CSEA (January 2022);
- *Flood Risk Assessment -Art Data Centre*, CSEA (January 2022);

- *Construction Environmental Management Plan* - Art Data Centre, CSEA (January 2022);
- Various design site plans and drawings; and
- Consultation with site engineers/ planners/ architects.

5.2.2.1 Site Investigation Works

Site investigations were carried out by Ground Investigations Ireland (GII) during April-May 2021. These investigations included the following:

- Excavation of thirty-one (31) no. trial pits (TPs) across the proposed development area to examine existing soil conditions and whether any infill or imported material is present on site (maximum depths up to 3.30 metres below ground level (mbgl) with refusals on boulders or rockhead).
- Drilling of twenty-one (21) no. bedrock boreholes; (PBH periphery boreholes and BH geotechnical boreholes; 80 mm diameter, depths up to 25 mbgl to characterise the site in terms of subsoil cover, depth to bedrock, and prevalence of weathered and/ or competent bedrock spatially).
- Logging of the arisings from each trial pit in accordance with BS5930:2015, noting any field evidence of potential impact by hazardous substances.
- Collection of soil samples from each of the trial pit arisings including samples selected for laboratory analysis focusing on potential contamination and the classification of the materials for waste disposal options. Other soil testing included 47 no. soil samples selected for laboratory analysis for pH and sulphate as part of characterising the subsoil aggressivity to concrete, spatially.
- Waste Acceptance Criteria (WAC) sampling with an asbestos fibre survey of samples collected at selected trial pit locations.
- Collection of 4 no. groundwater samples for laboratory analysis -including for hydraulically up-gradient [control] sampling points (eastern site boundary) and down-gradient sampling points at the southwestern site boundary line.

The location of all completed trial pits and boreholes at which representative samples were collected is presented in Figure 5-1 Site Investigation Exploratory Hole Map (GII, 2021) below.

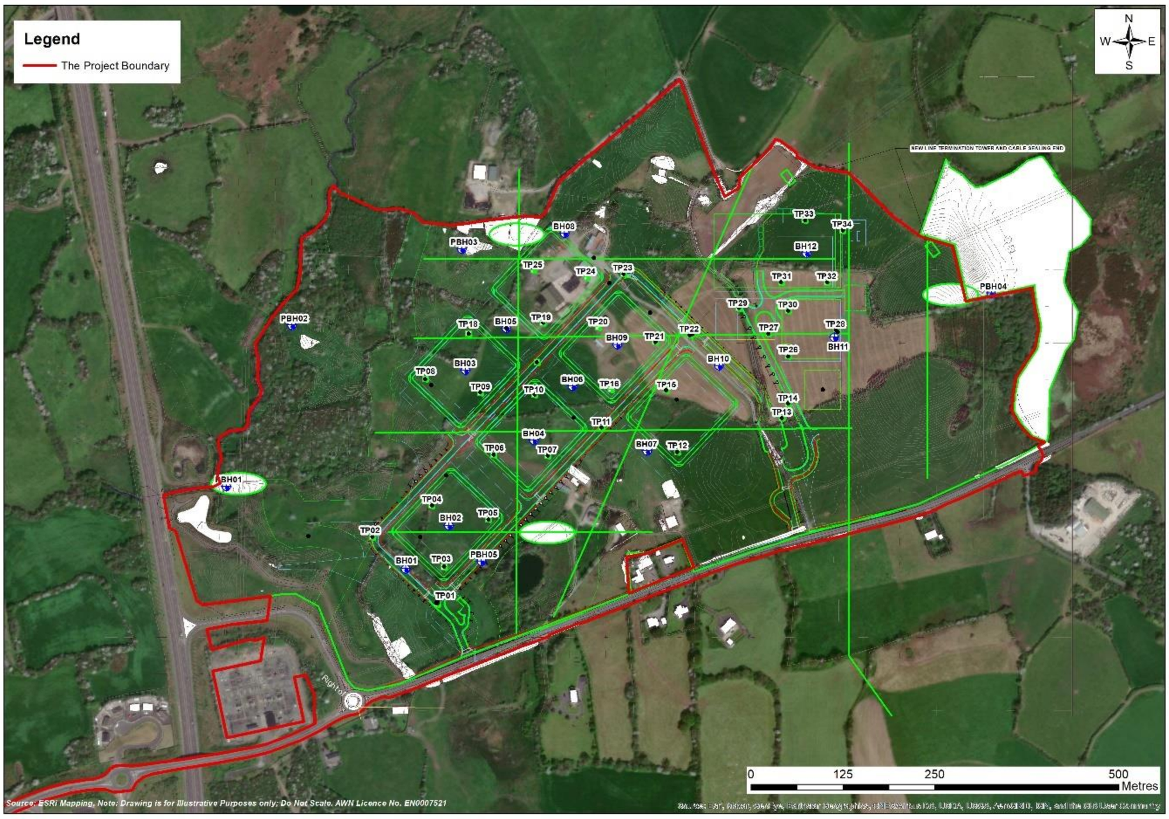


Figure 5-1 *Site Investigation Exploratory Hole Map (GII, 2021)*

Trial pit and borehole logs are included in the GII site investigation report which include a description of the lithologies observed in each excavation, depth to bedrock, refusals, type of bedrock and rock quality distribution (RQD) to borehole termination depth.

Representative samples were collected from arisings at trial pits and transferred directly into laboratory-supplied containers which were then clearly labelled to identify the sample location and depth (metres below ground level). Standard sampling techniques were used to collect the samples and designed to reduce the risk of any cross contamination between sampling events. Appendix 5.2 presents tables with the soil and groundwater analytical test results.

5.2.2.2 Geophysical Survey

APEX Geophysics Limited (AGL) carried out a geophysical survey in May-June 2021 as part of the ground investigation for the proposed development. The underlying objectives of the geophysical survey were to identify any potential underground karst conduits/ water-bearing strata within the overall study area including features which could potentially be discharging to Tooreen Lough and/ or to pond features located to the north, south and east of the site. In addition, the aims of the survey were to provide information on the subsurface conditions across the site. A summary of the geophysical interpretation is presented in Figure 5.15 below.

Further geophysical investigations were carried out in November 2021 (Phase II) & January 2022 (Phase III) for the proposed development to further examine the presence of karst features in selected areas. The objectives of the Phase II & Phase III geophysical survey were to examine the extent of the identified karst features / potentially water-bearing strata within the overall study area. Furthermore, to establish any potential flow paths discharging to Tooreen Lough and/ or to pond and spring features located to the north, south and east of the site.

The geophysical findings along with the borehole data provides key information with regard to the interpretation of subsurface anomalies present across the site and how these may potentially interact with interpreted groundwater movement patterns. The geology identified provide input to the hydrogeological conceptual site model (CSM) cross sections presented in Figures 5.16-5.21.

5.3 RECEIVING ENVIRONMENT

The receiving environment is discussed in terms of land geology, soils, hydrogeology and site history including potential for existing and historical contamination.

5.3.1 General Description of the Site

5.3.1.1 <u>Site Setting</u>

The site comprises approx. 58 hectares (ha) and is located to the east of Ennis in the townland of Tooreen and Cahernalough, Co Clare. The lands are bordered to the south by the R352 (Tulla Road) and to the west by the M18 national route. The lands are traversed by a [Gas Networks Ireland, GNI] transmission gas pipeline and overhead powerlines connecting to the existing Ennis 110kv Substation that adjoins the western boundary.

The site location map for the proposed development is presented in Figure 5.2 below.

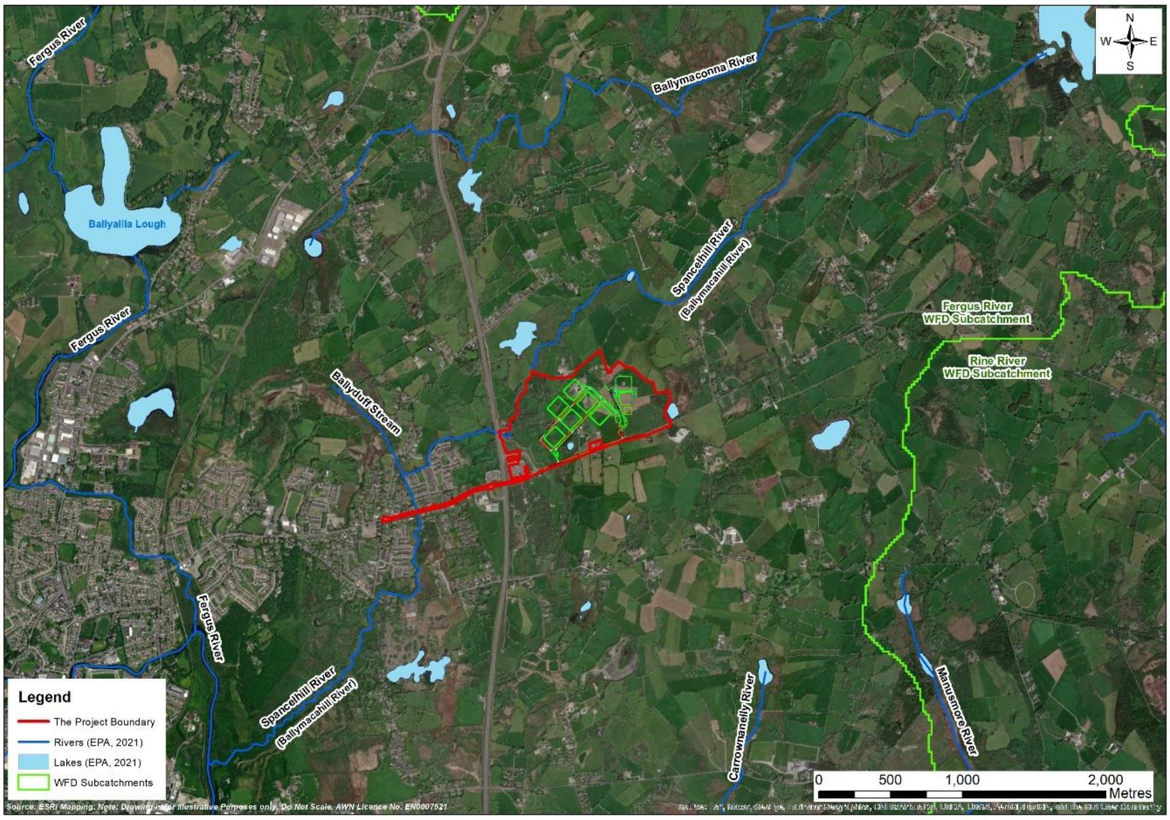


Figure 5-2 Site Location with site layout (AWN, 2021)

5.3.1.2 Land Use

The site is predominantly in agricultural use currently with the exception of a few residential properties. The site comprises of a series of irregularly shaped fields divided by hedgerows and ditches typical of an agricultural setting. The site contains a number of existing dwellings and farm outbuildings. A number of these will be retained and some demolished as part of the proposed site development.

Immediately beyond the southwest corner of the site boundary lies an existing ESB substation. The town of Ennis is located approx. 3.5 Km farther to the southwest. The western proposed development boundary is bounded by the M18 national route and the southern site boundary is bounded by the R352 road.

According to the EPA (2021) there are no licensed activities within the site boundary of the proposed development or directly adjacent to it. There are two licensed activities listed by the EPA as 'currently active' (i.e. west of the proposed development and located in Ennis, Gort Road Industrial Estate) as follows:

- Paclene Limited (P0144-01) -Licence issued in 2017; and
- Essidev S.A. (P0061-03) -Licence issued in 2015.

Both of these premises are licensed units and are located >3 Km downgradient (i.e. west) of the proposed development; there are no licensed activities located upgradient (i.e. east) of the proposed site.

Consultation with Clare County Council has confirmed that there are no known illegal/ historic landfills within 500 metres of the proposed site boundary.

Historical Ordnance Survey Ireland (OSi) maps (https://geohive.ie/) were examined for the purpose of an environmental due diligence. O.S. maps are available from 1830s-1930s (the historic 6" maps) and 1900 from the historic 25" maps. The historic maps indicate that the subject site was greenfield up to the present day (refer Figure 5-3 below).

There is no evidence to indicate industrial processes have been undertaken within the subject site boundary which appears to have always been used for agricultural purposes (for example grazing, storing cattle). This land use has not materially changed from the 1830s to 2005 and to present day (refer also Figure 5-4 below).

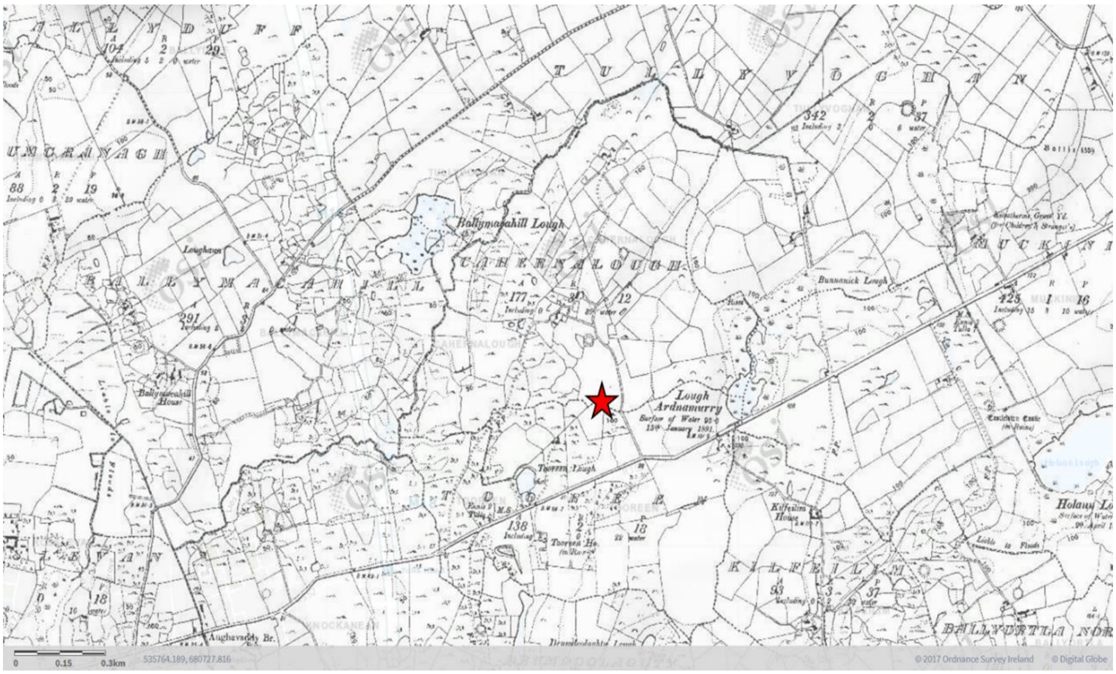


Figure 5-3 *Historic 6" mapping (Note: Site marked with red star; Source: OSi,)*

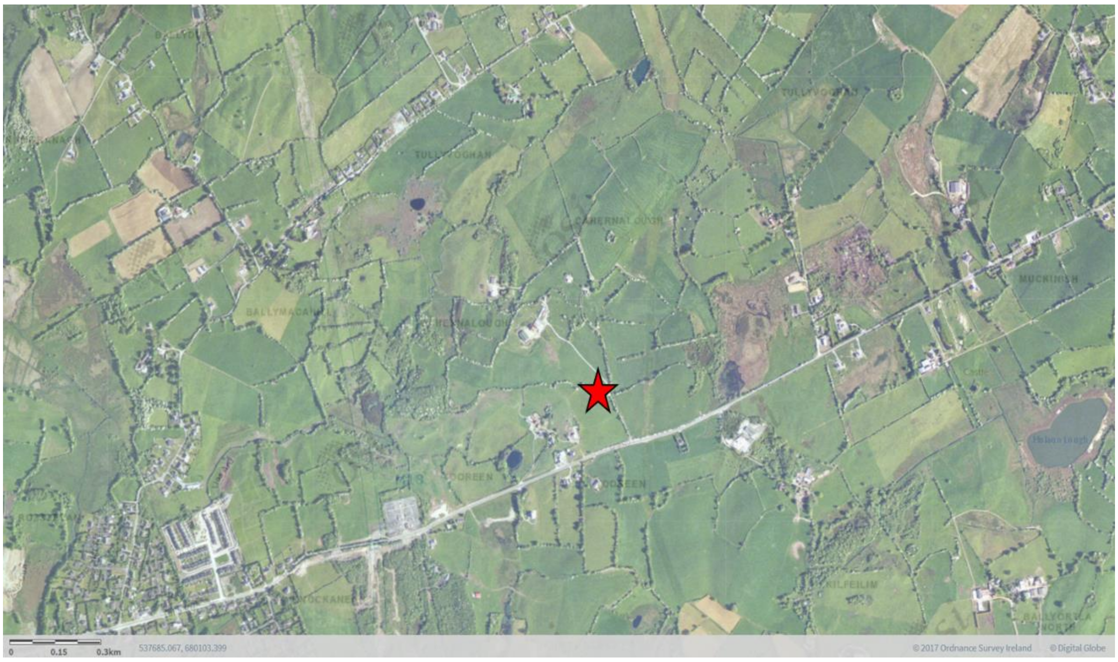


Figure 5-4 *Aerial 2005 Map (Site marked with red star; Source: OSi,)*

5.3.1.3 Topography

The topographical gradient across the development boundary is quite variable mostly due to the drumlin type features present. Overall, the ground level generally falls from east to west/ southwest with an elevation of approx. +15mOD (metres above Ordnance Datum) in the west and +46mOD in the east.

Additional detail on topographical gradients and general terrain elevations across the proposed development is presented in Chapter 6 Hydrology, Section 6.3.2.

5.3.1.4 Regional & Local Hydrology

Regional surface water drainage comprises the Ballymacahill River which runs to the north/ west of the development site boundary and which generally flows in a NE to S/SW direction. The river is also known as the Spancelhill (EPA, 2021) and converges with the River Fergus farther to the SW which in turn ultimately discharges into the Shannon Estuary.

Additional detail on the regional drainage (i.e. Ballymacahill River which converges with the River Fergus c. 3.0Km farther to the SW which subsequently discharges into the Shannon Estuary at the Lower River Shannon Special Area of Conservation (SAC)) and local surface water patterns (which comprise a feature lake, a number of ponds, swallow holes and spring discharges, the latter as streams to the main watercourse, Ballymacahill River) is discussed in Chapter 5 Hydrology, Section 6.3.3.

Regional and local hydrology is intrinsically connected to the hydrogeological setting within the proposed development.

5.3.2 Soils

The GSI/ Tegasc (2021) mapping shows that the soil type beneath the local area is composed of a range of lithologies. The principal soil types are described as follows:

- To the eastern boundary, the site is composed of AminPDPT - Poorly drained mineral soils with peaty topsoil, derived from mainly non-calcareous parent materials. Peaty gleys are included in this category.
- As the site extends to the west, the site is composed of BminDW - Deep well drained mineral soil derived from mainly calcareous parent materials. Grey, brown podzolics and brown earths (medium high base status) are included in this category and BminSW - Shallow well drained mineral soil, derived from mainly calcareous parent material which extends to the western boundary. Renzinas and lithosols are included in this category.
- A section of the southern boundary is composed of BminSRPT.

The following soil groups also occur but are less widespread and found in minor formations:

- FenPeat – which indicates wetland areas with organic material.
- AlluvMin – mineral alluvium.
- BminSP – shallow poorly-drained mineral soil, derived mainly from calcareous parent materials. Surface water gleys and groundwater gleys are included in this category.
- Lac - Lacustrine Deposits (undifferentiated).

Figure 5-5 below presents the soils map indicating the soil lithologies discussed above.

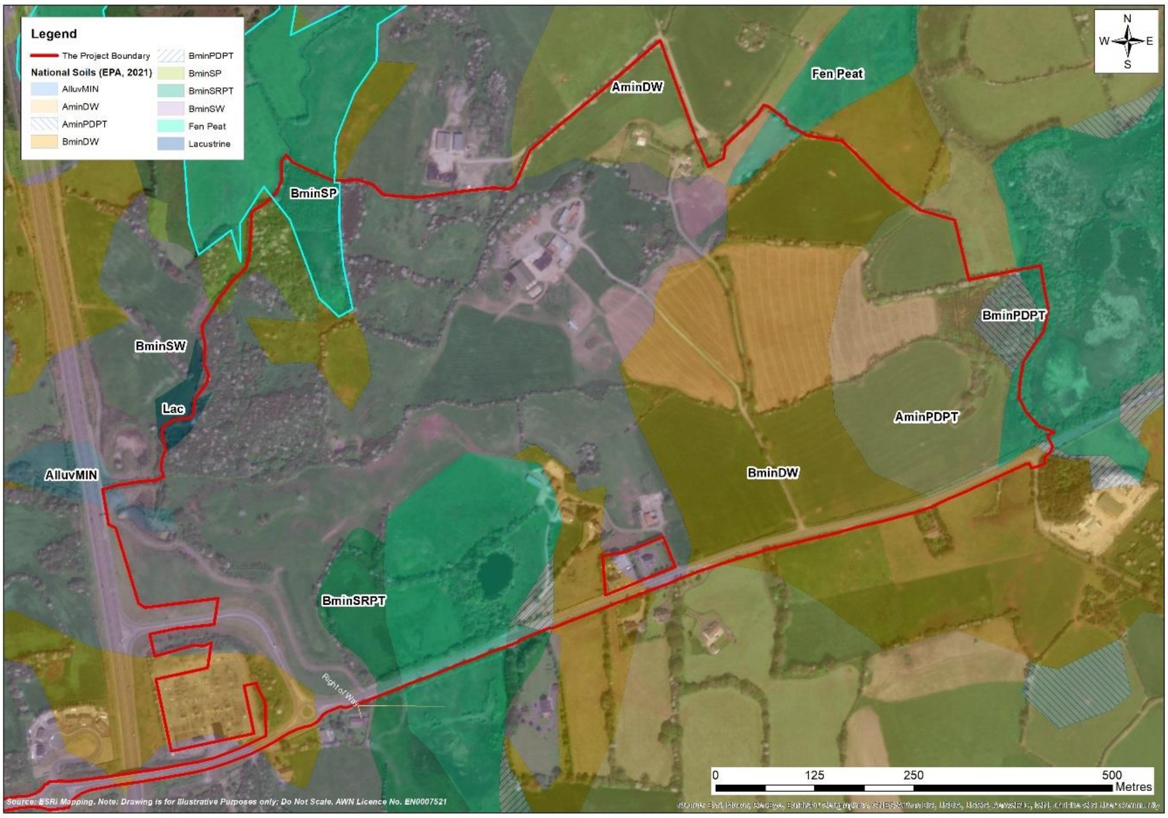


Figure 5-5 *Soils Map (Source: EPA/ Teagasc, 2021)*

5.3.3 Subsoils

The Quaternary geological period extends from about 1.5 million years ago to the present day and can be sub-divided into the Pleistocene Epoch, which covers the Ice Age period, and which extended up to 10,000 years ago and the Holocene Epoch, which extends from that time to the present day.

The GSI/ Teagasc mapping database of the subsoils in the area of the proposed development site indicates four (4) no. principal soil types, as shown in Figure 5-6 below. The subsoil types present across the site are:

- LIMESTONE till Carboniferous (TLs). A large section of the eastern boundary of the site is composed of limestone TILL. This till is made up of glacial CLAYs which are less permeable than alluvium subsoils.
- SANDSTONE till Devonian (TLs). A large section of the eastern and northern boundaries of the site are composed of sandstone TILL. This till is made up of glacial CLAYs which are less permeable than alluvium subsoils.
- Karstified bedrock outcrop or subcrop (KaRck). The majority of the western section of the subject site is composed of karstified bedrock. This indicates that the limestone bedrock is heavily karstified in this area and is close to the surface. Refer to Sections 5.3.4 & 5.3.6 below which describes the bedrock geology and aquifer vulnerability for the site and surrounding area.
- Fen Peat – which indicates wetland areas comprising organic material.

The EPA (2021) has classified this area as agricultural land used primarily for pasture farming activities.

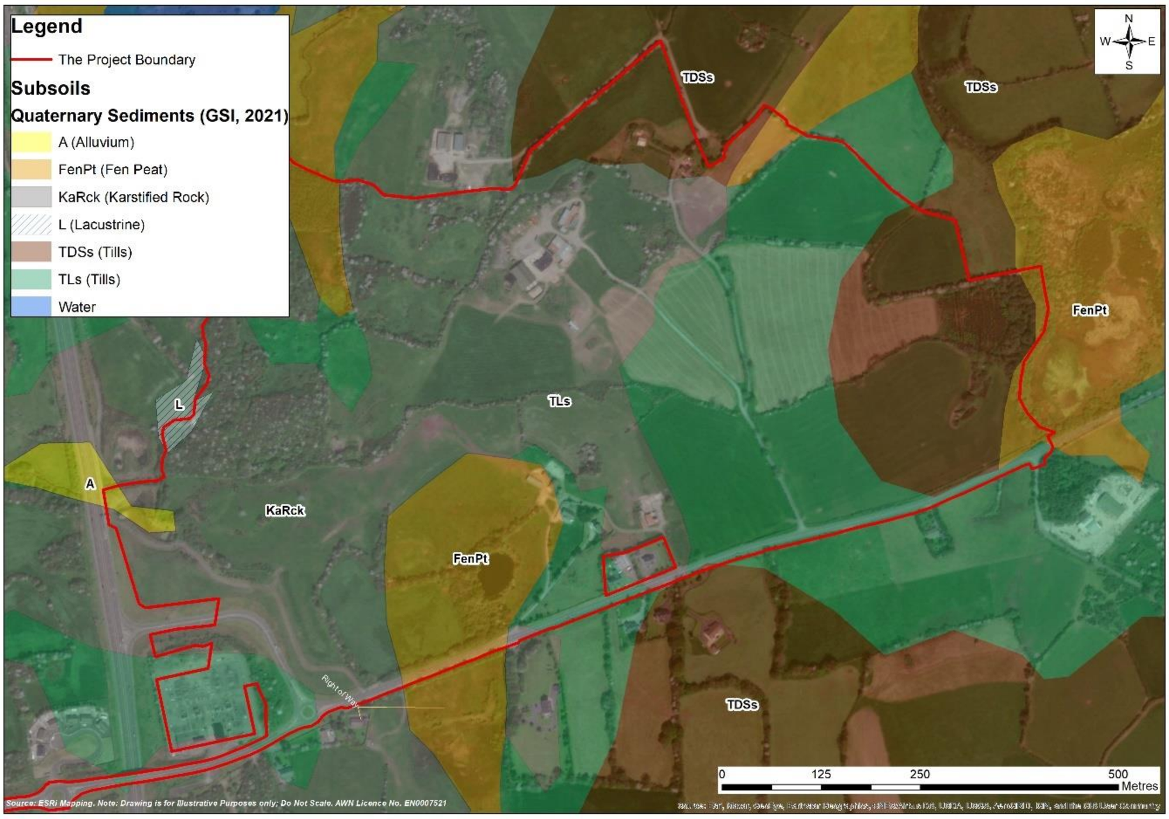


Figure 5-6 *Subsoils Map (Source: GSI, 2021)*

Recent investigations undertaken by GII confirm rockhead close to the surface within the west of the site and at local highs across the site. Generally, recorded depth to bedrock (dtb) increases towards the east. The depth of overburden varies to match this with sandy clayey GRAVELS reported to a depth of 2.00 metres below ground level (mbgl) noted along the western section; similar GRAVEL material is noted to 5.00 mbgl to the eastern section of the site (GII, 2021).

The geotechnical/ environmental site investigations were completed in April and May 2021 within the proposed development boundary in order to better characterise the subsoils, nature of the bedrock and where feasible local groundwater conditions. The thirty-four (34) no. trial pits (referenced as TP01 to TP34) were excavated using a 14-ton tracked excavator. The twenty-one (21) no. boreholes (referenced PBH01 to PBH05 & BH01 to BH13) were drilled using a rotary core rig to a depth between 5.0 mbgl to 25.0 mbgl. Water strikes are detailed in the trial pit logs, however due to the water flush drilling method used for the rotary coring there is no detail on groundwater strikes recorded on the borehole logs. The trial pit and borehole logs are available in the GII site investigation report. The soil profile is highly variable across the site and can generally be summarised as follows:

- Topsoil 0.0 m to >0.3 mbgl
- Subsoil 0.3 m to >11.5 mbgl
- Weathered Limestone Bedrock/ Bedrock 1.00 m to >25.0 mbgl

Figure 5-1 above presents the locations of completed trial pits and borehole. Trial pit and borehole logs (GII, 2021) are presented in the site investigation report. Furthermore, a detailed hydrogeological CSM is provided under Section 5.3.18 below.

5.3.4 Bedrock Geology

Inspection of the available GSI (2021) records (Data Sheet 14 and on-line mapping database) shows that the bedrock geology of the site and the surrounding area is dominated by rocks from the Tournaisian to Chadian – Arundian stage which is part of the Dinantian Series of the Carboniferous Era. The site is located over crinoidal & cherty limestone & dolomite referred to as the Tubber Formation (Rock Unit code: CDTUBB) (refer to Figure 5-7 below).

The regional area is highly geologically variable with mainly limestone bedrock. GSI maps do show the site as overlying the Tubber formation which is bordered to the east by a thin formation called Cregmahon Member. This unit is bounded by Waulsortian Limestones. The Tubber Formation is bounded by the Burren Formation to the west. The Burren Formation is made up of pale grey clean skeletal limestone.

The GSI (2021) bedrock geology map (100K structural database) indicates no structural faults in the study area.

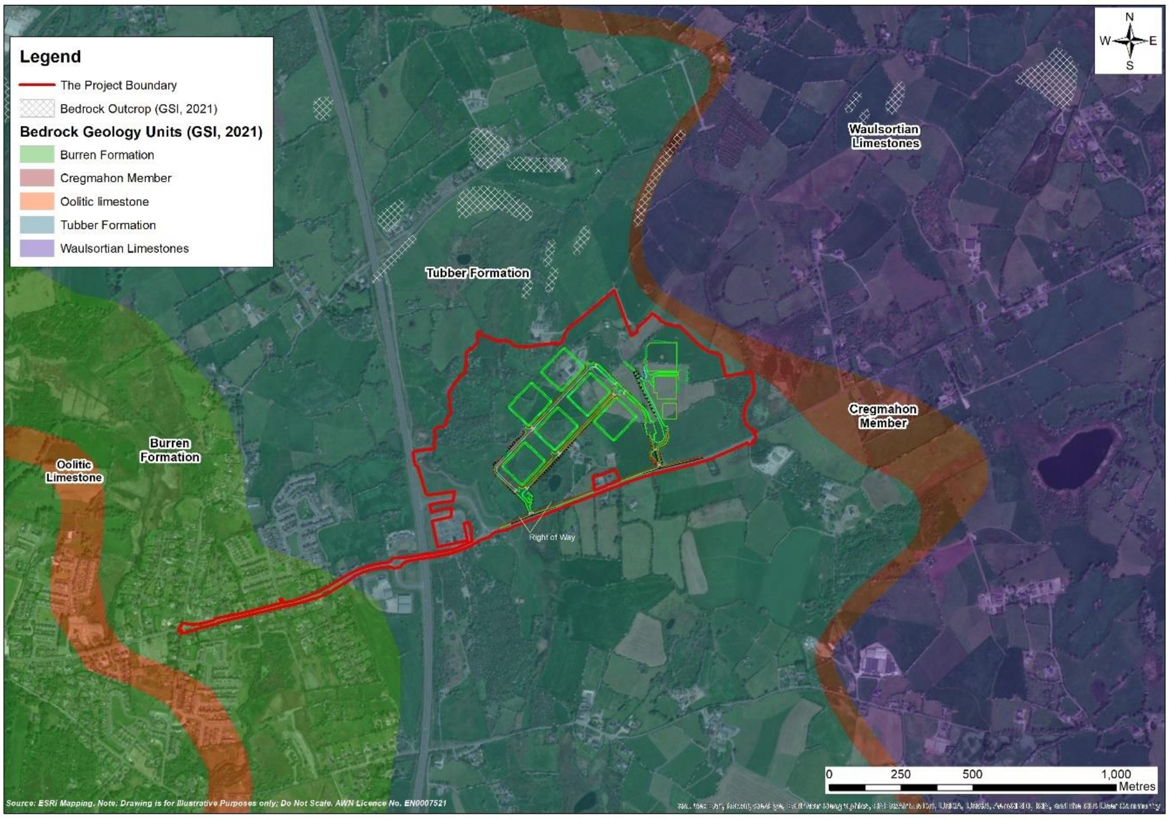


Figure 5-7 *Bedrock Geology Map with the proposed site layout (Source: GSI, 2021)*

Site investigations (GII, 2021) indicate bedrock depth is highly varied throughout the site with rockhead recorded at 0.60 mbgl at BH06 (western section of the site), 2.30 mbgl at BH08 (centre of the site) and 6.20 mbgl at PBH04 (eastern section of the site). The depth to bedrock is shallow across the site especially in the western and centre sections while bedrock is deeper along the eastern boundary owing to the thicker subsoils present. However, the bedrock surface is observed as undulating across the site and there are localised points with shallow bedrock for example within the eastern section of the site. Section 5.3.18 presents the CSM for the subject site. Bedrock was not encountered at any of the trial pits (with refusal also noted).

5.3.5 Regional Hydrogeology

The GSI has devised a system for classifying the bedrock aquifers in Ireland. The aquifer classification for bedrock depends on a number of parameters including, the area extent of the aquifer (km^2), well yield (m^3/d), specific capacity ($m^3/d/m$) and groundwater transmissivity (mm^3/d). There are three main classifications: regionally important, locally important and poor aquifers. Where an aquifer has been classified as regionally important, it is further subdivided according to the main groundwater flow regime within it. This sub-division includes regionally important fissured aquifers (Rf) and regionally important karstified aquifers (Rk). Locally important aquifers are sub-divided into those that are generally moderately productive (Lm) and those that are generally moderately productive only in local zones (Ll). Similarly, poor aquifers are classed as either generally unproductive except for local zones (Pl) or generally unproductive (Pu).

The bedrock aquifers underlying the subject site according to the GSI National Draft Bedrock Aquifer Map are classified crinoidal & cherty limestone & dolomite. GSI mapping has shown the site overlies one aquifer class which is Regionally Important Aquifer (Rkc) which indicates that the aquifer bedrock is dominated by karst environment with conduit flow (refer to Figure 5-8 below).

'Karstification' is the process whereby limestone is slowly dissolved away by percolating waters. It most often occurs in the upper bedrock layers and along certain fractures, fissures and joints, at the expense of others. Karstification frequently results in the uneven distribution of permeability through the rock, and the development of distinctive karst landforms at the surface (e.g., swallow holes, caves, dry valleys), some of which provide direct access for recharge/surface water to enter the aquifer. The landscape is characterised by largely underground drainage, with most flow occurring through the more permeable, solutionally-enlarged, interconnected fissure/conduit zones, which may be several kilometres long. Groundwater velocities through fissures/conduits may be high and aquifer storage is frequently low. Groundwater often discharges as large springs (>2,000 m^3/d), which range from regular and dependable to highly variable ('flashy'). There is strong interconnection between surface water and groundwater. The degree of karstification ranges from slight to intense.

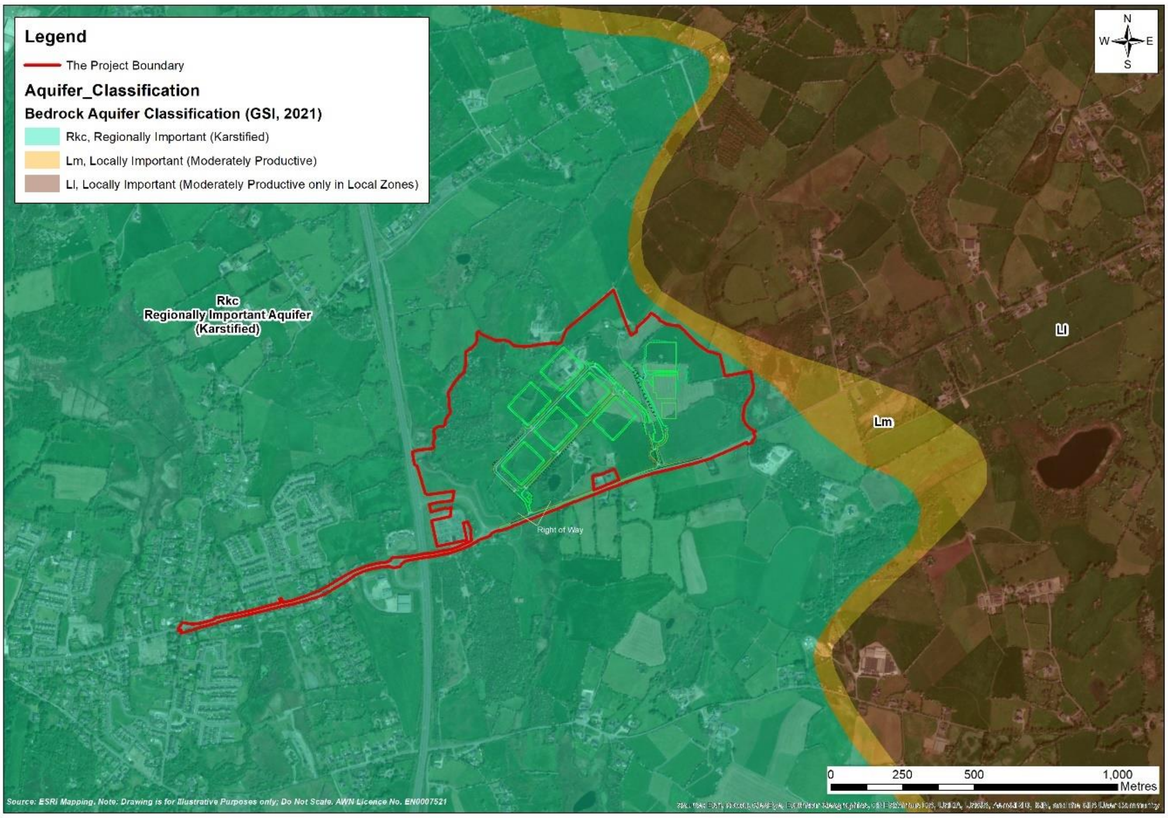


Figure 5-8 *Aquifer Classification Map with the proposed site layout (Source: GSI, reviewed 2021)*

5.3.6 Aquifer Vulnerability

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

The GSI currently classifies the aquifer vulnerability in the region as Extreme (E) to the south-western and western boundary. Aquifer vulnerability decreases to the east of the proposed development site. The eastern section of the site is classified as High (H) to Moderate (M). As can be seen from Table 5. 1 below an Extreme vulnerability with clayey subsoil denotes a depth to bedrock of 0-3 mbgl with High vulnerability categorised as 3-5 mbgl while subsoil thickness increases under the Moderate category.

The aquifer vulnerability class in the region of the site is presented below as Figure 5-9.

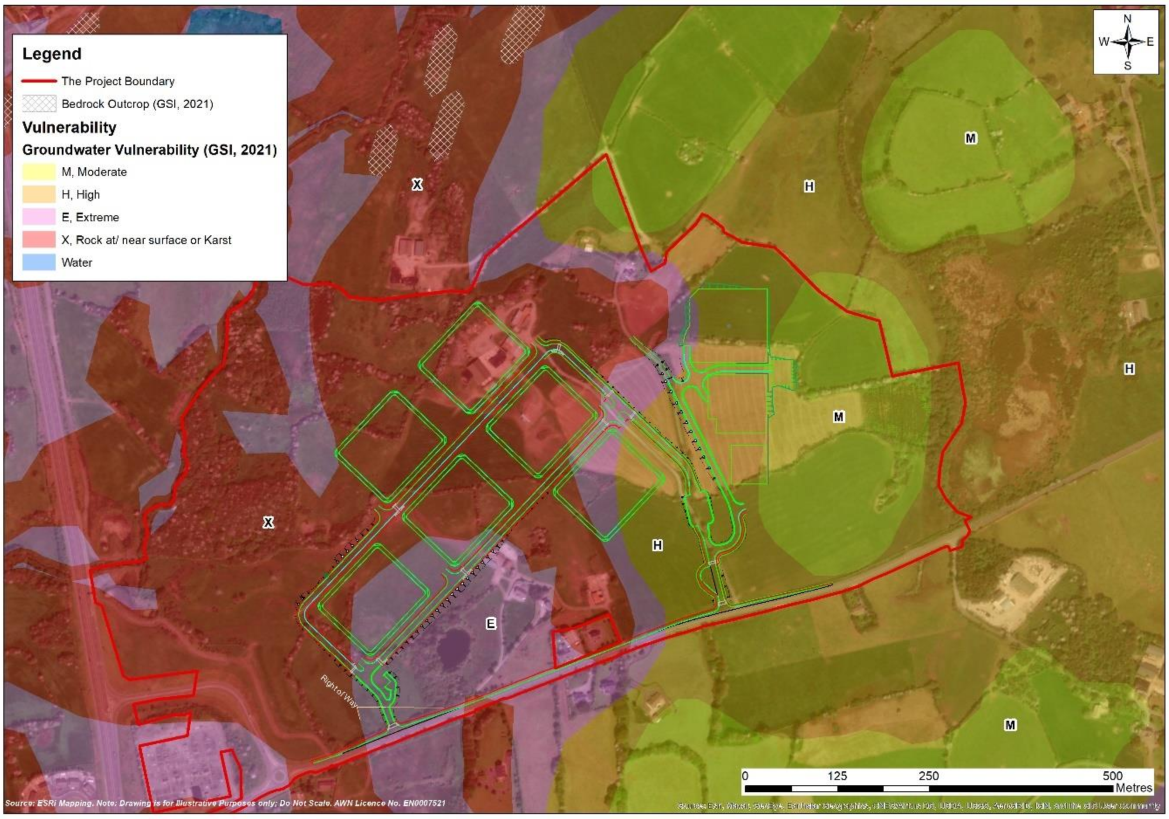


Figure 5-9 *Aquifer Vulnerability Map with the proposed site layout (Source: GSI, 2021)*

Table 5.1 below presents the GSI vulnerability mapping guidelines with specific reference to subsoil thickness and characteristics.

Table 5. 1 *Vulnerability Mapping Guidelines (Source: GSI, 2021)*

Vulnerability Rating	Hydrogeological Condition				
	Subsoil Permeability (type) and Thickness			Unsaturated Zone	Karst Features
	High Permeability (sand/gravel)	Moderate Permeability (e.g. sandy subsoil)	Low Permeability (e.g. clayey subsoil, clay, peat)	(Sand/ gravel aquifers only)	(<30 m radius)
Extreme (E)	0 - 3 m	0 - 3 m	0 - 3 m	0 - 3 m	-
High (H)	> 3 m	3 - 10 m	3 - 5 m	> 3 m	n/a
Moderate (M)	n/a	> 10 m	5 - 10 m	n/a	n/a
Low (L)	n/a	n/a	> 10 m	n/a	n/a

Notes: (1) n/a: Not applicable

(2) Precise permeability values cannot be given at present

(3) Release point of contaminants is assumed to be 1-2 below ground surface

The site investigations carried out by GII (2021) confirmed that the depth to bedrock throughout the site ranges from 0.6 m bgl at BH06 (western section section)), 2.30 mbgl at BH08 (centre of the site) and 6.20 mbgl at PBH04 (eastern section of the site), overlaid with low to medium permeability GRAVELS; therefore, the site-specific vulnerability can be more accurately described as generally 'Extreme' at the western section and 'High' to 'Moderate' throughout the rest of the site expect for localised topographic highs where rock head is close to the surface.

Furthermore, when reviewing recharge map on the GSI web viewer, this confirms that the eastern section of the site is karst environment as there is high volumes of recharge potential located here, refer to Figure 5-10 below. Recharge volumes for the proposed development site and surrounding are range from 175 mm/year to 660 mm/yr.

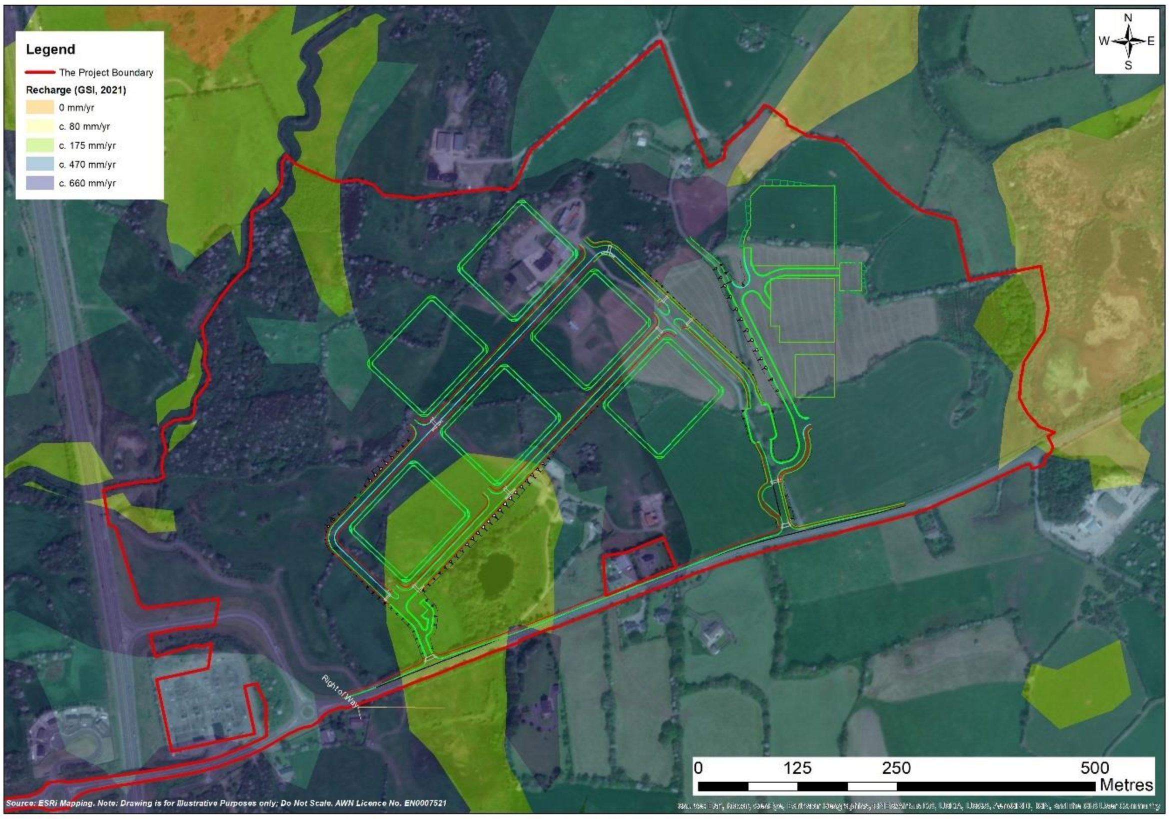


Figure 5-10 *Recharge map with proposed site layout (Source: GSI, 2021)*

5.3.7 Groundwater Flooding

Groundwater flooding occurs when storage in the underground aquifer is full and rainfall (recharge) cannot discharge quick enough, causing the water table to rise above the ground surface. According to the Geological Survey of Ireland (GSI), groundwater flooding in Ireland occurs mainly on the limestone lowlands to the west of the Shannon. The prevalence of groundwater flooding in the western counties is fundamentally linked to bedrock geology. The limestone bedrock in these areas has been dissolved over time in a process known as karstification, creating a subterranean network of water-bearing fractures and conduits with limited storage capacity. Surface drainage systems are frequently absent within well-developed karst landscapes. Instead, the groundwater conduit flow system acts as the main drainage mechanism for the region.

The following site-specific data was used to determine the potential of groundwater flooding across the site:

1. CFRAM flood maps.

2. Topography.
3. Walk over survey to assess water level marks and review of historical photographs of surface water features, including lakes.
4. Review of contemporary borehole logs drilled through both the overburden and the underlying bedrock.

These data have been used to assess the potential for groundwater flooding.

The topographical gradient is quite variable across the proposed development. Overall, the elevation falls from east to west/ southwest with detailed elevation of approx. +15mOD (meters above Ordnance datum) in the west and +46mOD in the east. The topography (presence of low-lying depressions) and presence of springs and discharge points (sinkholes) is crucial in determining where groundwater flooding occurs within the proposed development boundary.

There are four water features of significance either within the site boundary or along the site boundary where flooding historically occurs (see Figure 5-13, below). These are; Tooreen Lough to the south (within the proposed development area), Ardnamurry Lough farther to the east (outside of the site boundary line), and two pond features located to the north and north-east -both within the proposed development. These features discharge to ground at nearby sink holes also identified on Figure 5-13, below. All four areas are likely to be a combination of groundwater contribution and ponding rainfall. The latter two (i.e. ponds to the north/ northeast) are seen to continue to discharge during dry spells as observed on site (April/ May 2021). All four features are located in [locally] low lying depressions within the landscape.

All of these water features have been observed to expand in terms of lateral extent seasonally with autumn/ winter flooding and this footprint is generally followed by recession during drier conditions in summertime. This filling and emptying/ lowering of water levels is likely based on exceedance of storage capacity of the karst conduit system in wetter months in addition to pluvial components.

In terms of bedrock geology, groundwater flooding is more susceptible in areas where karstification is more prominent than where competent limestone bedrock prevails. Defining the geological setting in which the full site boundary lies is based on a combination of data provided by studies carried out by the GSI as well as based on the site-specific exploratory hole drilling and geophysical studies. Karst limestone with the presence of dolomite as the dominant bedrock geology has been identified in the western and south-western section of the site while more competent limestone rock is interpreted to prevail from the boundary with the karst in the west towards the centre of the site and extending eastwards.

Furthermore, the existing recorded sinkhole/ springs/ seepages/ will be retained as part of the site development proposals -these features are part of the existing groundwater-surface water system here and this controlled natural interaction between both will be maintained. Refer to Figure 5-13 and Conceptual Site Model (CSM) Section 5.3.18 below.

5.3.8 Groundwater Wells and Flow Direction

The GSI Well Card Index is a record of wells drilled in Ireland, water supply and site investigation boreholes. It is noted that this record is not comprehensive as licensing of wells is not currently a requirement in the Republic of Ireland. This current index does not show any wells drilled or springs at the site or surrounding area with the nearest recorded wells located 0.5 km to the east of the site (associated with the

Balseskin Reception Centre). None of the wells listed are categorised as domestic use. The site is not located near any public groundwater supplies or group schemes. There are no groundwater source protection zones in the immediate vicinity of the site. However, there is a private well located to the south of the proposed development site which is currently in use. The closest is c. 3.5 km to the west of the site (Drumcliff Springs PWS) and the proposed site is outside of the zone of contribution of this supply.

Figure 5-11 below presents the GSI well search for the area surrounding the site (note this source does not include all wells) and Table 5.2 below summarises the details of recorded wells present within this search area.

Regional groundwater flow would most likely be to the south – southeast towards the Shannon Estuary. Local groundwater flow has been interpreted as flowing south-southwest (i.e., towards the Ballymacahill River) based on the local topography and drainage pattern.

Table 5.3 below shows the water level in metres above ordinance datum (mAOD) recorded in 2021. Appendix 5.3 presents the logger data collected at selected boreholes and surface water features across the proposed development site.

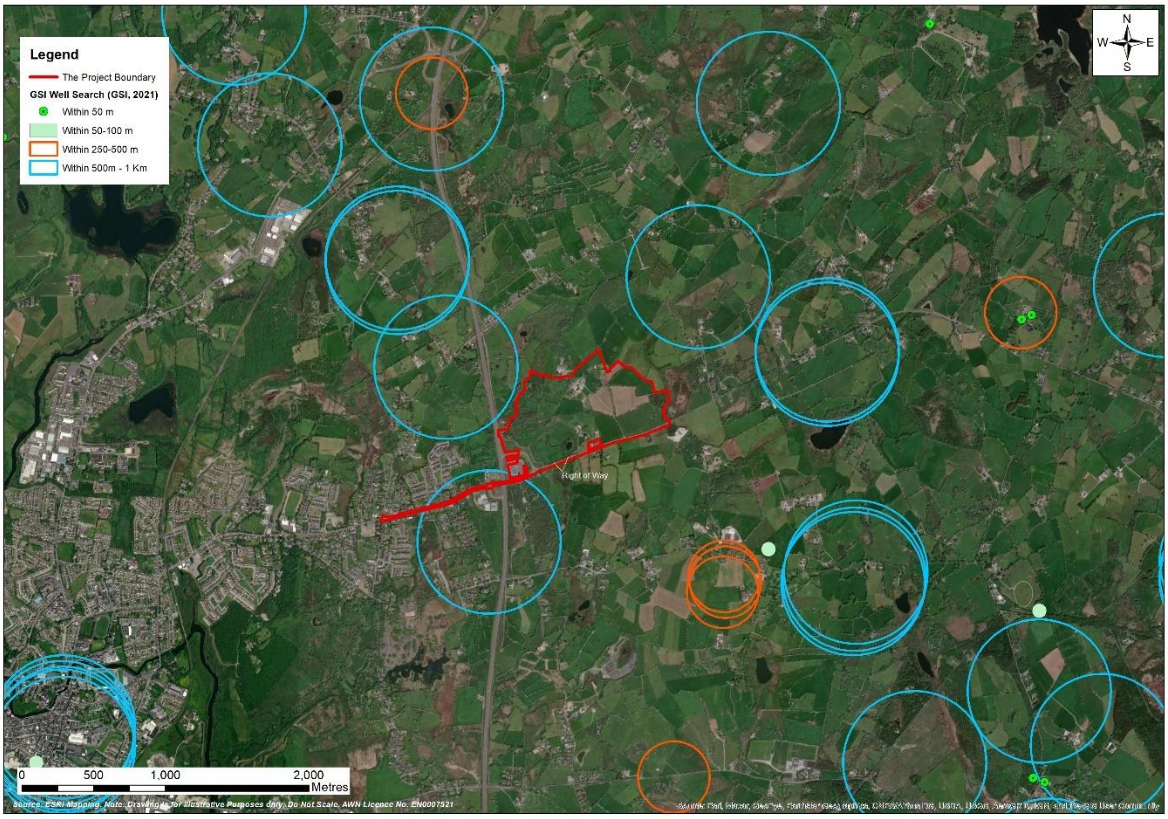


Figure 5-11 *GSI Well Search Map (Source: GSI, 2021)*

Table 5.2 *GSI Well Card Index (Source: GSI, 2021)*

GSI Name	Type	Depth to bedrock (m)	EASTING	NORTHING	TOWNLAND	COUNTY	Use	Yield Class	Yield m3/day
1117NEW077	Borehole	0.9	139900	182290	KILVOYDAN NORTH	Clare	Domestic use only	Failure	38.2
1417NWW020	Borehole		140540	180230	CRANAGHER	Clare	Agri & domestic use	Poor	
1417NWW029	Dug well		140610	180260	CRANAGHER	Clare		Failure	
1417SWW079	Borehole		140700	177000	MOYRIESK	Clare	Agri & domestic use		
1417SWW080	Borehole		140620	177030	MOYRIESK	Clare	Agri & domestic use		
1117SEW011	Borehole	4.9	133620	177170	CLONROAD BEG	Clare	Agri & domestic use	Moderate	
1117SEW123	Unknown		138730	178660	BALLYORTLA NORTH	Clare	Industrial use		
1417SWW085	Unknown		140620	178230	BALLYCRIGHAN	Clare			
1117NEW047	Borehole	6.1	136380	181840	BAREFIELD	Clare	Agri & domestic use	Poor	27.3
1117SEW003	Borehole		138420	178470	CREGGAUN	Clare	Agri & domestic use	Poor	
1117SEW004	Borehole	5.8	138430	178430	CREGGAUN	Clare	Agri & domestic use	Poor	
1117SEW007	Borehole	3.4	138410	178360	CREGGAUN	Clare	Agri & domestic use	Poor	136.2
1117SEW027	Borehole	3.4	138070	177070	KNOCKHOGAN	Clare	Agri & domestic use	Poor	86.4
1417NWW001	Borehole	2.4	140490	180310	CRANAGHER	Clare	Agri & domestic use		
1117NEW011	Borehole	15.2	138730	181770	CLOONKERRY	Clare	Agri & domestic use		
1117NEW012	Borehole	11.9	135000	182400	CLOONTEEN	Clare	Agri & domestic use	Poor	27.3
1117NEW052	Dug well	3.1	136380	181800	BAREFIELD	Clare	Agri & domestic use	Poor	21.8
1117NEW053	Borehole		139140	180050	MUCKINISH	Clare	Agri & domestic use		
1117NEW054	Borehole	0	139140	180020	MUCKINISH	Clare	Agri & domestic use	Poor	11
1117NEW055	Borehole	4.9	136140	180690	BALLYDUFF	Clare	Agri & domestic use	Poor	27.3
1117NEW056	Borehole	3.4	136140	180660	BALLYDUFF	Clare	Agri & domestic use	Poor	21.8
1117NEW057	Borehole	6.1	138240	180560	TULLYVAUGHAN	Clare	Agri & domestic use	Poor	16.4
1117NEW063	Borehole		135250	181480	BALLYMALEY	Clare	Agri & domestic use		38.2
1117SEW001	Borehole		139340	178500	BALLYORTLA	Clare	Agri & domestic use		
1117SEW002	Borehole	1.8	139330	178450	BALLYORTLA	Clare	Agri & domestic use	Poor	
1117SEW005	Dug well	4.3	136780	178710	KNOCKANEAN	Clare	Agri & domestic use	Poor	131
1117SEW006	Borehole	4.9	136480	179930	BALLYMACAHILL	Clare	Agri & domestic use	Poor	
1117SEW008	Borehole	2.7	139320	178420	BALLYORTLA	Clare	Agri & domestic use	Poor	32.7
1117SEW010	Borehole	3.1	133810	177420	CLONROAD BEG	Clare	Agri & domestic use	Moderate	15000
1117SEW014	Borehole	9.1	133800	177380	CLONROAD BEG	Clare	Agri & domestic use	Moderate	28.8
1117SEW015	Borehole	7.8	133810	177340	CLONROAD BEG	Clare	Agri & domestic use	Poor	0.07
1117SEW016	Borehole	6.1	133800	177320	CLONROAD BEG	Clare	Agri & domestic use	Good	28.8
1117SEW017	Borehole	2.1	133810	177270	CLONROAD BEG	Clare	Agri & domestic use	Moderate	8.64
1117SEW029	Borehole	3	139750	177170	FINANAGH	Clare	Agri & domestic use	Poor	
1417NWW065	Borehole	2.1	141500	180500	KNOCKANOURA	Clare	Agri & domestic use	Poor	10.9
1417SWW001	Borehole	5.5	141060	177290	MOYRIESK	Clare	Domestic use only	Moderate	54.5
1417SWW009	Borehole	0.9	140620	177670	MOYRIESK	Clare	Agri & domestic use	Poor	32.7
1417SWW010	Borehole	3	140690	176420	DRIM	Clare	Agri & domestic use	Poor	32.7

Table 5.3 *Site-specific Groundwater Levels. Overburden wells are represented with A after the number i.e. PBH01A. The remaining wells are screened in bedrock.*

Location ID	Ground elevation (mAOD)	Borehole Base of Well Screen Depth (mBGL)	Borehole Base of Well Screen Depth (mAOD)	SWL (mBGL) 05/05/2021	SWL as mAOD 05/05/2021
PBH01	7.97	15.00	-7.03	1.39	+6.58
PBH01A	7.97	5.00	+2.97	1.18	+6.79
PBH02	12.06	10.00	+2.06	3.69	+8.37
PBH03	15.13	12.00	+3.13	1.61	+13.52
PBH04	30.32	15.20	+15.12	2.73	+27.59
PBH04A	30.32	5.00	+25.32	2.30	+28.02
PBH05	14.66	15.30	-0.64	+0.02 (sl. Artesian)	+14.68
PBH05A	14.66	6.50	+8.16	0.6060	+14.11
BH01	11.87	14.00	-2.13	4.66	+7.21
BH02	13.88	14.00	-0.12	N/A	-
BH04	19.46	11.50	+7.96	N/A	-
BH09	21.46	9.90	+11.56	N/A	-

Note: Site-specific groundwater levels. Overburden wells are represented with the suffix ‘A’; the other PBH wells are screened in bedrock.

5.3.9 Soil Quality

There are no legislative threshold values for soils in Ireland. As such soil samples were compared to a Generic Assessment Criteria (GAC) derived to be protective of human health, water bodies (including groundwater) and also ecology for a resident and commercial/industrial end use.

Generic Assessment Criteria in the UK has been derived using the Contaminated Land Exposure Assessment (CLEA) model to be protective of human health for a number of different land uses. LQM (Land Quality Management) and the CIEH (Chartered Institute of Environmental Health) developed a document in July 2009 detailing their own research and derivation of their own 'LQM GACs'. A total of 82 substances including many organic substances had LQM GACs derived, for the standard land uses of residential, commercial/industrial and allotments. This was updated in 2015 following further research and the derived results are now called LQM/CIEH Suitable 4 Use Level (S4UL). The LQM/CIEH S4ULs are intended for use in assessing the potential risks posed to human health by contaminants in soil and as transparently derived and cautious "trigger values" above which further assessment of the risks or remedial action may be needed. For each contaminant S4ULs have been derived for six land use scenarios based on assessing exposure pathways in each planning scenario. In this instance the commercial scenario has been considered. Soil type and soil organic matter (SOM) has an influence on the behaviour of contaminants. S4ULs have been derived for three SOM contents (1%, 2.5% and 6%) to cover the likely range in soils. A prudent approach has been taken by considering the lower 1% SOM content.

The UK values do not have any legal standing within the Republic of Ireland and no statutory guidance for assessing the significance of soil contamination currently exists. However, the values do provide a means of placing the data within context when considering magnitude of risk and have been used in that capacity for this assessment.

In total, ten (10) soil samples were collected throughout the trial pitting exercise and sent to Element Environmental Laboratory in the UK for analysis of a range of parameters to examine the soil quality and to investigate any present and/or past contamination occurred across the subject site. Full laboratory result tables for the soil and groundwater samples are presented in Appendix 5.2.

The soil samples were analysed by Element Environmental in Deeside, UK for the following parameters:

- Metals (As, Cd, Cr, Se, Cu, Ni, and Zn);
- Total Petroleum Hydrocarbons Criteria Working Group (TPH CWG);
- Polycyclic Aromatic Hydrocarbons (PAHs);
- Mineral oil;
- A range of Voltaile Organic Compounds (VOC);
- BTEX compounds (benzene, toluene, ethylbenzene and xylenes) and methyl tert-butyl ether (MTBE); and,
- Leachable component of a range of organic and inorganic parameters.
- Waste Acceptance Criteria (WAC) for inert waste landfills in accordance with the 2002 European Landfill Directive (2002/33/EC). This suite of parameters includes the following (carried out on 2 samples).

For this assessment, the soil results were compared to the Generic Assessment Criteria (GAC) concentrations. GACs are soil concentrations that have been derived for a defined set of generic assumptions and are used as trigger values in determining whether further risk management action is required in cases where detailed quantitative risk assessment is not being undertaken. There are no published Generic Assessment Criteria for soils in the Republic of Ireland. Instead, reliance is often placed on criteria from the UK and the Netherlands.

Soil sample analysis are summarised below. Detailed tables are presented in Appendix 5.2. These tables exhibit the soil quality across the site from the ten representative samples taken across the subject site.

Metals

All metal parameter concentrations recorded values below the most conservative threshold value for the LQM/CIEH for HHRA (Human Health Risk Assessment) Residential Threshold at 1% SOM. See Table 1 in Appendix 5.2.

Total Petroleum Hydrocarbon Criteria Working Group (TPH CWG)

All parameters recorded below the laboratory's limit of detection (LOD) for all soil samples collected across the subject site. Therefore, there are no exceedances recorded when these concentrations were compared to the most conservative threshold i.e., LQM/CIEH for HHRA Residential Threshold at 1% SOM.

PAHs

All parameters recorded below the laboratory's LOD for all samples collected across the subject site. Therefore, there are no exceedances recorded when these concentrations were compared to the most conservative threshold i.e., LQM/CIEH for HHRA Residential Threshold at 1% SOM.

Waste Acceptance Criteria (WAC) Analysis

Two (2) no. samples were analysed and compared against Waste Acceptance Criteria (WAC) set out by the adopted EU Council Decision 2003/33/EC which established criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 and Annex II of Directive 1999/31/EC (2002). There was no fill material noted during trial pit excavations with all samples being recorded as original clay subsoil.

The WAC analysis identifies that the representative samples are suitable for classification as Category A – Inert. Based on the laboratory results and parametric concentrations obtained from the site investigation, material from the sample locations would be acceptable at inert waste facilities (Category A). It should be noted that waste facilities develop facility specific criteria also and this should be considered should any soil/ material to be removed from site in the future. The comparison tables for the analysed samples against current WAC criteria can be seen in Table 2 in Appendix 5.2.

Asbestos

There were no asbestos containing materials (ACM) identified in any of the trial pit or soil samples taken.

5.3.10 Groundwater Quality

5.3.10.1 Regional Scale

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.

'Good Status' was to be achieved in all waters by 2015, as well as maintaining 'high status' where the status already exists. The EPA co-ordinates the activities of the River Basin Districts, local authorities and state agencies in implementing the directive, and operates a groundwater quality monitoring programme undertaking surveys and studies across the Republic of Ireland.

Presently, the groundwater body in the region of the site (Ennis GWB) is classified under the WFD Risk Score system (EPA, 2021) as 'under review" for the WFD cycle (2013-2018). The Ennis GWB was given a classification of "Good" for the last WFD cycle (2013-2018).

5.3.10.2 Local Scale

AWN carried out groundwater monitoring on selected groundwater monitoring wells located along the boundary of the proposed development site. Four (4) no. groundwater samples were taken across the site. 2 no. upgradient groundwater wells (PBH04 & PBH04A) and 2 no. downgradient groundwater wells (PBH01 & PBH01A) were sampled. PBH01 is a deep well which is screened within bedrock, while PBH01A is a shallow well screened in overburden. PBH04 is a deep well which is screened within bedrock, while PBH04A is a shallow well screened in overburden. The groundwater flow is considered to be in a west to southwesterly direction towards the Ballymacahill (also referred to Spancelhill) River which is located along the southwestern boundary of the proposed development. The groundwater wells are screened in the underlying limestone rock to a depth of c. 15 mbgl for the bedrock wells (PBH01 & PBH04) and c. 5.0 mbgl for the overburden wells (PBH01A & PBH04A). Refer to Figure 5-1Er above for borehole locations. Borehole logs and well installation details are presented in the site investigations report (GII, 2021) at the end of this report.

A total of four (4) no. groundwater samples were collected across the site; one groundwater sample from each bedrock borehole. These groundwater samples were sent to Element Environmental Laboratory in the UK for analysis of a range of parameters to examine the groundwater quality and to investigate any present and/or past contamination occurred across the subject site. Appendix 5.2 presents tables with the soil and groundwater analytical test results.

The groundwater samples were analysed for the following parameters;

- TPH CWG,
- Metals (As, Ba, Br, Cd, Cr, Pb, Se, Cu, Ni, Mn, V and Zn,), and
- Chloride, Potassium, Magnesium, Sulphate, Sodium, Orthophosphate, Ammoniacal Nitrogen, Nitrate, Nitrite, Fluoride, Total Suspended Solids, Alkalinity, Total Hardness and Bicarbonate.

Groundwater samples were collected using best practice (BS1995:5930) guidelines for water sampling including sufficient well volume purging (i.e. achieved as a result of the combined pumping tests) prior to sample collection and following adequate aquifer formation recharge to each test well sampled.

Groundwater results were compared with Groundwater Threshold Value (Groundwater Directive S.I. No. 9 of 2010 and amendment; S.I. No. 366 of 2016) and EPA Interim Guidelines for groundwater where available.

The analytical testing was undertaken by Element Environmental (UK) Forensics Limited, a United Kingdom Accreditation Service (UKAS) accredited laboratory located in Deeside, England. The laboratory is accredited under UKAS 4225 as well as to ISO/IEC 17025:2005.

The reported analytical results for the groundwater samples are presented in Appendix 5.2 and compared primarily with the relevant Groundwater Regulations S.I. No. 9 of 2010, SI No. 366 of 2016 and EPA Interim Guideline Values (IGVs), 2003. A brief summary of principal results is presented below.

Field Measurements

Field parameters were measured at PBH01 to PBH05, inclusive. In general, there were no exceedances recorded for field parameters at any of the groundwater monitoring locations. It was noted that two groundwater wells contained elevated pH.

There were slight exceedances recorded at PBH03 & PBH04A monitoring locations of available threshold values for pH. PH concentrations were recorded at 10.90 and 9.60 units, respectively. These concentrations slightly exceed the EPA IGV upper threshold value for pH of 9.5 units (refer to Table 3 in Appendix 5.2).

Metals

Table 4 in Appendix 5.2 summarises the metal parameter concentrations recorded at each of the four (4) no. wells during the groundwater sampling round. These measurements are assessed against the available Groundwater Regulations SI No. 9, 2010 (& 366 of 2016) as well as the EPA's Interim Guideline Values (IGVs) where available also.

The majority of the metal analysis suite recorded a concentration below the laboratory's LOD. There were no exceedances above Groundwater Regulations SI No. 9, 2010 (& 366 of 2016) or EPA's Interim Guideline Values (IGVs) other than a slight exceedance of zinc at PBH04 (Deep). Zinc is naturally occurring in soils and the slightly elevated values recorded are most likely due to sediment in the sample.

Hydrocarbons

Table 5 in Appendix 5.2 summaries the results of Hydrocarbon testing. In summary, there were no exceedances across the hydrocarbon suite of parameters in any of the four (4) no. groundwater samples.

General Suite

Table 6 in Appendix 5.2 summarises the general suite of parameters analysed at Element Environmental (UK) Limited. The table also included the results for polychlorinated biphenyls (PCBs). There was no exceedance of current regulatory thresholds.

5.3.11 Economic Geology

The GSI (2021) mineral database was consulted to determine whether there were any mineral sites close to the study area. There are no active quarries in a 3 km radium from the proposed development site.

While the origins of the suppliers of general construction materials and data centre components are not known at this stage, in relation to supply of sand, aggregate, stone and cement, which will comprise a significant proportion of HGV traffic generated during the construction phase, 3 quarries have been identified for consideration. These options are further discussed in Chapter 12 Traffic and Transport of this EIA Report.

5.3.12 Geological Heritage

The Geological Survey of Ireland (GSI) Public Viewer (www.gsi.ie/mapping) was reviewed to identify sites of geological heritage for the site and surrounding area. There are no geological heritage sites (audited & unaudited) in a 3 km radius of the proposed development site. The nearest geological site is Kilbreckan (CE0225). This site is located approx. 3.8 km south of the proposed development site. Kilbreckan Mine is situated between Ennis and Quin. It was worked intermittently for silver and lead from 1834 until 1856.

5.3.13 Radon

According to the EPA (now incorporating the Radiological Protection Institute of Ireland), Ennis is a High Radon Area (27.8 %) where is it estimated that more than twenty per cent of the homes in this 10km grid square are estimated to be above the Reference Level. This is the highest of the five radon categories which are assessed by the EPA.

5.3.14 Geohazards

Much of the Earth’s surface is covered by unconsolidated sediments which can be especially prone to instability. Water often plays a key role in lubricating slope failure. Instability is often significantly increased by man’s activities in building houses, roads, drainage and agricultural changes. Landslides, mud flows, bog bursts (in Ireland) and debris flows are a result. In general, Ireland suffers few landslides. Landslides are more common in unconsolidated material than in bedrock, and where the sea constantly erodes the material at the base of a cliff and leads to recession of the cliffs. Landslides have also occurred in Ireland in recent years in upland peat areas due to disturbance of peat associated with construction activities. The GSI landslide database was consulted and the nearest landslide to the proposed development was approx. 7.6 km to the southeast of the site, referred to as the Ayleacotty 2009 (event ID - GSI_LS09-0004) which occurred on 23rd August 2009 where a steep railway bank collapsed. There have been no recorded landslide events at the site. Due to the local topography and the underlying strata, there is a negligible risk of a landslide event occurring at the site.

In Ireland, seismic activity is recorded by the Irish National Seismic Network. The Geophysics Section of the School of Cosmic Physics at the Dublin Institute for Advanced Studies (DIAS) has been recording seismic events in Ireland since 1978. The station configuration has varied over the years. Currently there are five permanent broadband seismic recording stations in Ireland and operated by DIAS. The seismic data from the stations comes into DIAS in real-time and are studied for local and regional events. Records since 1980 show that the nearest seismic activity to the proposed location was in the Irish sea (1.0 – 2.0 Ml magnitude) and ~55km to the south in the Wicklow Mountains. There is a very low risk of seismic activity to the proposed development site. There are no active volcanoes in Ireland so there is no risk from volcanic activity.

5.3.15 Areas of Conservation

According to the NPWS (2021) on-line database there are no special protected area on or in the vicinity of the subject site. The closest European listed sites are as follows;

- Lower River Shannon Special Area of Conservation (SAC) (site code 002165) - circa. 2.1 km to the southwest of the site.
- Ballyallia Lake SAC and proposed National Hertiage Area (pNHA) (site code: 000014) - circa. 2.3 km to the west of the subject site.
- Ballyallia Lake Special Protection Area (SPA) (site code: 004041) - circa. 2.8 km to the northwest of the subject site.
- Newpark House (Ennis) pNHA (site code: 000061) - circa. 1.6 km to the southwest of the site.

The site would have direct hydrological connection with the Lower River Shannon (SAC) (site code 002165) - circa. 2.1 km to the southwest of the site through the local drainage network and the Ballymacahill (also referred to Spancelhill) River. This waterbody is located along the western boundary of the site. This waterbody is further discussed in Chapter 6 Hydrology of this EIA Report.

Figure 5-12 below presents the location of these protected areas in the context of the subject site.

Figure 5-12 *Natura Sites in the Context of the Subject Site (Source: NPWS, 2021)*

5.3.16 Karst Features

According to the GSI (GSI, 2021) website, there are no recorded karst features within the site boundary. However, based on the initial site walkover carried out by AWN in April 2021 it was established that there are a number of karst features within the site boundary and in adjacent lands which transports water into the site. These are described below:

1. Ardnamurray Lough and the southern sinkhole which are located adjacent to the site. The lough drains along the Tulla Road and into lands south of this road. A sinkhole is located within this land. This karst feature is connected to underground conduits which direct water towards the proposed development site and the main spring located within the site boundaries. This is further discussed below in groundwater-surface water interactions.
2. One of the two pond features (north ponds) is believed to be attributed to groundwater water levels with some surface water influence. These extend and recede based on the seasonal rainfall changes through the year.
3. The second pond feature (north-eastern ponds) is believed to be attributed to surface water influence. These extend and recede based on the seasonal rainfall changes through the year. Based on recent geophysical data (January 2022), the northeast pond is an ephemeral surface water feature with no groundwater influence. Based on the geophysical survey (Line R17/ R18) undertaken here, there is approx. 5 to 7m of overburden comprising Peat/Clay/Silt hence the feature is a capture point for arterial run-off from elevated areas with levels controlled by rainfall, very slow infiltration to ground and evaporation effects.
4. There are two (2) no. springs located across the proposed development site – one is located to the north-western section of the site and the second is located in the western section of the site (southwest of the proposed DC 6 building). Refer to Figure 5-13 below. These springs are dependent on water levels across the site and seasonal changes.
5. There is one (1) no. sinkhole located west from Toureen Lough. There is a small overland stream from Toureen Lough to this sinkhole. It is believed that this sinkhole discharges through a spring located along the Ballymacahill (also referred to Spancelhill) River.

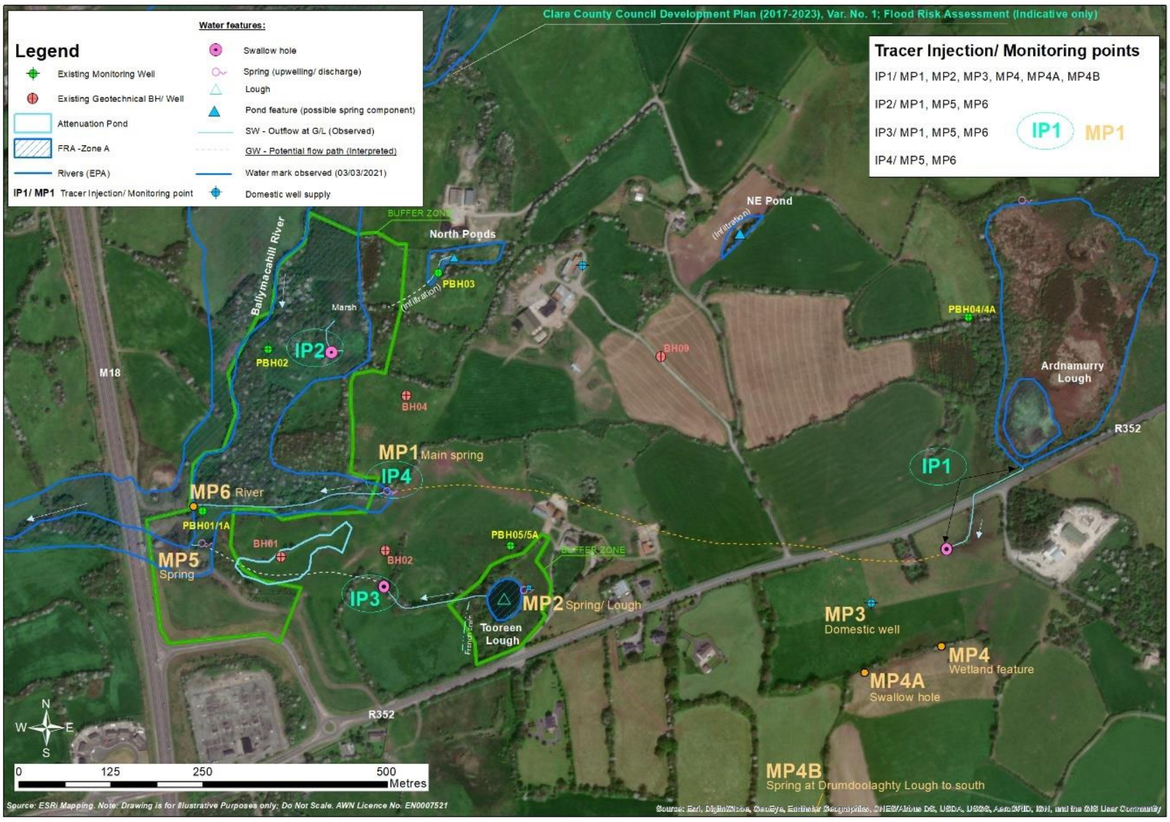


Figure 5-13 *Internal and local karst features across the site with the proposed Site Layout.*

<u>5.3.16.1 Interactions between Groundwater & Surface water features</u>

Regarding surface water-groundwater interactions, the following additional field works were completed in December 2021 and January 2022:

- Extensive geophysical survey profiles to more accurately define the extent of weathered and/ or more competent Limestone, as well as the likely flow orientation for groundwater at the site. Refer to Apex report (2022).
- Groundwater and surface water quality testing as part of assessing the hydrochemistry for the site and possible similarities in water type(s) (refer **Appendix 5.2**).
- Continuous datalogging of groundwater levels spatially for a nominal period which now includes the high winter water levels (refer **Appendix 5.3**).
- Dye tracer testing using recorded injection points (swallow holes) and likely discharge points in the wider site area (refer **Appendix 5.4**).

With regard to surface water features in context of groundwater, there are five (no.) main surface water features located within/ at the site boundary, and presented in Appendix A, as follows; Ardnamurry Lough, Tooreen Lough, Northeast Pond, North Ponds, and Ballymacahill River. These are discussed briefly below.

Ardnamurry Lough drains from north of the R352 Tulla Road and into lands immediately south, ultimately discharging under sufficient head into a swallow hole (IP1). Based on the successful dye tracing exercise completed on 17/12/2021, this swallow hole has been proven to directly connect with the [main] spring (IP4) located north of the proposed DC6 structure. It is interpreted from the tracer test that the discharged water is flowing below ground in a W to WNW direction, and to the north of

Tooreen Lough where no breakthrough was recorded. Groundwater flow is within the gravels and the upper weathered limestone (with confirmation on local geology provided by additional geophysical surveys in December 2021 and January 2022). There is no notable heavily karstified rock between the swallow hole and this spring which indicates that the groundwater flow is predominantly within the gravels and top of the limestone rock. From this spring, the water travels along a drainage ditch which flows in the direction of the Ballymacahill River, but which may also include likely discharge to ground in the western site extent.

Tooreen Lough is not connected to the afore-mentioned swallow hole located south of Tulla Road. No emergence of dye was noted here including on 17/12/2021. Tooreen Lough is likely fed by a smaller 'spring' which is located adjacent to the water feature. Tooreen Lough is directly connected to a nearby swallow hole which regulates the water levels in the lough (see also **Appendix 5.3** hydrograph for SP2). Continuous datalogging of water levels in Tooreen Lough indicates a range from +14.24 mAOD (May 2021) to +14.51 mAOD (December 2021), i.e. very little variation in water levels due to the nearby swallow hole from which Tooreen Lough water discharges to the west towards the Ballymacahill River. No connection is recorded between this swallow hole (IP3) and the main spring (IP4).

In the context of the buffer zone applied, the nearest GPS surveyed historical high-water mark for Tooreen Lough of approx. +14.6mAOD has not been reached/ surpassed since May 2021 including where site-wide observed water levels have increased in recent [winter time] months.

The northeast pond is an ephemeral surface water feature with no groundwater influence. Based on the geophysical survey (Line R17/ R18) undertaken here, there is approx. 5 to 7m of overburden comprising Peat/Clay/Silt hence the feature is a capture point for arterial run-off from elevated areas with levels controlled by rainfall, very slow infiltration to ground and evaporation effects.

The north ponds, in contrast, are surface water features with likely groundwater influence. Based on the geophysical survey (Line R26), there is approx. 1.0-1.5 metres of overburden (sandy gravelly Clay – clayey sandy Gravel) below the top pond which discharges into the second pond to the immediate SW. This second pond discharges to ground with ultimate flow towards the nearby marshy area and the Ballymacahill River.

The Ballymacahill River is the principal drainage feature in the area and flowing in a N-S/SW to W direction. Based on additional extensive geophysical surveys in the area, and assessment of monitored groundwater levels, then it is likely that the river receives baseflow from the underlying rock together with composite discharge from key water features listed above.

As part of the potential linkages between surface and groundwater systems, additional water quality was completed on 13/01/2022 with testing of major anions and cations completed on select groundwater and surface water samples. **Appendix 5.2** presents the tabulated water quality data as well as trilinear plots for reference (plots are also grouped into groundwater and surface water to aid comparison).

In summary, the plotted analytical data indicate a hydrochemical facies calcium-bicarbonate ($Ca^{2+}Mg^{2+}HCO_{3-}$) type water for the majority of the [groundwater and surface water] samples tested. This is representative of the type of limestone till and bedrock in the area of the proposed development and further indicates the hydraulic connectivity potential between all waters present at the subject site.

As part of the examination of surface water and groundwater interactions, a number of dye tests were carried out including on 05/05/2021 and 19/09/2021 however due in large to the low flow rates observed at the main spring and swallow holes then no dye breakthrough was noted. However, on 17/12/2021, following excavation works at the swallow hole to the south of the R352, which created a significant discharge to ground (i.e. approx. 20-30 l/sec inflow rate), the injection of 250g of Fluorescein dye (and de-ionised water) was observed on site at IP4 within <2 hours as presented in **Appendix 5.4**.

It is noted that the silt laden water resulting from the swallow hole excavation works was also observed at the main spring and sooner than the dye -this is due in effect to the rapid 'slug of water' effect associated with the sudden release of water to ground at the time of excavation.

As mentioned above, dye was <u>not</u> observed within Tooreen Lough during any of the tests completed, indicating a more northern flow path to the north of the lough.

Continuous data loggers have been installed at selected locations across the site and have monitored groundwater/ surface water levels since May 2021 to present. These loggers will continue to capture fluctuations in groundwater levels over summer (low) and winter (high) seasons.

Based on the continuous monitoring data, the following is of note:

- It is apparent that the groundwater levels are directly related to the meteoric recharge within the wider site area, with increased variations in logged groundwater levels relative to heavy rainfall events (typically associated with the wetter winter season).
- Temporal artesian conditions are noted at periphery monitoring boreholes PBH03 (deep, screened within the gravels and the underlying bedrock), PBH05 (deep, screened within the underlying bedrock) and PBH05A (shallow, screened within the gravels). PBH05 & PBH05A are located directly north of Tooreen Lough and the hydrographs correlate well to that of the lough (SP2) indicating the influence of groundwater on the lough levels.
- Groundwater levels in the western side of the site are heavily influenced by local meteoric recharge conditions. The west of Ireland (similar to the other parts of the country) experienced a dry summer/ autumn which coincides with the low, relatively consistent groundwater levels noted in the western side of the site. In comparison to the current winter (high water table) season, groundwater levels have begun to rise due to the increase in rainfall.

Appendix 5.3 presents hydrographs for all monitored groundwater and surface water. Figure 5-13b below presents the site drainage and monitoring network for reference.

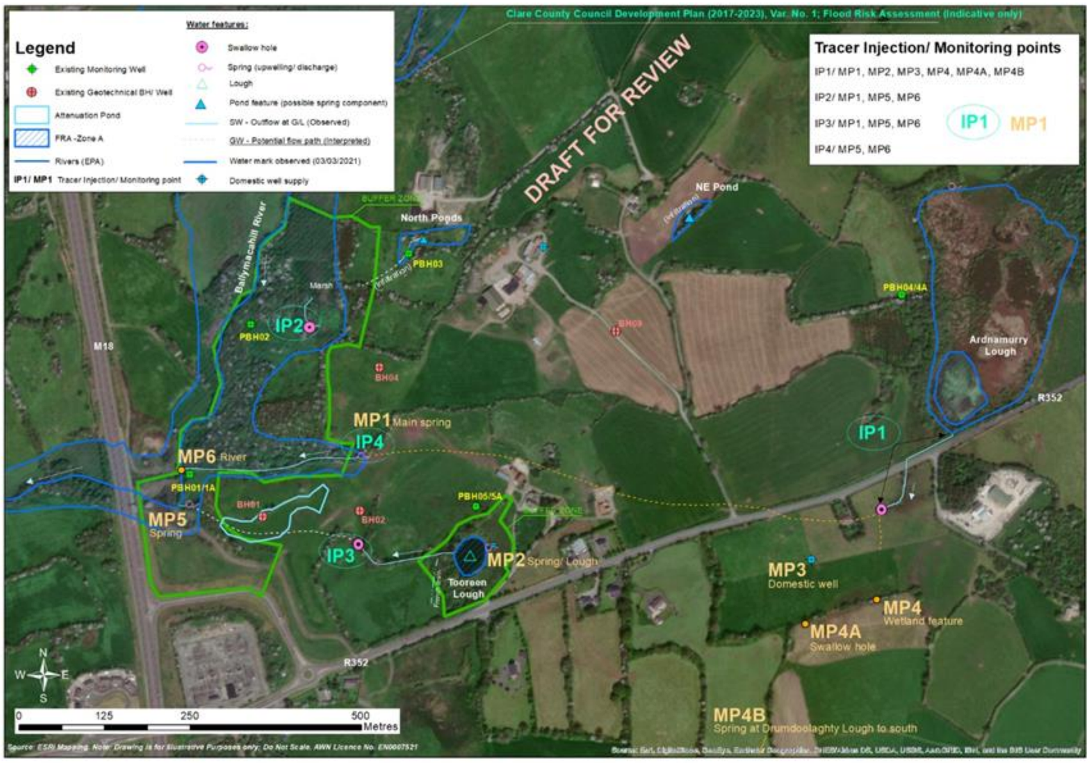


*Figure 5-14***b** *Site Drainage with monitoring network across the site and nearby areas.*

Inserts 5.1 to 5.8 below show karst/ drainage features on site.

Insert 5.1 *Toureen Lough – view is N-W*

Insert 5.2 *Ardnamurry Lough -View is to E (discharge is to south crossing beneath the R352 road to Right Hand Side)*

Insert 5.3 *Pond to north-east (view is W-E) with existing wall to the Right Hand Side*

Insert 5.4 *Ponds to the north -saturated (03/03/2021) -view is to North.*

Insert 5.5 *Spring discharge (main) which flows directly to Ballymacahill River.*

Insert 5.*6* *Spring discharge (main, second view) and flows directly to Ballymacahill River.*

Insert 5.*7* *Swallow hole located to south of R352 (i.e discharge from Ardnamurry Lough)*

Insert 5.*8* *Swallow hole located to south of proposed DC6 building and connected to Toureen Lough stream flow.*

5.3.17 Ecological Receptors

As outlined in Chapter 7 (Biodiversity), there are a number of water habitats which are water fed/ maintained. These are described in Section 7.3.2.1. International and national habitats which are dependent on '*no measurable change in the natural water environment'* are summarised as follows:

Table 6.1 *Ecological attributes within the site boundary*

Alluvial woodland [*91E0] (WN5 Riparian Woodland and WN6 Wet Willow-Alder-Ash Woodland) GW fed	International
Cladium Fen [*7210] (FS1) GW fed	International
Alkaline fen [7230] (PF1 – Rich Fen and Flush)	National
Molinia Meadows [6410] (GS4 Wet Grassland) GW fed	National

The above habitats are presented in Figure 5-15 below and Figure 7.8 of Chapter 7 (Biodiversity) of this EIA Report which shows the level of ecological importance of habitats at the development site. It is noted that an area of International Importance (alluvial woodland) is present at the edge of Fen habitat at Tooreen Lough and along the eastern boundary. Furthermore, the Reed and Large Sedge swamp (Cladium Fen) area is located along the eastern boundary of the proposed development site. Further information on the habitats is discussed in Chapter 7 (Biodiversity) of this EIA Report. There are no specific groundwater dependent species identified i.e. the habitats present requiring flooding only.

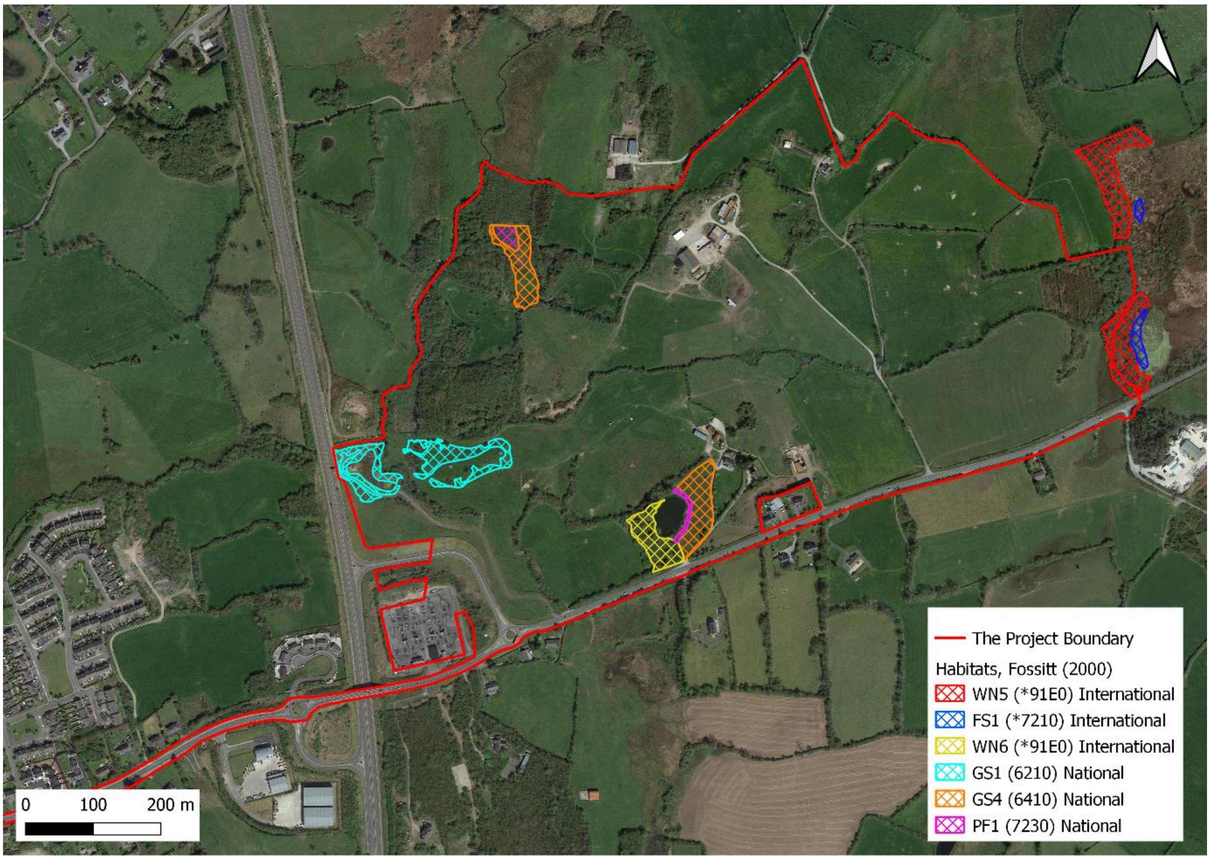


Figure 5-15 *Ecological Features of International and National Importance located within the site boundary*

Fen type habitat was located in two different areas. These are considered of National Importance according to their species composition and structure.

The small area of rich fen and flush, located in the far northwest of the proposed development site, described as a wetland/pond feature, corresponded to a depression between wooded areas, and are naturally relatively species-rich vegetation communities. It is likely to have formed as a consequence of a lake infilling and can be described as a topogenous fen (i.e. forming in a valley or depression). A more-species-poor fen community occurs bordering on the landward side of reed and tall sedge swamp vegetation at Tooreen Lough.

Fen habitats located within these two particular areas corresponded to the description of the Annex I habitat Alkaline fen [7230], which are described as '*Wetlands mostly or largely occupied by peat- or tufa-producing small sedge and brown moss communities developed on soils permanently waterlogged, with a soligenous or topogenous base-rich, often calcareous water supply, and with the water table at, or slightly above or below, the substratum…*' within the Interpretation Manual of European Union Habitats (European Commission, 2013). The examples of rich fen and flush habitats within these two areas are considered to be of National Importance.

The areas of oak-ash-hazel woodland and immature woodland in the northwest, Tooreen Lough, the alluvial woodland (*91E0), Molinea meadows (6410) and alkaline fen (7230) surrounding Tooreen Lough and in the north-west, and calcareous grassland (6210) adjacent to the attenuation pond by the M18 Motorway, will be protected under the 'Ecological Buffer Space' as designated by Clare County Development Plan Variation No. 1. These areas will be retained, protected from development and will not be directly impacted from the development.

The wetland in the north of the site will also not be impacted by the proposed hardstand footprint of the development.

5.3.18 Conceptual Site Model (CSM)

The subsoil underlying the site is classified as clayey GRAVELS (generally low to moderate permeability) and the underlying varied limestone aquifer which is classified as a Regionally Important Aquifer. The aquifer vulnerability is considered to be 'Extreme' to 'High' vulnerability across the majority of the site while a section of the eastern boundary is classed as 'Moderate' aquifer vulnerability. This was confirmed during the site investigations.

The geology of the site can be described into two sections – the western and eastern section:

<u>*Western Section of the Site*</u>

- The underlying geology of this section is made up of weathered / fissured DOLOMITE underlain by competent LIMESTONE at greater depth (generally greater than 7 metres below ground level). Refer to Figure 5-17, below. This is based on the available data, geophysical data and site investigations carried out across the site.
- This DOLOMITE bedrock is highly weathered and fissured with some silt and clay infilled voids.
- Within this unit, there are areas where there is highly karstified LIMESTONE rock. These features are usually located approx. 7 to 10 metres below ground level (m bgl).

- Competent LIMESTONE rock unit is underlying this dolomitised rock which is presented in Figure 5-17,Figure 5-18 and Figure 5-19.

Eastern Section of the Site

- The underlying geology of the centre and eastern sections of the proposed development site is mainly made up of strong competent LIMESTONE rock. This is presented in Figure 5-20and Figure 5-21 below.
- This bedrock is generally very strong, massive, grey, fine to medium grained LIMESTONE.

The depth of bedrock across the site is generally shallow – 0.90 m bgl to 6.20 m bgl. Site investigations (GII, 2021) indicate bedrock depth is highly varied throughout the site with rockhead recorded at 0.60 mbgl at BH06 (western section of the site), 2.30 mbgl at BH08 (centre of the site) and 6.20 mbgl at PBH04 (eastern section of the site). The depth to bedrock is shallow across the site especially in the western and centre sections while bedrock is deeper along the eastern boundary owing to the thicker subsoils present. However, the bedrock surface is observed as undulating across the site and there are localised points with shallow bedrock for example within the eastern section of the site.

Groundwater levels range from 0.6060 m bgl (PBH05A) to 4.66 m bgl (BH01) while slightly artesian conditions were noted at PBH05 (deep well screened in bedrock) as the static water level was +0.02 metres above ground level (m agl). The regional groundwater flow is in a western to southwestern direction towards the Ballymacahill (also referred to Spancelhill) River and the Shannon Estuary.

Local drainage within the development boundary is less defined. Surface water features within the site boundary comprise a series of ponds to the north with variable seepage to ground, and Toureen Lough to the south near the R352. As mentioned in Section 5.3.17 above, there are a number of karst features within and adjacent to the proposed development site. Spring discharges have been identified mainly to the west of the site and include a spring to the immediate east of Tooreen Lough discharging to this feature, and a spring to the NW of the lough which receives groundwater from a swallow hole located farther east and south of the R352 road (this water is discharged from the Ardnamurry Lough wetlands located adjacent to the eastern site boundary line -refer to Figure 5-13 above). It is likely, under increased local water levels [head] at the lake, that Tooreen Lough ultimately discharges into the Ballymacahill River under gradient flow observed in the field as both at surface and possibly through gravelly subsoils located between the lough and the river. Local drainage would also typically follow the topographical decline in gradient recorded from east to west/ southwest (refer also to Figure 5-13 above). Refer to Section 5.3.15 for a discussion on groundwater – surface water interactions across the proposed development site based on recent site investigations.

Site walkovers conducted by AWN in March/ April/ May 2021 included a visual inspection of the local drainage network and features across site. These features are encapsulated in Figure 5-13 above and include some seepages/ springs with intermittent or ephemeral characteristics which discharge into what are surface streams that ultimately discharge towards the Ballymacahill River running along the western/ southwestern boundary of the site.

The majority of these hydrological and hydrogeological features are located in the south-western section of the site where the karstified limestone and weathered dolomite is located. According to the geophysical survey (APEX, 2021), there is a zone of karstified rock and dolomitised rock underlying the majority of the south-western section, refer to Figure 5-16 below. Bedrock is close to or at the surface to allow the springs and swallow holes to form across the proposed development site.

Review of the hydrogeology and geology in the immediate surrounding region indicates that there are no sensitive receptors such as groundwater dependent SACS/NHAs, Council Water Supplies/ Group Water Schemes or geological heritage sites which could be impacted by this development. No evidence of disposal of waste material was identified the location area proposed for excavation. Collection and analysis of representative soil and groundwater samples for a wide range of parameters shows no evidence of contamination. The review of the groundwater quality data collected on site found that the groundwater beneath the site is of good quality. Groundwater quality results are presented as Appendix 5.2.

Six (6) no. local geological cross sections can be seen in Figure 5-17 to Figure 5-22 below based on the available data such as geophysical survey report, site investigations borehole logs and supplementary site walkovers. The relevant borehole logs were used to construct the Conceptual Site Model (CSM) for the proposed development. These are presented in the cross-sections below in Figure 5-17 to Figure 5-22.

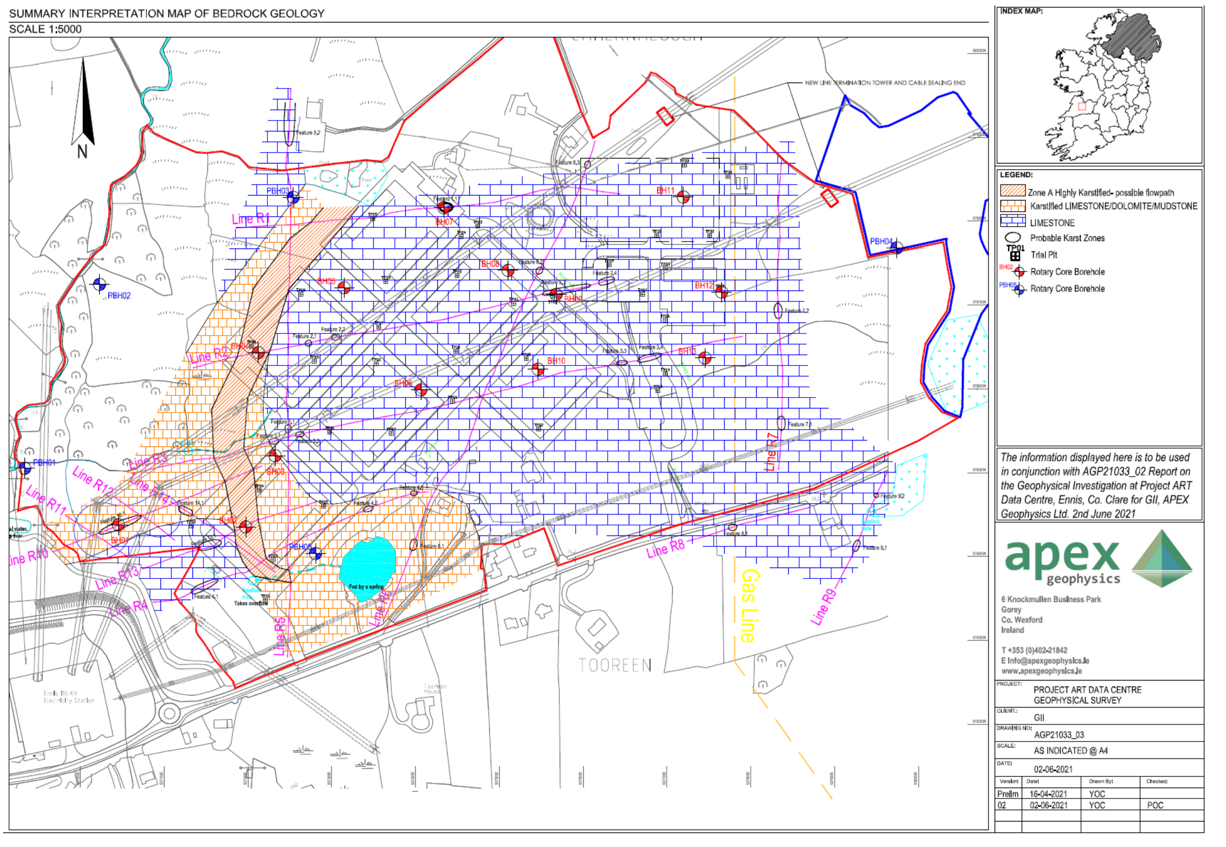


Figure 5-16 Geophysical survey – interpretation map of the bedrock geology (Apex, 2021).

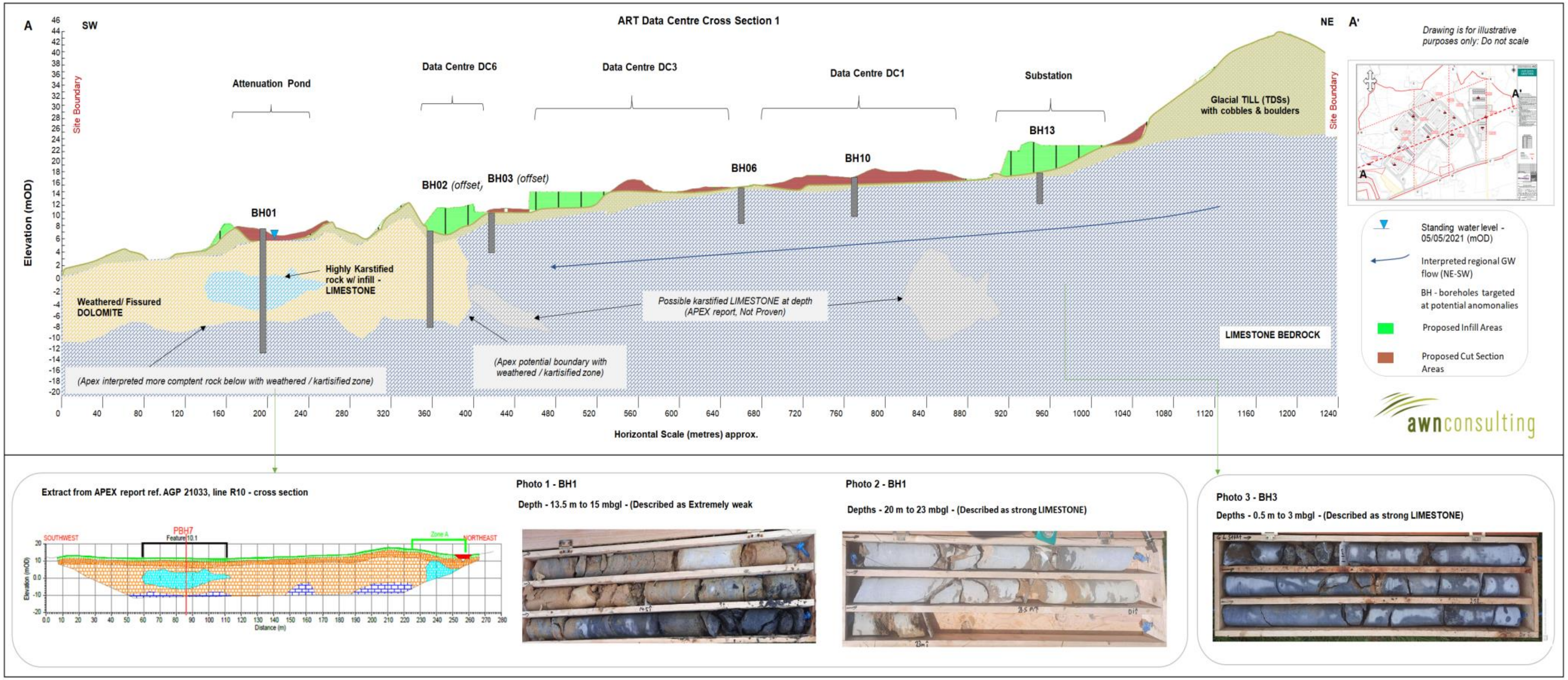


Figure 5-17 *Local Cross Section A-A' with view from SW to NE.*

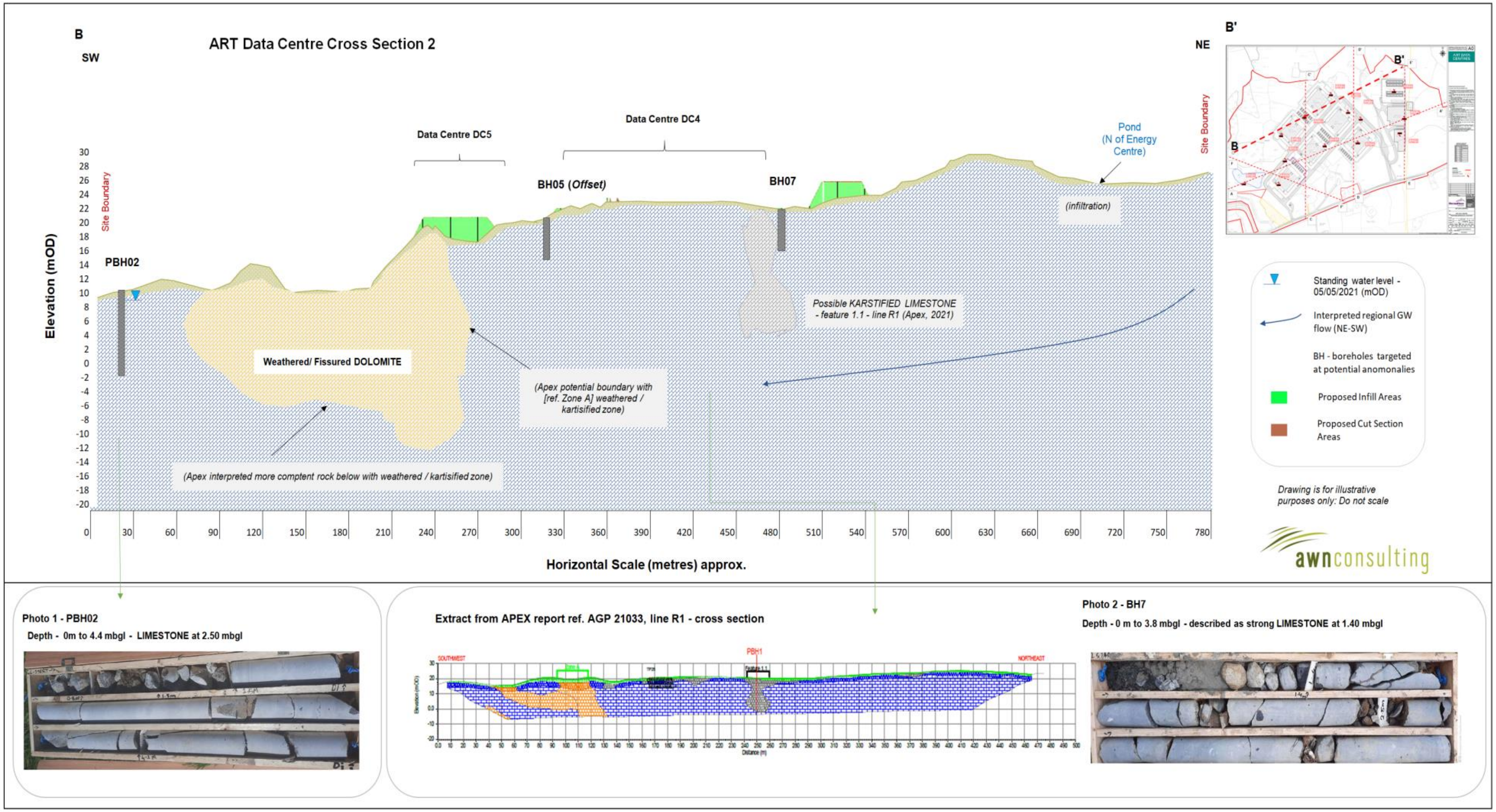


Figure 5-18 Local Cross Section B-B' with view from SW to NE.

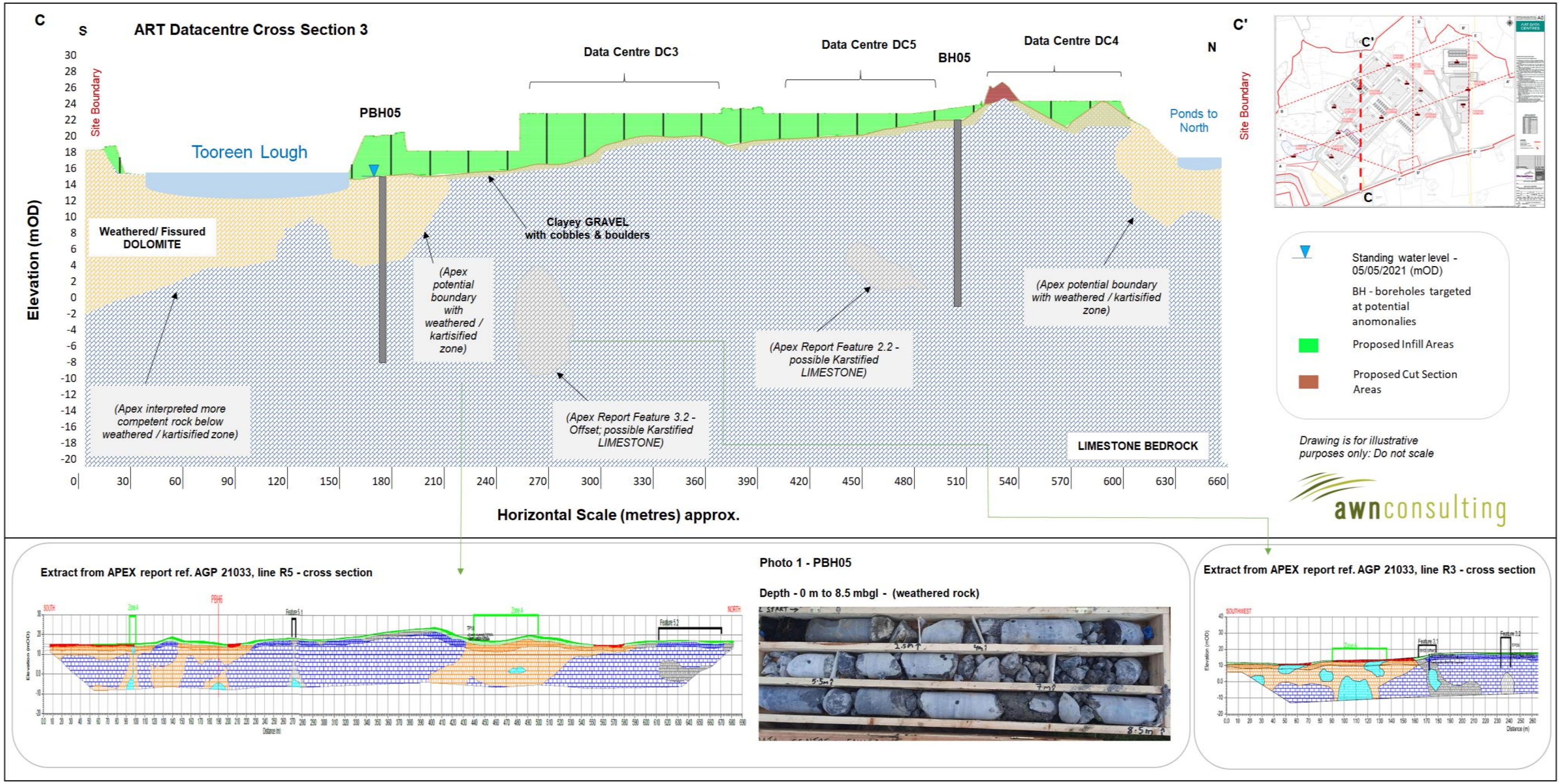


Figure 5-19 *Local Cross Section C-C' with view from S to N.*

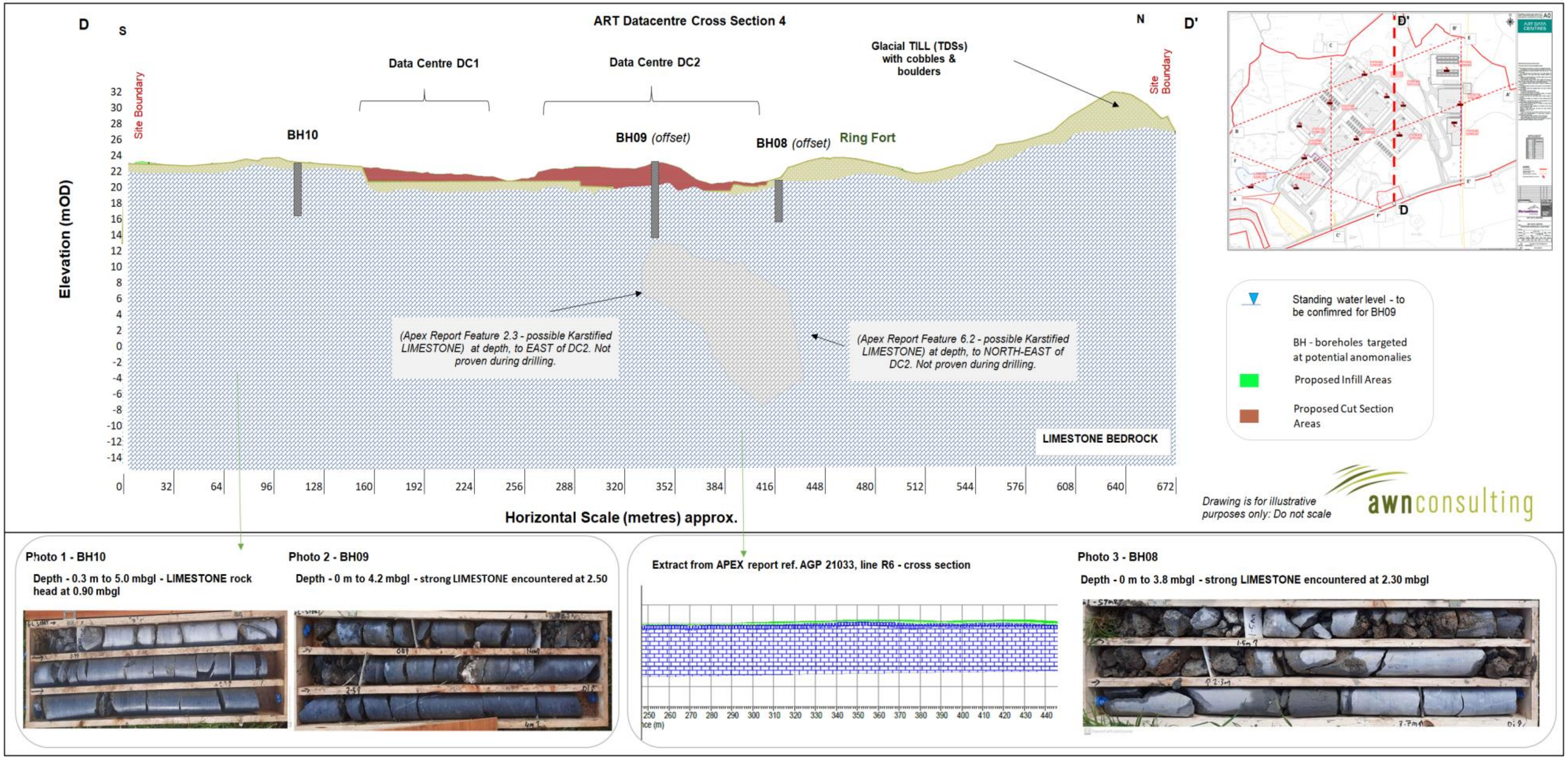


Figure 5-20 *Local Cross Section D-D' with view from S to N.*

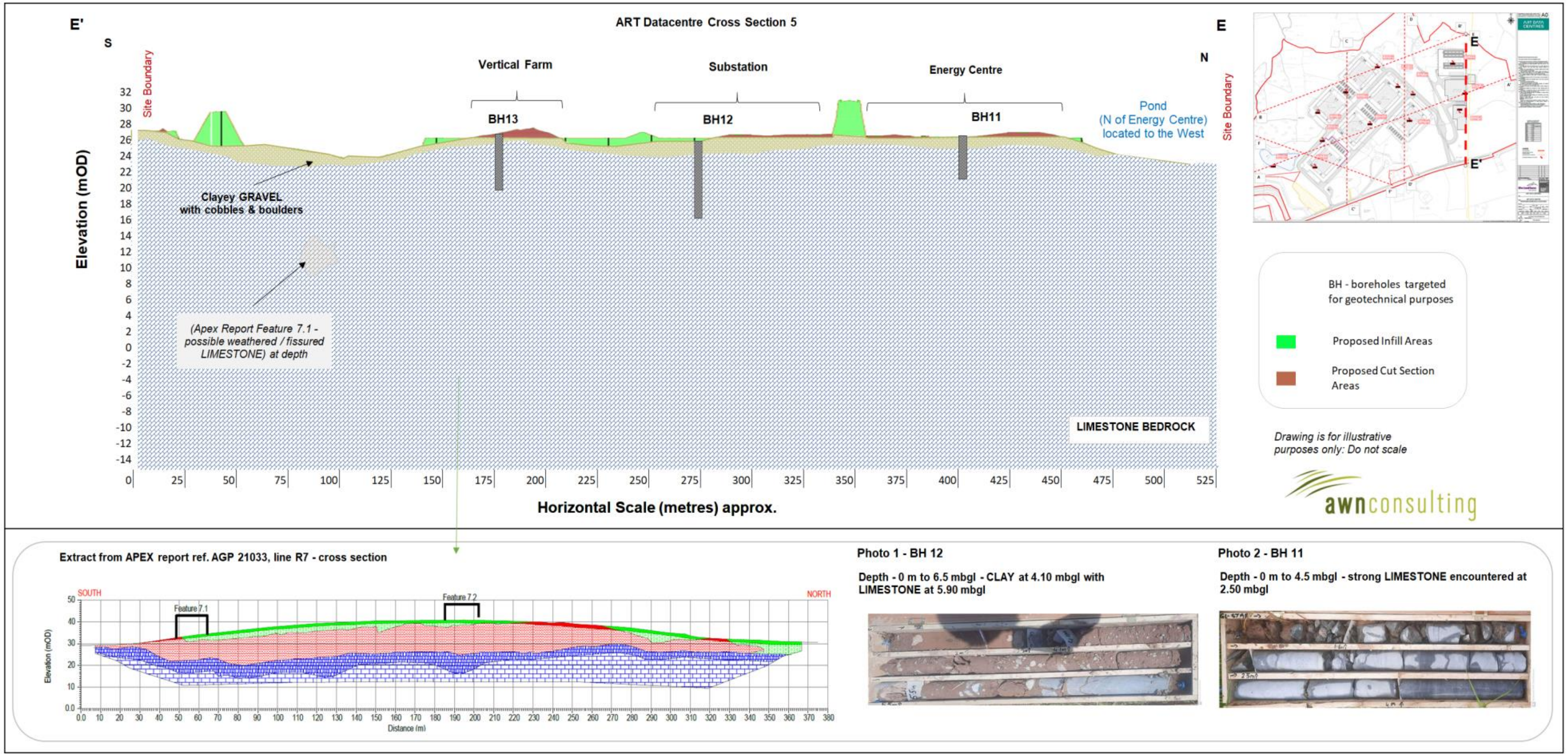


Figure 5-21 *Local Cross Section E-E' with view from S to N.*

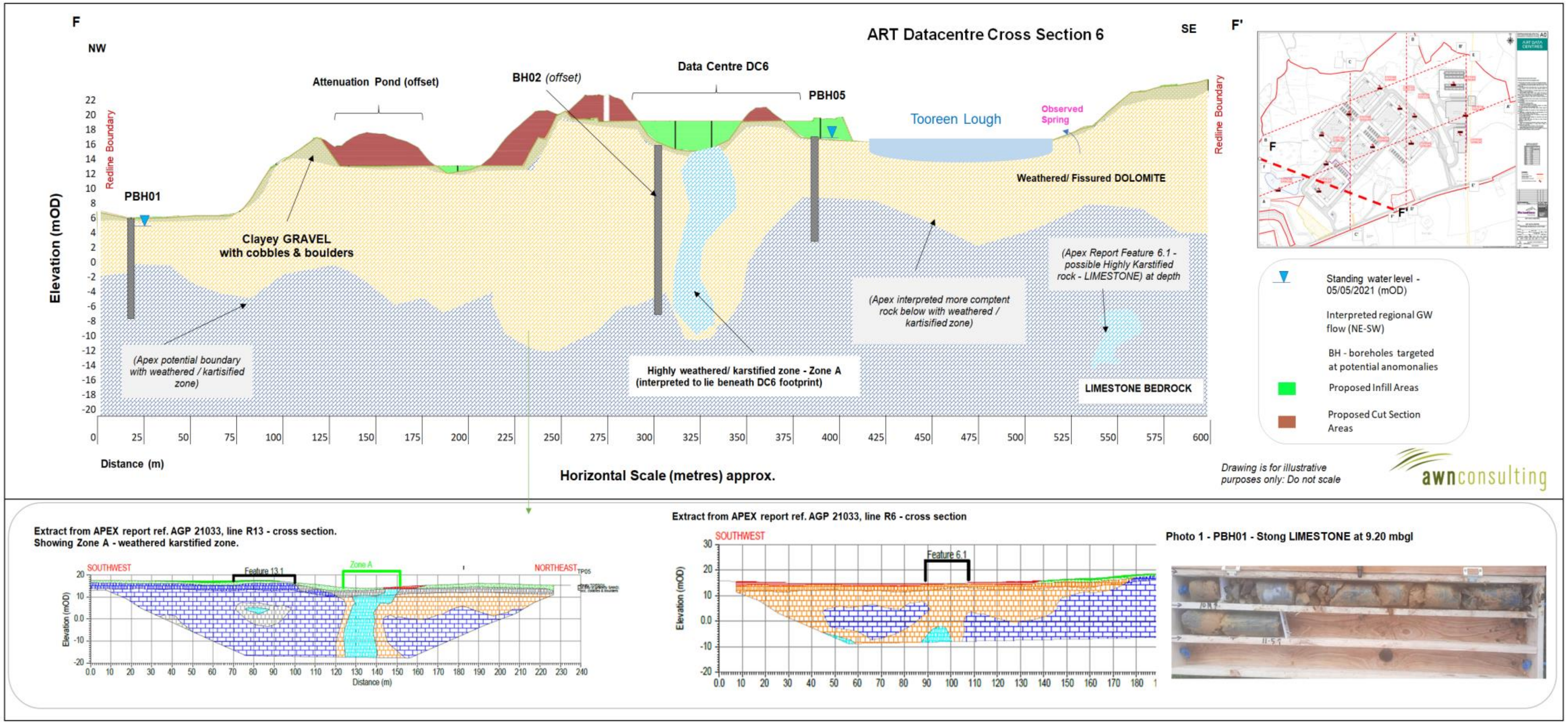


Figure 5-22 *Local Cross Section F-F' with view from NW to SE.*

5.3.19 Rating of Importance of Geological and Hydrogeological Attributes

Based on the TII (previously NRA) methodology (2009) (See Appendix 5.1), criteria for rating site importance of geological features, the importance of the bedrock and soil features at this site is rated as *‘Medium Importance’* with medium significance or value on a local scale. This is due to the existence of well drained and/or high fertility soils across the site.

Based on the TII methodology (2009) (See Appendix 5.1) the importance of the hydrogeological features at this site is rated as ‘*Very High Importance’* based on the assessment that the attribute has a high-quality significance or value on a local scale. This assessment is based on the presence of the underlying aquifer which is a Regionally Important Aquifer. In addition, there would be direct or at least an indirect hydrogeological connection between the site and any protected sites (Natura Sites - SAC, SPA, NHA).

5.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The proposed development is c. 60 hectares and comprises:

- Six (6) no. data centres buildings (DC1 to DC6).
- A gas-powered Energy Centre and Above Ground Installation (AGI).
- A new 110kV substation, two drop down masts and underground grid connection.
- Fibre connection.
- Connection and upgrade of foul sewer and mains supply extending along the existing R352.
- Undergrounding of two of the existing overhead 110kv circuits.
- Associated Infrastructure: including roads and an attenuation pond.
- Demolition (one house and a number of farm buildings).

The proposed development occupies c. 60 ha for the total development site. The proposed development represents an overall increase in hardstanding surfaces of approx. 17.3 hectares. The rest of the site comprises landscaping and undeveloped areas. The site layout reserves c. 10 ha of lands as ecological buffer zones. These indicated buffer zones can be seen in Figure 2.1 in Chapter 2 were delineated following assessment undertaken as part of the area assessment within the Clare County Development Plan 2017 – 2023 (Variation No. 1). Further assessment has been undertaken by the project ecologist to protect ecology during construction and operation of the proposed development.

It is noted that a significant proportion of the site is unpaved, and recharge will continue as current. In addition, where there is no storage of bulk fuel i.e., generator yards, SuDS measures have been incorporated in the design to facilitate recharge to ground.

5.4.1.1 Fuel Storage

In the event of a loss of power supply, the emergency generators are designed to automatically activate and provide power to the data storage facility. The generators will be supplied by low sulphur diesel. Fuel oil for the emergency generators is the only required bulk chemical required on site. Located within the services yard of three of the six datacentres, it is proposed to have up to 7 bunded above ground bulk storage tanks for fuel oil (440m^3 for three (3 no.) data storage facilities), distribution pumps, overground delivery pipeline to the belly tanks for diesel fired standby generators within each data storage facility.

The proposed Energy Centre will have back-up fuel storage with up to 20 fully bunded above ground bulk storage tanks for fuel oil (total of 1,440 m^3 of fuel oil). The total fuel store will be 2,900 m^3 (or 2,494 tonnes). All bunds will be capable of containing 110% of the volume of the largest drum/tank within the bund or 25% of the total volume of the substance stored and will designed in accordance with the EPA's guidelines for the storage and transfer of materials for scheduled activities (EPA, 2004).

The site is traversed by a high-pressure Gas Networks Ireland gas pipeline running in a S-N direction to the east of the development site. An AGI will be constructed to facilitate supply for the Energy Centre.

The redline boundary includes c. 2.1 km of the existing Tulla Road for connection to sewer.

Two of the 110kV overhead circuits which currently traverse the site will be brought underground to the [existing] Ennis substation as they come on to the site on the eastern side.

Further details of the proposed development are described in Chapter 2 Description of the Proposed Development. The details of the construction and operation of the development in terms of Land, Soils Geology and Hydrogeology is detailed in the Table 5.4 below.

Table 5.1 *Summary of site activities*

Phase	Activity	Description
Construction	Discharge to Ground	Run-off percolating to ground at the construction site.
	Earthworks: Excavation of Superficial Deposits	Excavations and infilling across the site are required for the site preparation and levelling works, to achieve foundation level and facilitate construction, along with arising from the installation of underground services. The project engineers have estimated that c. 111,424 m^3 of material will require excavation for the Data Centre site. This volume comprises topsoil, subsoils, and (eventually) bedrock. It is envisaged that the majority of this material will be reused on site as part of the site levelling works. This will be used as back fill and to establish the proposed landscaping berms. The estimates will be refined prior to commencement of construction. In addition to this there is a net import of suitable engineering fill up to c. 135,600 m^3 for the Data Centre site. These estimates will be refined prior to commencement of construction. Excavation of the proposed attenuation pond to the southwest of the site (proposed lowest surface water capture point within the main development site). The removal of localised overburden material will be required during preparation of the foundations and platform for the proposed structures. The foundations for the main buildings will be a mix of pad foundations and pile foundations to bedrock as required based on identified ground conditions.
	Storage of soils/aggregates	Aggregate materials such as sands and gravels will be stored in clearly marked receptacles within a secure compound area to prevent contamination. Temporary storage of spoil will be managed to prevent accidental release of dust and uncontrolled surface water run-off which may contain sediment and solid matter. Materials will be sent off site for recycling where possible and, if not suitable for recycling, materials will be disposed of to an appropriate permitted/licensed waste disposal facility.
	Storage of hazardous Material	Temporary storage of fuel required for on site for construction traffic. Liquid materials i.e., fuel storage will be located within temporary bunded areas, doubled skinned tanks or bunded containers (all bunds will conform to standard bunding specifications - BS8007-1987) to prevent spillage. These will be stored within the contractor yard.
	Localised Temporary Dewatering	There is no major dewatering works planned during the construction of the data centre site. According to site investigations, levels of groundwater from the aquifer beneath the site would range from approx. 2.73 mbgl (northeast of the site) to approx. 1.39 mbgl (southeast). Therefore, local groundwater ingress can be expected if excavations below c. 2.0 mbgl into rock are required to the southeast of the site, based on the Section 5.3.18 CSM above. It is also expected during the excavation works that localised dewatering of the subsoils will be required to address perched groundwater.
	Increase in hard standing area	The proposed surface water networks for the development collect runoff from roofs, roads and other hard standing areas in a sealed system of pipes and gullies. The proposed development represents an overall increase in hardstanding surfaces of c. 17.3 hectares.

Phase	Activity	Description
		The proposed surface water drainage service to the development comprises various drainage components including positive stormwater networks, attenuation systems and several Sustainable Drainage Systems (SuDS) elements. The proposed surface water drainage was designed in accordance with the SuDS Manual 2015. The developed area of the site is 17.3 ha and attenuation has been designed on site for the 1:100 yr. flood event including consideration of a 20 % allowance for climate change. An overflow subsurface pipeline will discharge at current discharge rates (greenfield) to the Ballymacahill (also referred to Spancelhill) River. Drainage will be to a single lined attenuation pond with an upgradient oil interceptor. An attenuation volume of 15,900 m^3 is designed as part of the proposed development. A continuous datalogger has been installed at the location of the proposed attenuation system/ pond - the reference groundwater monitoring well is BH01 (geotechnical borehole). It is recorded that the difference in water levels at BH01 over the full monitoring period 04/05/2021 to 13/01/2022 was 1.82 metres and this is shown on the hydrograph to lie approx. 2.55m below the proposed basin lower elevation of +12.23mAOD. The water level at this borehole (BH01) location ranged from +7.86 mAOD (September 2021) to +9.68 mAOD (January 2022). Reference is also made here to data reviewed from EPA long-term monitoring wells in Pure-Bedded Limestone (Height Fort Hire station – IE_SH_G_0052_3600_012) in the Limerick area which indicated a variation over the previous 3 months of lowest of approx. +13.37mOD to highest of approx. +13.95mOD; variation of ~0.58m between 25/10/2021 and 18/11/2021. Based on a year’s monitoring data, there is a variation of 1.20 metres for 2021 when comparing winter and summer water levels, with +13.00mAOD the lowest recorded value and +14.20mAOD the highest value.

Phase	Activity	Description
Operation	Storage of hazardous Material	The site is traversed by a high-pressure Gas Networks Ireland gas pipeline. An AGI will be constructed to facilitate supply for the energy centre. In the event of a loss of power supply, the emergency generators are designed to automatically activate and provide power to the data storage facility. The generators will be supplied by low sulphur diesel. Fuel oil for the emergency generators is the only required bulk chemical required on site. Three of the six datacentres in their service yard, will have up to 7 bunded above ground bulk storage tanks for fuel oil (440 m^3 for three data storage facilities), distribution pumps, overground delivery pipeline to the belly tanks for diesel fired standby generators within each data storage facility. The energy centre will have back up fuel storage with up to 20 bunded above ground bulk storage tanks for fuel oil (total of 1,440 m^3 of fuel oil). The total fuel store will be 2900 m^3 or 2,494 tonnes. All bunds will be capable of containing 110% of the volume of the largest drum/tank within the bund or 25% of the total volume of the substance stored and will designed in accordance with the EPA’s guidelines for the storage and transfer of materials for scheduled activities (EPA, 2004). As the oil is only for emergency use and testing, refuelling requirement is low and as such the potential for any leak/spill during delivery and offloading is low. A dedicated tanker unloading area will be provided at each of these service yards which will be surrounded by a drainage channel to capture any run-off. A class 1 oil-water full retention separator will be installed to capture any oil in the run-off from the pad. A standard operating procedure for fuel unloading will be in place at the site and tanks will be fitted with high level alarms to prevent overfilling. The risk to the aquifer is considered low due to the design measures in place for containment, delivery and distribution and use of oil interceptors on the stormwater system downgradient of the offloading area and prior to discharge from the site.

The projected volumes of strip, cut and fill are presented in Table 5.5 below:

Table 5.2 *Projected Earthwork Volumes*

	Volume (m^3)
Cut (incl. Utility Trenches)	111,424
Fill	241,303
Net imported material (granular material, concrete, capping, asphalt, topsoil)	135,600

It is predicted that the majority of the spoil generated during site preparation/levelling will be removed from site with some top soil and spoil used in landscaped and bermed areas.

Chapter 14 Waste Management of this EIA Report contains a detailed description of waste management relating to construction of the proposed development. A detailed Construction and Demolition Waste Management Plan will be prepared prior to construction to ensure best practice is followed in the management of waste from the proposed development.

As outlined in Table 5.4 the activities required for the construction phase of the proposed development represents the greatest risk of potential impact on the geological environment. These activities primarily pertain to the site preparation, excavation, levelling and infilling activities required to facilitate construction of the proposed development.

5.4.2 Do Nothing Scenario

The proposed development land is currently agricultural land; the land is zoned 'enterprise' provides for the use and development of land for high end research and development, business science and technology-based industry, financial services, call centres/telemarketing, software development, data centres, enterprise and incubator units, small/medium manufacturing or corporate office in high quality campus/park type development.' It is likely that the land use will change over time even if this development does not go ahead. The associated impact of any such development will be similar to the proposed development for the underlying land soils and hydrogeological regime.

5.5 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

An analysis of the potential impacts of the proposed development on the land, soils, geology and hydrogeological environment during the construction and operation is outlined below. Due to the inter-relationship between soils, geology and hydrogeology and surface water (hydrology) the following impacts discussed will be considered applicable to both Chapter 5 and 6 (Hydrology) of the EIAR. Remediation and mitigation measures included in the design of this project to address these potential impacts are presented in Section 5.6 below.

5.5.1 Construction Phase

5.5.1.1 Excavation and Infilling

Due to the lack of previous development at the site and the historical residential and agricultural use at the site, the risk of contaminated soils being present onsite is low and this was confirmed by onsite soil sampling and analysis. Nonetheless material, which is exported from site, if not correctly managed or handled, could impact negatively on human beings (onsite and offsite) as well as water and soil environments.

The levelling of the ground and excavation for foundations for the main buildings will require the excavation of topsoil, subsoil and bedrock (where encountered).

Excavated material will be reused on site for infilling and landscaping works where possible. Import of c. 135,600 m^3 of fill will be required.

Site investigation and laboratory analysis has not identified any existing contamination. However, if contaminated soil/water is encountered, it will be required to be removed by a licensed waste contractor.

Therefore, groundwater ingress is not expected, and localised dewatering will not be required during the construction phase – mainly in the eastern section of the building within the competent limestone rock. Minor groundwater strikes may be encountered but this groundwater volume would be minor given the ground condition and nature of the bedrock (competent limestone rock). However, minor groundwater strikes may be encountered but this groundwater volume would be minor given the ground condition and nature of the bedrock. Minor groundwater ingress is expected in the south-western section of the site where the majority of weathered dolomite and karstified limestone bedrock is located. Bedrock is close or at the surface in these areas. Minor dewatering operations will not impact the flow regime of the karst features. It is expected during the excavation works that localised dewatering of the subsoils will be required to address perched groundwater. There will little to no dewatering required in areas of the competent limestone bedrock. Refer to Section 5.3.18 CSM above.

5.5.1.2 Accidental Spills and Leaks

As with all construction projects there is potential for water (rainfall and/or groundwater) to become contaminated with pollutants associated with construction activity. Contaminated water which arises from construction sites can pose a significant short-term risk to groundwater quality for the duration of the construction if contaminated water is allowed percolate to the aquifer. The potential main contaminants include:

- Suspended solids (muddy water with increase turbidity) – arising from excavation and ground disturbance;
- Cement/concrete (increase turbidity and pH) – arising from construction materials;
- Hydrocarbons (ecotoxic) – accidental spillages from construction plant or onsite storage;
- Wastewater (nutrient and microbial rich) – arising from accidental discharge from on-site toilets and washrooms.

Accidental spillages which are not mitigated may result in localised contamination of soils and groundwater underlying the site, should contaminants migrate through the subsoil's and impact the underlying groundwater. Groundwater vulnerability at the site is currently classified as a 'Extreme' to the southwestern section and 'Moderate' to 'High' throughout the rest of the site. Any soil stripping will also further reduce the thickness of subsoil and the natural protection they provide to the underlying aquifer.

5.5.1.3 Potential Blockage of Swallow Holes & Springs

During construction for Data Centre DC6 there is potential for the existing swallow hole that receives water from Tooreen Lough stream flow to become blocked if silt laden run-off is allowed to discharge to it directly.

Similar to the swallow hole at DC6, the main spring located to the immediate north of DC6 may also potentially be impacted from adjacent earthworks (sediment run-off for example) if not protected adequately during construction works.

5.5.1.4 Loss of agricultural land

There will be local loss of agricultural soil however, the area of development is small in the context of the overall agricultural land available in the region. The entire site is also zoned for development. Within the overall context of Ireland's available farmland, the loss is negligible. There will be no impact to mineral resources in the area as a result of the proposed development.

5.5.1.5 Summary of Construction Phase Impacts

A summary of construction phase impacts for the proposed development (with and without mitigation) following EPA (2017) EIA guidelines is provided below.

The magnitude of the impact for the construction phase without mitigation (design) measures is *Temporary* in duration with a *Significant impact* rating to the underlying aquifer and karst features present across the proposed development site.

However, with the implementation of design measures and mitigation measures (Section 5.6 below) for the proposed development site the impact of the construction phase is *Temporary* in duration with an *Imperceptible impact* rating.

5.5.2 Operational Phase

5.5.2.1 <u>Discharge to Ground</u>

There are no discharges to ground included in the design and no abstractions from the aquifer.

5.5.2.2 <u>Increase in hardstanding</u>

The increase in hardstanding (17.3 ha) will result in an increase in run-off rate and potential downgradient flooding, if not adequately attenuated on site. As described in Section 6.4.2.3 above, the design has incorporated adequate attenuation for a 1: 100-year flood event including correction for climate change effects.

Incorporation of hard stand area on previous greenfield area and the use of SUDs techniques will have a minor effect on local recharge to ground; however, the impact on the overall groundwater regime will be insignificant considering the proportion of the site area in relation to the total aquifer area. It is noted that a significant proportion of the site is unpaved, and recharge will continue as current. In addition, where there is no storage of bulk fuel i.e., generator yards, SuDS measures have been incorporated in the design to facilitate recharge to ground.

5.5.2.3 <u>Accidental Spill and Leaks</u>

The development includes the storage and use of diesel fuel which has the potential to have water quality impacts if a leak/ spill occurs and is not adequately mitigated. The design incorporates containment measures and measures for treatment of any spills/ leaks (described in Section 5.6 below).

Any accidental petrol emissions during storage, transfer, or delivery or leakage in the car parks could cause localised contamination if the emissions enter the soil and groundwater environment without adequate mitigation. However, it is noted that any accidental discharge will more likely impact stormwater drainage due to the hardstand and drainage infrastructure proposed and any releases to drainage will be mitigated through petrol interceptors.

5.5.2.4 <u>Summary of the Operational Phase Impacts</u>

A summary of operational phase impacts for the proposed development (with and without mitigation) following EPA (2017) EIA guidelines is provided below.

The magnitude of the impact for the operational phase without mitigation and design measures is *Temporary* in duration with a *Significant impact* rating to the underlying aquifer and karst features present across the proposed development site.

However, with the implementation of design and mitigation measures for the proposed development site the impact of the operation phase is *Long-term* in duration with an *Imperceptible impact* rating.

5.6 REMEDIAL AND MITIGATION MEASURES

The design has taken account of the potential impacts of the development on the land, soils, geology and hydrogeological environment local to the area where construction is taking place]. Measures (including full containment of oil storage areas) have been incorporated in the design to mitigate the potential effects on the surrounding soils, geology and hydrogeology. These are described below.

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

5.6.1 Construction Phase

In order to reduce the potential for any adverse impacts on the existing hydrological environment, a number of mitigation measures will be adopted as part of the construction works on site.

A Construction Environmental Management Plan (CEMP) and Construction Surface Water Management Plan (SWMP) for the site are included with the planning documentation. The contractor will be obliged to work to implement the mitigation measures outlined in the CEMP and SWMP (refer to Chapter 13 of this EIA Report). The CEMP sets out the overarching vision of how the construction of the proposed development will be managed in a safe and organised manner by the Contractor.

The CEMP will be a live document and it will go through a number of iterations before works commence and during the works. It will set out requirements and standards which must be met during the construction stage and will include the relevant mitigation measures outlined in the EIA Report and any subsequent planning conditions relevant to the proposed development.

The SWMP follows 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.

5.6.1.1 Control of Soil Excavation

Site preparation, excavations and levelling works required to facilitate construction of foundations, access roads and the installation of services will require c. 135,600 m^3 of imported material. A total of c. 111,424 m^3 will be excavated during the construction phase. Suitable soils will be reused on site as backfill in the grassed areas, where possible. Contractors shall be required to submit and adhere to a method statement indicating the extent of areas likely to be affected and demonstrating that this is the minimum disturbance necessary to achieve the required works.

Topsoil and subsoil will be excavated to facilitate the construction of the proposed data centre buildings, energy centre building, substation, and other ancillary works. It is envisioned that soil/stones (topsoil & subsoil) arising on the site will be removed from the site and disposed of as a waste or, where appropriate, as a by-product by a licensed contractor. Soil tested and classified as hazardous or non-hazardous in accordance with the EPA *Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous* publication, HazWasteOnline tool or similar approved method. The material will then need to be classified as inert, non-hazardous, stable non-reactive hazardous or hazardous in accordance with *EC Decision 2003/33/EC*.

According to onsite investigations, the bedrock vulnerability is 'Moderate' to 'High' to the central and north-eastern section and 'Extreme' throughout the rest of the site (e.g., towards the south-western section of the site). Removal and reinstatement of subsoil cover will not alter the vulnerability category of the underlying bedrock. The deposition of infill soil would increase the overburden thickness (refer to Table 5.5 above) and thus may even decrease the groundwater vulnerability.

To facilitate the construction of the proposed sewer connection, it is proposed that approx. 2.1Km of the existing Tulla Road will be excavated. As a conservative measure, it is envisioned that the tarmacadam, concrete, and subsoils will be contaminated. Soil tested and classified as hazardous or non-hazardous in accordance with the EPA *Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous* publication, HazWasteOnline tool or similar approved method. The material will then need to be classified as inert, non-hazardous, stable non-reactive hazardous or hazardous in accordance with *EC Decision 2003/33/EC*. The material which is considered hazardous from this alignment for the sewer connection will be removed by a licensed contractor to a registered landfill facility.

Temporary storage of soil will be carefully managed in such a way as to prevent any potential negative impact on the receiving environment and the material will be stored away from any open surface water drains. No soil storing will be allowed within 30 metres of the open water where sufficient working areas are available within the site boundaries, which is in line with Inland Fisheries Ireland guidelines. Movement of material will be minimised in order to reduce degradation of soil structure and generation of dust.

Although there is no evidence of historical contamination in the proposed development area, all excavated materials will be visually assessed for signs of possible contamination such as staining or strong odours. Site investigations classified the subsoils as 'inert'. Should any unusual staining or odour be noticed, samples of this soil will be analysed for the presence of possible contaminants in order 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 disposed of by a licensed waste disposal contractor.

Stockpiles have the potential to cause negative impacts on air and water quality. The effects of soil stripping and stockpiling will be mitigated against through the implementation of appropriate earthworks handling protocols during construction. Stockpiles will be formed within the boundary of the site and there will be no direct link or pathway from storage areas to any surface water body. Overburden material will be protected from exposure to wind by storing the material in sheltered parts of the site, where possible.

5.6.1.2 Sources of Fill and Aggregates

All fill and aggregate for the proposed development will be sourced from reputable suppliers. All suppliers will be vetted for:

- Aggregate compliance certificates/declarations of conformity for the classes of material specified for the proposed development;
- Environmental Management status; and
- Regulatory and Legal Compliance status of the Company.

5.6.1.3 Fuel and Chemical Handling

Any fuels or chemicals (including hydrocarbons or any polluting chemicals) will be stored in a designated, secure bunded area(s) within the designated contractor's compound to prevent any seepage of potential pollutants into the underlying subsoil and bedrock.

All mobile fuel bowsers shall carry a spill kit and operatives must have spill response training. All fuel containing equipment such as portable generators shall be placed on drip trays. All fuels and chemicals required to be stored on-site will be clearly marked. Care and attention will be taken during refuelling and maintenance operations. Particular attention will be paid to gradient and ground conditions, which could increase risk of discharge to waters.

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 within the contractor's compound. Oil and fuel storage tanks 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 within the contractor's compound which will be away from surface water gullies or drains. 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 storm water to the underlying subsoil. Wash down and washout of concrete transporting vehicles will take place at an appropriate facility offsite and no washing of concrete from vehicles will be done on site.

In the case of drummed fuel or other chemical 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 are required to be outlined in the detailed CEMP. All personnel working on the site will be suitably trained in the implementation of the procedures, and upskilled where necessary.

5.6.1.4 Accidental Spills

A robust and appropriate Spill Response Plan and Environmental Emergency Plan will be prepared prior to works commencing and they will be communicated, resourced and implemented for the duration of the works. Emergency procedures/ precautions and spillage kits will be available and construction staff will be trained and experienced in emergency procedures in the event of accidental fuel spillages.

Machinery activities on site during the construction phase may result in contamination of runoff/ surface water. Potential impacts could arise from accidental spillage of fuels, oils, paints etc. which could impact surface water if allowed to infiltrate to runoff to surface water systems and/or receiving watercourses. However, implementation of the mitigation measures detailed below will ensure that this does not occur.

Concreting operations carried out near surface water drainage points during construction activities could lead to discharges to a watercourse. Concrete (specifically, the cement component) is highly alkaline and any spillage to the underlying subsoil and aquifer bedrock would be detrimental to water quality and local fauna and flora. However, employment of the mitigation measures highlighted above and within the CEMP will ensure that any impact will be mitigated.

5.6.1.5 Protection of Hydrological / Hydrogeological Water Features

This section describes the specific mitigation measures implemented during construction for the protection of the existing identified surface water features and maintaining the existing surface water drainage system. Given the interconnectivity between the identified surface water features and groundwater type features in what is a karst environment then all mitigation measure which apply to hydrogeology will also apply to hydrology (Refer to Chapter 6, Section 6.6).

These measures will be implemented in association with the measures described above to ensure the protection of all hydrological [and hydrogeological] attributes. Mitigation measures are further discussed in the CEMP and SWMP for the development.

Tooreen Lough

There will be no construction works carried out within Tooreen Lough. There will be no oil or subsoil storage in the vicinity of this feature. An ecological buffer of at least 10 metres applies to this feature.

It is proposed that that overland stream discharging from Tooreen Lough will be culverted. The culvert will be designed in accordance with *Section 50 of the Arterial Drainage Act, 1945*, as amended and the overground pipe will be adequately designed for winter flows. This will ensure continued conveyance of existing flows without any upgradient or downgradient impacts on flow or water quality. The culvert will be adequately sized for current and future flow conditions.

Ardnamurry Lough

There are no construction activities planned for this area and this feature is located upgradient and outside of the redline boundary, along the eastern boundary of the proposed development. Therefore, no mitigation measures are needed for this feature.

Swallow Hole (Receiving water from Tooreen Lough) located south of DC6

Prior to commencement of construction works, the discharge stream from Tooreen Lough and swallow hole will be clearly delineated and marked. The swallow hole will be surrounded by a concrete ring with chamber and accessed by a manhole cover to avoid blockage during works on the site. This swallow hole will be monitored daily to ensure it is free flowing. i.e. ensuring no change to the existing flow regime there.

Main Spring located north of DC6

Prior to commencement of construction works, the spring and areas around this feature will be clearly delineated and marked. There are no proposed construction works within this spring area and a buffer zone of at least 10 metres will be implemented to ensure that the integrity of the spring is protected. Therefore, maintaining the flow and water quality of this spring. Daily to weekly monitoring of the spring in terms of flow and water quality will be recorded during construction phase works.

Furthermore, provision of exclusion zones and barriers (e.g. silt fences) between earthworks, stockpiles and temporary surfaces will be provided to prevent sediment washing into the existing drainage systems and hence protecting the integrity of this feature.

Pond located North of the Energy Centre

There are no construction activities proposed within this feature. It is proposed that the Energy Centre will be built up by infill material and a retaining wall will be built to protect the pond feature. An existing [field dividing] wall is in place and will be protected throughout the construction phase works.

Karst Features - conduits/ flow paths

The building foundations will be a combination of both pad and piled foundations. The subsurface design is based on the nature of the soils and geology identified in the site investigation undertaken in May-June 2021 and presented in Figures 5.16 - 5.21. In areas where karst features (including clay/sand/gravel infilled cavities and/or clay/water infilling of fissures/ voids) were interpreted beneath buildings (DC5 and DC6), then the design of the piling methodology proposed including pile depths/ pile spacing will allow for effective bridging of the existing karst terrain including any such clay/ water infilled features; this approach will ensure no change to the existing groundwater flow regime across the site. Relevant subsurface designs are provided within the planning drawings provided with planning (Drawing reference ART-CSE-ZZ-XX-DR-C-1800).

Further geophysical surveys were carried out across proposed structure DC6 to examine the degree of karstified rock and the potential for clay/water infilled conduits underlying this data centre building. The findings of the geophysical survey (Apex, 2022) fed into the overall foundation design and the construction methodology, i.e. the use of piling as discussed below. The foundation and piling methodology are designed such as to maintain as far as possible the existing groundwater movement at depth at the site. This relates to both the more competent geology as reported by Apex for the general mid to eastern portion of the site as well as to the more weathered and dolomitised limestone rock reported to lie mostly within the western extent and over which DC6, and a portion of DC5, will lie.

Groundwater movement is observed from continuous dataloggers (installed to date for approximately 9 months) to flow east to west as indicated in the hydrographs presented in Appendix 5.3 and this would be expected given the degree of weathering reported during the geophysical survey work and spatially across the site boundary. The western part of the proposed development site ties in with the Ballymacahill River and so this is considered as potentially the comparatively more saturated area. The additional geophysical survey near the river has also confirmed the extent of the weathering farther west and towards the river where not previously surveyed.

Piling foundation design has considered the importance of ensuring the continuity of groundwater flow at depth across the site with the key objective of negating/ limiting the impacts otherwise associated with groundwater mounding potential upgradient of other pile types. Refer to drawings 3108-AST-ZZ-00-DR-S-0101 DC6 - Summary Interpretation Map of Soils -Phase I & II, and 3108-AST-ZZ-00-DR-S-0102 DC6 - Summary Interpretation Map of Bedrock Geology -Phase I & II both of which present detailed plan and sections for the DC6 structure in particular.

The piling design has adopted the foundation strategy of piled foundations using 500mm diameter CFA (Continuous Flight Auger methodology), which in turn supports the superstructure using a grillage of pile caps and reinforced concrete ground beams. This construction is located just below the finished floor levels of the buildings (including within engineered site infill) with only the piling columns extending down through the existing site level and into the rock strata below. This methodology also ‘minimises’ below ground disturbance which is an important attribute in karst terrain. One can see from the sections presented in drawings 3108-AST-ZZ-00-DR-S-0101 and 3108-AST-ZZ-00-DR-S-0102 for DC6 -where the bedrock is highly weathered and therefore acting as a ‘porous medium’ for groundwater movement - that the spacing (linear m) of the bored piles will not interfere with any groundwater flows. The use of CFA as a piling methodology is very different to other contiguous methodologies such as secant or sheet piling in that the CFA will not create a ‘barrier’ to the natural/ existing flow regime but rather ensure that the natural hydraulic conditions are maintained. The piling column lateral separation has been set as far apart as possible – ranging from 3 metres to 12 metres below DC6 and therefore prevents any upgradient mounding effects. Furthermore, the CFA piling operation itself, restricts ‘concrete overfill’, within the supporting rock strata.

Therefore, the piling below the footprint of DC6 (and DC5) will have negligible impact on groundwater movement potential beneath the data centre building(s).

Ponds located North of the DC4

There are no construction phase activities proposed within these two (2) no. features. However, the proposed Data Centre building DC4 is located in close proximity. It is proposed that the DC4 structure will be ‘built up’ using engineered infill material.

As previously discussed, there will be no stockpiling of subsoil/ rock matrix by this feature as well as fuel storage -fuel will be adequately stored in effective bunds located within the contractor compound. Provision of exclusion zones and barriers (e.g. silt fences) between earthworks, stockpiles and temporary surfaces to prevent sediment washing into the existing drainage systems like this feature and hence protecting the integrity of this attribute.

5.6.1.6 Control of Water during Construction

Care will be taken to ensure that exposed soil surfaces are stable to minimise erosion. All exposed soil surfaces will be within the main excavation site, which limits the potential for any offsite impacts.

Should any discharge of construction water be required during the construction phase, discharge will be to foul sewer. Pre-treatment and silt reduction measures on site will include a combination of silt fencing, settlement measures (silt traps, 20 m buffer zone between machinery and watercourses, refuelling of machinery off site) and hydrocarbon interceptors.

Any minor ingress of groundwater and collected rainfall in the excavation will be pumped out during construction. It is estimated that the inflow rate of groundwater will be low and limited to the northeast of the site. It is therefore proposed that the water be discharged via the existing stormwater sewer network. Extensive monitoring will be adopted to ensure that the water is of sufficient quality to discharge to the sewer. The use of slit traps and an oil interceptor (if required) will be adopted if the monitoring indicates the requirements for the same with no silt or contaminated water permitted to discharge to the sewer. 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 subsoils and the relative shallow nature for excavations, infiltration to the underlying aquifer is not anticipated.

The management of surface water runoff is further discussed in Chapter 6 Section 6.6 and the project-specific Surface Water Management Plan (SWMP) attached to this EIA Report.

5.6.2 Operational Phase

5.6.2.1 Emergency Response Procedures

As normal for a development site of this type, all staff will be suitably trained in emergency response procedures and standard operating procedures (SOPs) to respond to an on-site fuel spillage incident. All employees will be provided with such equipment, information, training and supervision as is necessary to implement the emergency response procedures and SOPs.

5.6.2.2 *Environmental Procedures*

Containment measures are included within the design to reduce potential for environmental impact. There will be comprehensive emergency response procedures and SOPs to respond to chemical/ oil spillage of all types. All employees will be provided with such equipment, information, training and supervision as is necessary to implement the emergency response procedures and SOPs.

5.6.2.3 Fuel Storage

The provision of spill kit facilities and training of operatives in use of same; should be undertaken at the operational stage in order to manage any leaks from fuel storage and vehicles resulting in soil and/or groundwater quality impacts:

All bunds will be capable of containing 110% of the volume of the largest drum/tank within the bund or 25% of the total volume of the substance stored and will designed in accordance with the EPA's guidelines for the storage and transfer of materials for scheduled activities (EPA, 2004). As oil is only required for emergency operation only and testing, refuelling requirement is very low therefore the risk from tanker movement is low. A dedicated tanker unloading area will be provided at each of these service yards which will be surrounded by a drainage channel to capture any run-off. A class 1 oil-water full retention separator will be installed to capture any oil in the run-off from the pad. A standard operating procedure for fuel unloading will be in place at the site and tanks will be fitted with high level alarms to prevent overfilling.

The storage of fuel oil for the emergency generators should be restricted to the generator yard, the bulk fuel tanks, and belly tanks should be bunded, and the over ground delivery pipeline double-lined. The final design for the diesel storage will be contained within a bunded area in line with the requirements of the *Guidance to Storage and Transfer of Materials for Scheduled Activities* (EPA, 2005).

In terms of the risk to the underlying aquifer (with connectivity to surface water features) this is considered low due to the mitigation in place for containment, delivery and distribution and use of oil interceptors on the stormwater system downgradient of the off-loading area and prior to discharge from the site.

5.6.2.4 Management of Surface water during Operation

The proposed development will provide full attenuation for increase in hardstand area in compliance with the requirements of the Greater Dublin Strategic Drainage Study. The proposed surface water drainage service to the development comprises various drainage components including positive stormwater networks, attenuation systems and several Sustainable Drainage Systems (SuDS) elements. The proposed surface water drainage was designed in accordance with the SuDS Manual 2015. This is further detailed in Chapter 6 Hydrology of this EIA Report.

5.6.2.5 Protection of Surface Water Features

Intermittent and on-going inspection and maintenance of the swallow hole south of DC6 discharge from Tooreen lough will be undertaken to ensure free flowing discharge to Ballymacahill River along the western boundary of the proposed development.

5.7 CUMULATIVE IMPACT ASSESSMENT

The cumulative impact of the proposed development with any/all relevant other planned or permitted developments (as described in Chapter 3 Appendix 3.1)) are discussed below.

5.7.1 Construction Phase

The potential for impact on land, soils and groundwater during construction primarily arises from accidental leaks and spills to ground or dewatering. The proposed development does not require dewatering and with the proposed mitigation in place (as outlined in Section 5.6) for management of accidental discharges, the effect due to construction in this area is considered to be a *neutral* on quality and an *imperceptible* significance. Contractors for the proposed development will be contractually required to operate in compliance with the CEMP which includes the mitigation measures outlined in this EIA report. The other developments considered, which are identified in Chapter 3 and Appendix 3.1 will also have to incorporate measures to protect soil and water quality in compliance with legislative standards for receiving water quality. As a result, there will be no cumulative potential for change in soil quality or the natural groundwater regime. The cumulative impact is considered to be *neutral and imperceptible*.

5.7.2 Operation Phase

Overall, there will be a local change in recharge to ground pattern due to the increase in hardstand from these proposed and planned developments. However, based on the overall size of the underlying aquifer and measures to protect soil and water quality there will be no overall change on the groundwater body status. The operation of the proposed development is concluded to have a *long-term, imperceptible* significance *with a neutral* impact on soil and water quality.

The proposed development includes design measures to protect against any accidental discharges to ground e.g. adequate containment measures for oil storage, use of hardstand in loading areas and drainage through oil interceptors. As such the impact will be *neutral* and *imperceptible* in relation to soil and water. The other developments considered, which are identified in Chapter 3 and Appendix 3.1, will be required to manage sites in compliance with legislative standards for receiving water quality. As such the cumulative or in-combination impacts are concluded to be *neutral* and *imperceptible* in relation to soil and water.

Overall, there will be a loss of agricultural land which is in line with the zoning of the area therefore the cumulative impact on land is considered to be *long-term neutral* and *not significant.*

5.8 RESIDUAL IMPACTS OF THE PROPOSED DEVELOPMENT

5.8.1 Construction Phase

The implementation of mitigation measures outlined above (Section 5.6) will ensure that the predicted impacts on the geological and hydrogeological environment do not occur during the construction phase and that the residual impact will be **short-term-imperceptible-neutral**. Following the TII criteria (refer to Appendix 5.1) for rating the magnitude and significance of impacts on the geological and hydrogeological related attributes, the magnitude of impact is considered **negligible**.

5.8.2 Operational Phase

The implementation of the design and mitigation measures highlighted above (Section 5.6) will ensure that the predicted impacts on the geological and hydrogeological 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 5.1) for rating the magnitude and significance of impacts on the geological and hydrogeological related attributes, the magnitude of impact is considered **negligible**.

5.9 MONITORING OR REINSTATEMENT

5.9.1 Construction Phase

During construction phase the contractor will be obliged to undertake monitoring in compliance with the SWMP and CEMP this will include:

- Regular inspection of surface water run-off and sediments controls e.g. silt traps will be carried during the construction phase.
- Weekly checks will be carried out to ensure surface water drains are not blocked by silt, or any other items, and that all soil storage is located at least 10 metres from the nearest surface water receptors. A regular log of inspections

will be maintained, and any significant blockage or spill incidents will be recorded for root cause investigation purposes and updating procedures to ensure incidents do not re-occur.

- Regular inspection of construction mitigation measures will be undertaken e.g. concrete pouring, refuelling etc.
- Regular monitoring of the silt traps/ trenches/ fences around established buffer zones to ensure on-going protection of all hydrological and hydrogeological water attributes.
- Soil sampling to confirm disposal options for excavated soils.

5.9.2 Operational Phase

There will be no requirement for groundwater monitoring as there is no likely discharge to ground. Maintenance of the surface water drainage system and foul sewers as per normal urban developments is recommended to minimise any accidental discharges to ground.

6.0 HYDROLOGY

6.1 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.

6.2 METHODOLOGY

6.2.1 Criteria for rating of effects

This chapter evaluates the effects, if any, which the proposed development will have on Hydrology as defined in the Environmental Protection Agency (EPA) 'Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports' (EPA, 2017). The Draft EPA document entitled '*Advice Notes for Preparing Environmental Impact Statements'* (EPA, 2015) is also followed in this hydrological assessment and classification of environmental effects. In addition, the document entitled '*Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes'* by the National Roads Authority' (NRA, 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 EIAR 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 Draft EPA Guidelines (2017) publication).

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 TII criteria for rating the magnitude and significance of impacts and the importance of hydrological attributes at the site during the EIA stage are also relevant in assessing the impact and are presented in Tables 1-3 in Appendix 6.1.

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.

6.2.2 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. Envision water quality monitoring data for watercourses in the area;
- River Basin Management Plan for Ireland 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.floodmaps.ie);
- South Dublin City Council (2005), Greater Dublin Strategic Drainage Study: Technical Documents of Regional Drainage Policies. Dublin: Dublin City Council; and
- 'Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors' (CIRIA 532, 2001);
- National Parks and Wildlife Services (NPWS) – Protected Site Register.

Site specific data was derived from the following sources:

- Engineering Planning Report – Drainage and Water Services. Art Data Centre. Clifton Scannell Emerson Associates (CSEA) (January 2022);
- Flood Risk Assessment. Art Datacentre Ennis. Clifton Scannell Emerson (January 2022);
- Report on the Geophysical Investigation for the Project Art Data Centre, Ennis, Co. Clare. Apex Geophysics (Apex). Report Reference – AGP21033_Phase III_01. (January 2022).
- Construction Environmental Management Plan. Art Data Centre Ennis. AWN Consulting (January 2021) which includes a Surface Water Management Plan for the Construction Phase prepared by (CSEA) (January 2021)
- Art Data Centre – Ennis Campus Clarification document, CSEA May 2022 file no 20_110MEMO-20_110-001
- Various design site plans and drawings; and
- Consultation with design engineers.

6.3 RECEIVING ENVIRONMENT

The following section describes the receiving environment in terms of current land use, local and regional hydrological features and surface water quality, flood risk and areas of ecological importance. A summary of the hydrological attributes and importance rating of same (following TII, 2009 criteria) is presented at the end of the section -this will be used as part of the impact assessment covered in Section 6.5 below.

6.3.1 Site Setting & Land Use

The receiving environment is discussed in terms of surface water hydrology including potential for existing and historical contamination. The proposed development site is c. 55 hectares (ha) in area and is located to the east of Ennis in the townland of Tooreen and Cahernalough, Co. Clare. The lands are bordered to the south by the R352 (Tulla Road) and to the west by the M18 national route. The lands are traversed by a [transmission] gas pipeline running south to north towards the eastern site boundary as well as overhead powerlines running east to west and which connect to the existing Ennis 110kv substation that adjoins the south-western boundary.

The site is used for agricultural purposes currently and comprises a series of irregularly shaped fields divided by hedgerows and ditches typical of a rural setting. A number of existing dwellings and farm outbuildings are present within the development boundary. A number of these structures will be retained, and some will be demolished as part of the proposed development of the site.

6.3.2 Topography

The topographical gradient across the development boundary is quite variable mostly due to the drumlin type features present. Overall, the ground level generally falls from east to west/ southwest with an elevation of approx. +15mOD (metres above Ordnance Datum) in the west and +46mOD in the east.

The topographical low points are generally to the southwest where the Ballymacahill River crosses the M18 road. Here, elevations within the range of +7.0mOD to +8.0mOD are recorded. Farther to the east, the general [lake edge] elevation of the Tooreen Lough lies at approx. 14.2mOD. Beyond the eastern site boundary, the Ardnamurry Lough to the immediate north of the R352 lies at approx. +27.5mOD to +28.0mOD with the discharge via the swallow hole to the south of the R352 lying at an elevation of approx. +26.5mOD to +26.0mOD.

6.3.3 Regional & Local Hydrology

Regional Hydrology

The subject site is located within the former Shannon Estuary North River Basin District (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).

According to the EPA (2021) on-line mapping, the proposed development site lies within the Shannon Estuary North Catchment (Hydrometric Area No. 27) and the River Fergus sub-catchment (refer to Figure 6-1 below).

Regional surface water drainage near the proposed development boundary includes the Ballymacahill (EPA ref: Spancelhill) River to the north/ west of the site boundary. The Ballymacahill River generally aligns with the full western site boundary with only a section of the river (to the immediate east of the M18 road) shown to lie within the south-western boundary of the site. The river flows in a NE to SW direction crossing beneath the M18 road. The river converges with the River Fergus c. 3.0Km farther to the SW and the River Fergus ultimately discharges into the Shannon Estuary at the Lower River Shannon Special Area of Conservation (SAC) located >7.0Km downstream of the site.

Note: The perimeter of the Lower River Shannon SAC extends upstream along the River Fergus towards Ennis and approx. 2.1 km southwest of the site. Therefore, the proposed development has direct connectivity to the Lower River Shannon SAC via the Ballymacahill River feature to the west.

In terms of regional drainage, generally all identified water courses tend to drain in a northeast to southwest orientation (refer Figure 6-1 below). This would also indicate a general interpreted NE-SW groundwater flow orientation (refer Chapter 6 Land, Soil, Geology & Hydrogeology).

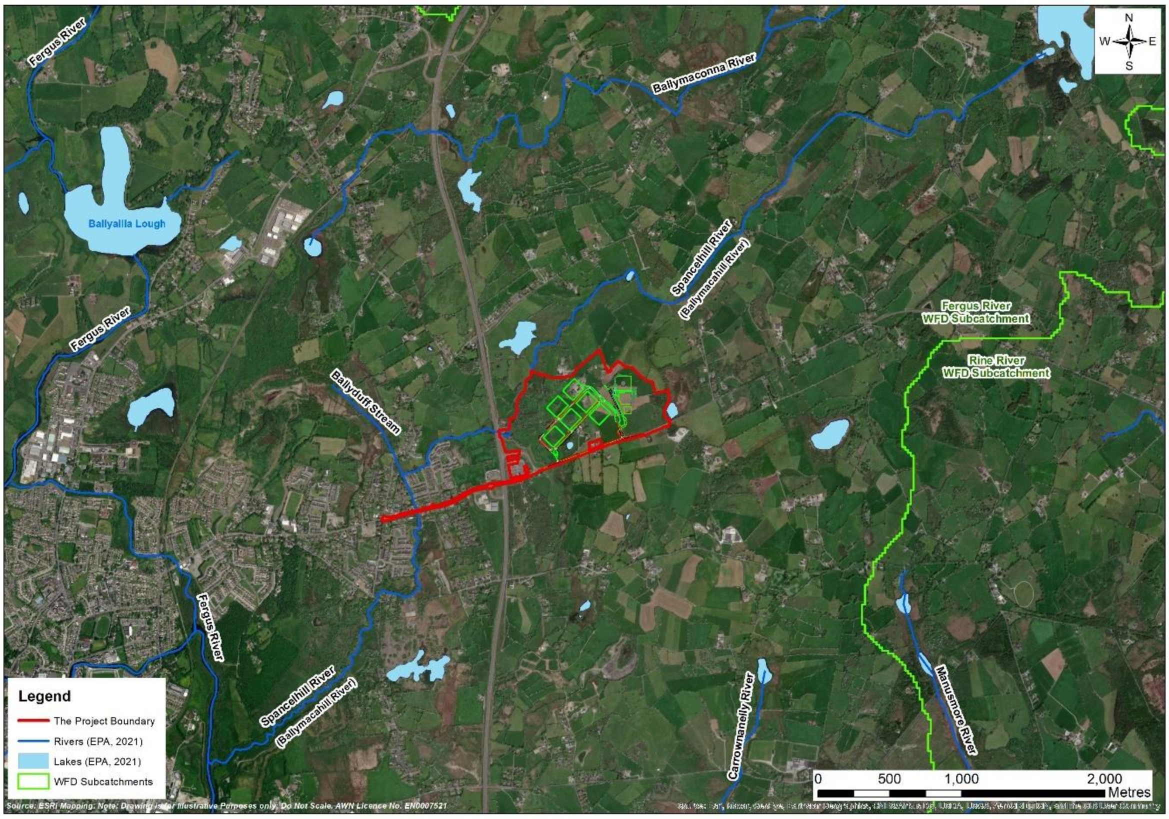


Figure 6-1 *Hydrological Setting and Site Boundary (Source: EPA, 2021)*

Local Hydrology

Drainage within the site boundary comprises a feature lake, a number of ponds, swallow holes and spring discharges, which ultimately discharges to the Ballymacahill River. Local drainage at the proposed development site is typical of a karst environment.

Spring discharges have been identified mainly to the west of the site and include a spring to the immediate east of Tooreen Lough discharging to this feature, and a spring to the NW of the lough which receives groundwater from a swallow hole located farther east and south of the R352 road (this water is discharged from the Ardnamurry Lough wetlands located adjacent to the eastern site boundary line -refer to Figure 6-2 below). It is likely, under increased local water levels [head] at the lake, that Tooreen Lough ultimately discharges into the Ballymacahill River under gradient flow observed in the field as both at surface and possibly through gravelly subsoils located between the lough and the river. Local drainage would also typically follow the topographical decline in gradient recorded from east to west/ southwest (refer also to Figure 6-2 below). Refer to Section 5.3.16 in Chapter 5 for groundwater and surface water interactions discussion.

Site walkovers conducted by AWN in March, April, and May 2021 included a visual inspection of the local drainage network and features across site. These features are encapsulated in Figure 6.2 below and include some seepages/ springs with intermittent or ephemeral characteristics which discharge into what are surface streams that ultimately discharge towards the Ballymacahill River running along the western/ southwestern boundary of the site.

Local drainage within the development boundary is further defined in Section 6.3.4 (Lakes) and Section 6.3.5 (Ponds) below.

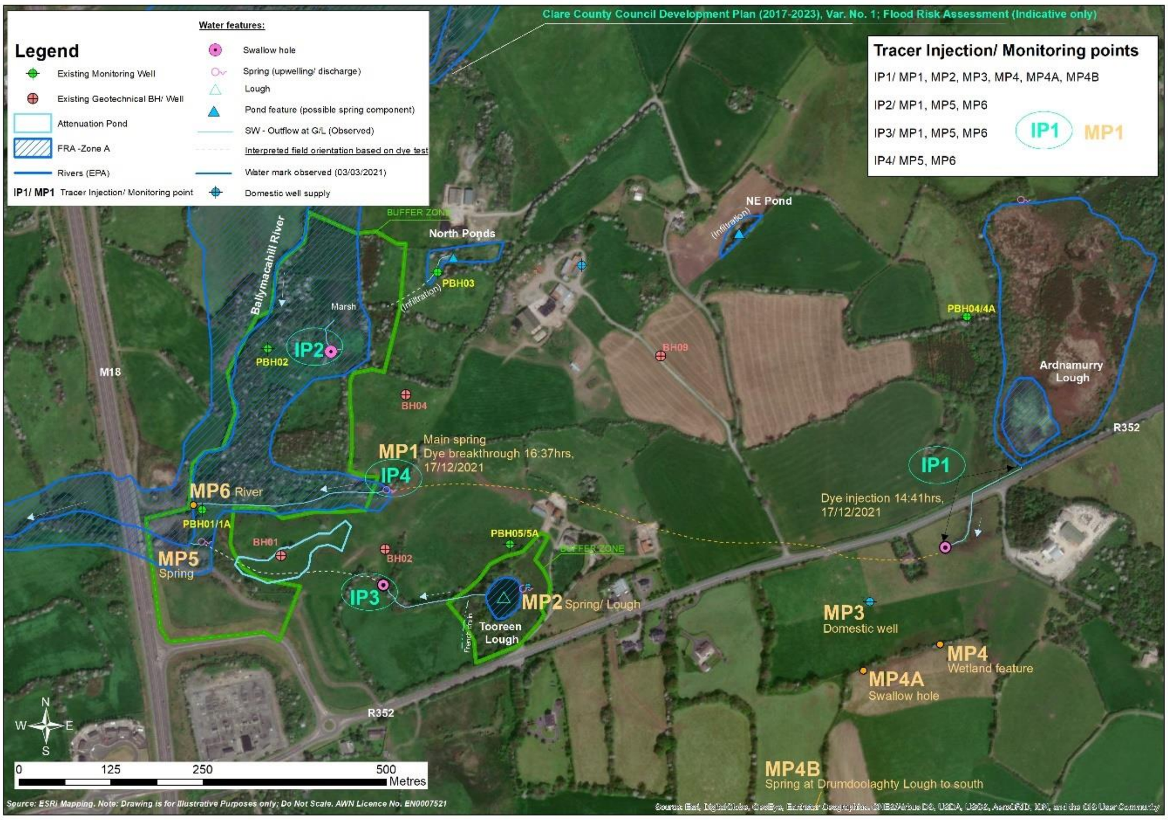


Figure 6-2 Site Location and Local Drainage

6.3.4 Lake Features

There are two lake features, refer to Figure 6-2 above. These lakes are called Tooreen Lough and Ardnamurry Lough and are located along the southern boundary with the R352 road and outside the eastern boundary of the site, respectively.

These lakes are primarily collected surface water within low lying depressions but are also fed by groundwater. A spring is located to the immediate east of Tooreen Lough and is likely discharging into this feature. The spring is also a local groundwater supply point for nearby residents and its presence indicates some continuity of upwelling effects in terms of supplying this well point. Farther to the east at Ardnamurry Lough, groundwater seepages (described in [GeoHive] historical 6" mapping for the area (OSi, 2021) as 'Rises') were recorded by AWN (March and May 2021) and are located to the north of the lough feature. It is therefore interpreted that the feature receives a component of groundwater inflow in addition to meteoric recharge in the wider area which drains towards this locally low wetland feature.

Tooreen Lough overflow water is recorded as discharging as stream flow to the immediate northwest/ west with the stream mainly flowing westwards towards an identified swallow hole located two fields across. Surface water discharges to ground at this point with an obvious [acoustically observed] 'drop' in water level below ground.

This discharge is interpreted to ultimately drain towards a spring observed with 'overburden outflow' located farther west near the Ballymacahill River into which this outflow water finally discharges.

Tooreen Lough is not connected to the swallow hole located south of Tulla Road. No emergence of dye was noted here including on 17/12/2021. Tooreen Lough is likely fed by a smaller 'spring' which is located adjacent to the water feature. Tooreen Lough is directly connected to a nearby swallow hole which regulates the water levels in the lough (see also **Appendix 5.3 Chapter 5** hydrograph for SP2). Tooreen Lough discharges at ground level to the west before the water flow enters the nearby swallow hole (IP3) which effectively regulates the water levels in the lough. This is confirmed by the information gathered from the data logger installed at SP2.

Continuous datalogging of water levels in Tooreen Lough indicates a range from +14.24 mAOD (May 2021) to +14.51 mAOD (December 2021), i.e. very little variation in water levels due to the nearby swallow hole from which Tooreen Lough water discharges to the west towards the Ballymacahill River. No connection is recorded between this swallow hole (IP3) and the main spring (IP4).

Refer to Appendix 5.3 in Chapter 5 for hydrograph data for Tooreen Lough (SP2).

The swallow hole located farther east and south of the R352 road (this water is sourced from the wetlands at Ardnamurry Lough) is interpreted as discharging westwards crossing the R352 at a point where 'possible karstified Limestone' is reported by APEX (2022) as Feature 8.1 through which the transmission gas main also runs. This feature is interpreted as 5-6m in depth and discussion with the landowner indicated significant groundwater in the area during the excavation for the gas main installation. Where (b) represents a potential [groundwater] flow path then this water is interpreted to flow westwards beneath the proposed development and ultimately discharging to the main spring located to the northwest of Tooreen Lough. Discharge to the main spring to the northwest of the lough, then this water will feed into the stream flow that ultimately discharges to the Ballymacahill River (refer also Figure 6-2 above). This was confirmed during the most recent dye tracer event in December 2021. following excavation works at the swallow hole to the south of the R352, which created a significant discharge to ground (i.e. approx. 20-30 l/sec inflow rate), the injection of 250g of Fluorescein dye (and de-ionised water) was observed on site at IP4 within <2 hours as presented in **Appendix 5.4 Chapter 5**.

It is noted that the silt laden water resulting from the swallow hole excavation works was also observed at the main spring and sooner than the dye -this is due in effect to the rapid 'slug of water' effect associated with the sudden release of water to ground at the time of excavation.

As mentioned above, dye was <u>not</u> observed within Tooreen Lough during any of the tests completed, indicating a more northern flow path to the north of the lough.

The geophysical survey (APEX, 2022) did not identify these conduits but identified a significant karstic and dolmitised zone which coincides with the swallow holes on the west of the proposed development site. The ecological assessment (Chapter 7) has not identified any specifical groundwater dependent species present at Tooreen Lough.

Insert 6.1 presents [current] imagery of both lake features.

Insert 6. 1 *Tooreen Lough (LHS, April 2021) and Ardnamurry Lough (RHS, March 2021)*

6.3.5 Pond Features

Surface water features within the site boundary comprise a series of ponds to the north/ northeast with interpreted [seasonal/ recharge dependent] infiltration to ground.

There are two (2) no. pond water features of note either within the site boundary or along the site boundary where flooding historically occurs (see Figure 6-2 above). These features are located to the north (northwest of the proposed Data Centre DC4) and northeast (north of the proposed Energy Centre). These features discharge to ground and water fluctuates due to seasonality i.e. with swelling of levels during winter/ wetter months and recession of levels during summer/ drier months as presented in Figure 6-2 above and Insert 6.2 below. These areas are likely to be a combination of groundwater contribution and ponding after rainfall events. All pond features are located in [locally] low lying depressions within the landscape. The ecological assessment (Chapter 7) has not identified any specific groundwater dependent species present.

Based on recent geophysical data (January 2022), the northeast pond is an ephemeral surface water feature with no groundwater influence. Based on the geophysical survey (Line R17/ R18) undertaken here, there is approx. 5 to 7m of overburden comprising Peat/Clay/Silt hence the feature is a capture point for arterial run-off from elevated areas with levels controlled by rainfall, very slow infiltration to ground and evaporation effects.

The north ponds, in contrast, are surface water features with likely groundwater influence. Based on the geophysical survey (Line R26), there is approx. 1.0-1.5 metres of overburden (sandy gravelly Clay – clayey sandy Gravel) below the top pond which discharges into the second pond to the immediate SW. This second pond discharges to ground with ultimate flow towards the nearby marshy area and the Ballymacahill River.

The Ballymacahill River is the principal drainage feature in the area and flowing in a N-S/SW to W direction. Based on additional extensive geophysical surveys in the area, and assessment of monitored groundwater levels, then it is likely that the river receives baseflow from the underlying rock together with composite discharge from key water features listed above.

The Ballyamachill (Spancelhill) River flows along the north-western boundary of the proposed development site. It flows between two attenuation ponds located within and adjacent to the western section of the proposed development site, before exiting the site through a culvert under the M18 Motorway to Ennis, refer to Insert 6.2 below. Ballyamachill River then flows *c.* 2.1km downstream into the River Fergus, which in turn discharges into the Fergus Estuary *c.* 4.9km downstream. The River Fergus overlaps with the Lower River Shannon SAC where the Ballyamachill River joins the River Fergus, and the Fergus Estuary overlaps with the River Shannon and River Fergus Estuaries SPA *c.* 4.9km downstream.

Insert 6.2 *Culvert under M81 motorway.*

The Dromore Woods and Loughs SAC is located *c.* 4.5km northwest of the proposed development site. A portion of the River Fergus flows through this European site. The River Fergus then flows *c.* 9.3km downstream, via Ballyallia Lough SAC, and combines with the outfall of the River Fergus that connects with the Ballyamachill River, upstream of this.

There is therefore a hydrological link between the proposed development site and European sites therein.

6.3.6 Surface Water Quality

The proposed development is located within the former Shannon Estuary North River Basin District (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). lies within the Shannon Estuary North Catchment (Hydrometric Area 27) and the River Fergus sub-catchment (refer to Figure 6.1 above).

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 Eastern River Basin District (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 proposed development is situated within the administrative area of Clare County Council. The Planning and Development policy framework with which the proposed development complies is defined by the Clare County Development Plan 2017 – 2023 (CCDP) and specifically Variation No.1 (adopted March 2019). Variation No.1 was undertaken to give effect 'to the *Government Policy Statement on the Development of Data Centres* in Ireland by identifying, in a plan led manner, the preferred location of a Data Centre in County Clare.' In terms of water quality, Variation No. 1 states that a development must "*maintain and improve water quality, as well as avoid and minimise effects on natural processes in particular natural flood management and catchment processes*".

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

Surface water quality is monitored periodically by the EPA at various regional locations along with principal and other smaller watercourses. The EPA assesses the water quality of rivers and streams across Ireland using a biological assessment method, which is regarded as a representative indicator of the status of such waters and reflects the overall trend in conditions of the watercourse. The biological indicators range from Q5 - Q1. Level Q5 denotes a watercourse with good water quality and high community diversity, whereas Level Q1 denotes very low community diversity and bad water quality.

In relation to the subject site, the nearest active EPA monitoring stations located along the Ballymacahill (Spancelhill) River are:

- Up-gradient monitoring station: 'Bridge NW, near Spancelhill' (EPA Code: RS27S030200): located along the Ballymacahill River c. 1.30Km upstream of the proposed development site. The most recent status recorded by the EPA (2019) is classified as *Q3/ Poor*.
- Down-gradient monitoring station: 'Gaurus Br (Br d/s Aughavaddy Br)' (EPA Code: RS27S030400): located along the Ballymacahill River c. 1.35Km downstream of the proposed development site. The most recent status recorded by the EPA (2019) is classified as *Q3/ Poor*.

Figure 6-3 below presents the location of these EPA quality monitoring points in the context of the proposed development site.

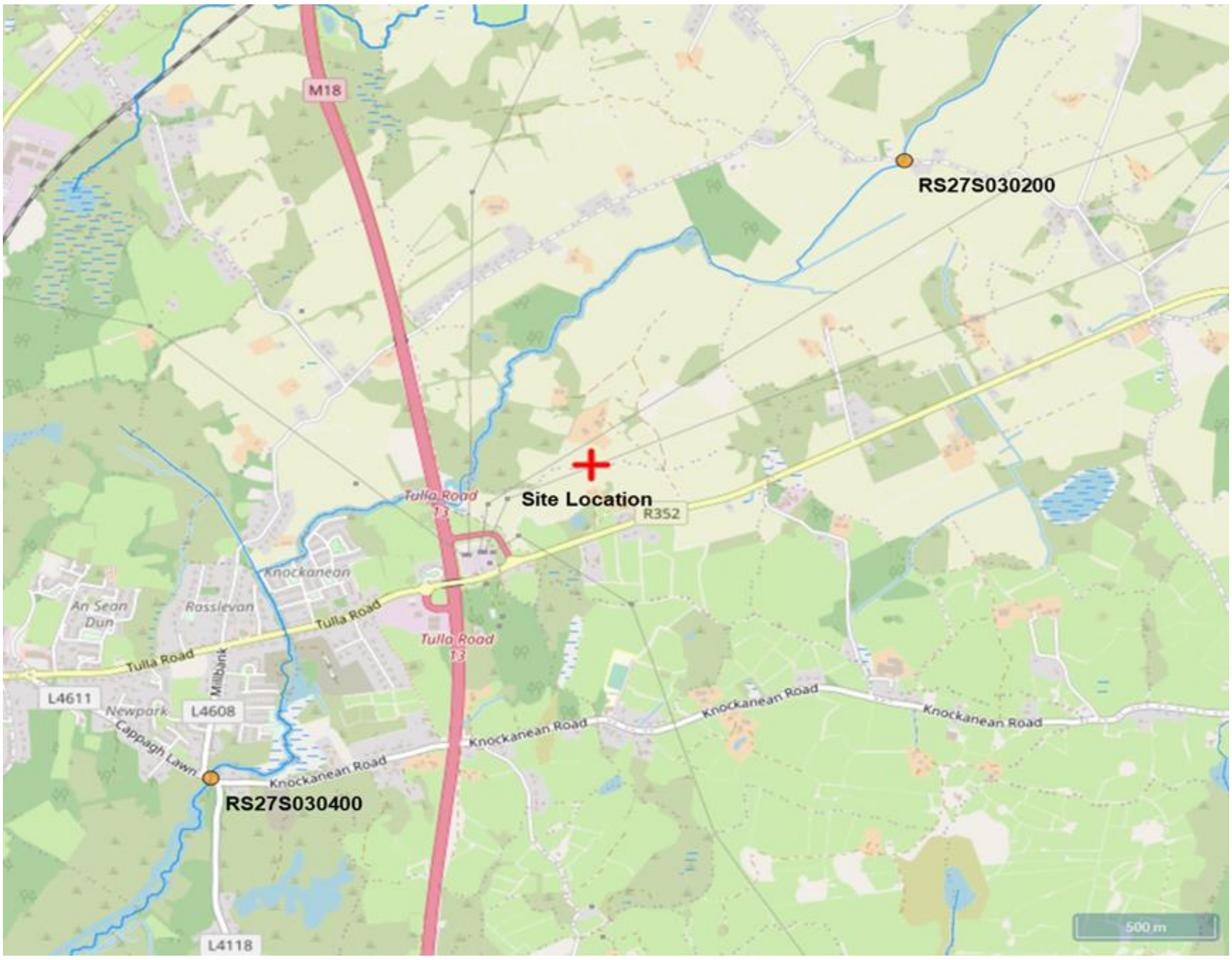


Figure 6-3 *EPA Surface Water Quality Stations (Source: EPA, 2021)*

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. ‘Good status’ means both ‘good ecological status’ and ‘good chemical status’.

The Ballymacahill (Spancelhill) River is currently classified by the EPA as having ‘Poor’ water status and is ‘*At risk of not achieving good status*’. This poor status is related to Anthropogenic Pressures along this waterbody.

Site-Specific Water Quality

The following table presents a summary of baseline field parameters collected at points across the proposed development site. Parameters include for pH, EC -electrical conductivity (uS/cm) and temperature (Deg. C) as well as some manual flow measurements on the date shown.

These sampling points are also shown in Figure 6-2 above.

Table 6. 1 *Summary of Field Parameters*

Feature ID	**General location**	**pH**	**EC (uS/cm)**	**Temp (Deg. C)**	**Comments**
Tooreen Lough	North of R352	08/04/2021 8.50 05/05/2021 8.10	08/04/2021 654 05/05/2021 661	08/04/2021 11.8 05/05/2021 14.6	08/04/2021 Some recession of water mark observed at lake boundary; clear water. 05/05/2021 No further significant recession in water levels observed; clear water
Swallow hole at Tooreen Lough	West of stream discharge from Tooreen Lough	03/03/2021 - 08/04/2021 8.09 05/05/2021 7.80	03/03/2021 642 08/04/2021 632 05/05/2021 715	03/03/2021 7.1 08/04/2021 9.6 05/05/2021 10.5	08/04/2021 Flow estimated at ~2.0 l/sec; very clear
Spring near Ballymachill River	West of swallow hole from Tooreen Lough	05/05/2021 7.30	05/05/2021 703	05/05/2021 13.5	Very slow seepage, clear
Main spring	North-west of Tooreen Lough	03/03/2021 - 08/04/2021 7.67 05/05/2021 7.20	03/03/2021 592 08/04/2021 633 05/05/2021 729	03/03/2021 7.4 08/04/2021 8.4 05/05/2021 10.4	08/04/2021 Flow estimated at ~5.8 l/sec; very clear

GW seepage	North-west (in wooded area)	05/05/2021 7.70	05/05/2021 685	05/05/2021 10.5	05/05/2021 Minimal upwelling and discharge observed
Ponds to North	Main pond to East	05/05/2021 N/A	05/05/2021 N/A	05/05/2021 N/A	05/05/2021 Observed as generally drying out
Spring at Ardnamurry Lough	North of Ardnamurry Lough	08/04/2021 7.47 05/05/2021 7.80	08/04/2021 874 05/05/2021 648	08/04/2021 11.8 05/05/2021 10.8	08/04/2021 Wet conditions observed. 05/05/2021 Observed as generally damp only
Swallow hole from Ardnamurry Lough	South of R352	03/03/2021 7.80 05/05/2021 7.20	03/03/2021 540 05/05/2021 651	03/03/2021 6.0 05/05/2021 10.4	05/05/2021 Flow estimated at ~0.5 l/sec; very clear

Table 6.1 above indicates EC values that would be typical of groundwater (mineralised waters) rather than surface water, and this ties in with the monitored feature types (springs, seepages etc) as presented. Note: While a similar EC profile (~632uS/cm) is presented for the stream water at the point of discharge via the swallow hole to the west of Tooreen Lough and that of the main spring farther to the north, the estimated flow rates for each, in addition to the pH values recorded on 08/04/2021 would infer no connectivity, especially as the flow to the swallow hole is less than that recorded at the main spring discharge.

6.3.7 Flood Risk

According to the Flood Risk Assessment (FRA) carried out by Clifton Scannell Emerson Associates (CSEA, 2022), and the information provided in Art Data Centre – Ennis Campus Clarification document, CSEA May 2022 file no 20_110MEMO-20_110-001there is no risk of flooding affecting the site from fluvial or coastal sources, since the site lies within Flood Zone C (i.e., where the probability of flooding from rivers is less than 0.1% or 1 in 1000). This Flood Risk Assessment report is included with the planning and the flood map extent of the Ballymacahill River (and main spring discharge to the east of this watercourse) is presented in Figure 6-2 above.

A regularly maintained drainage system would ensure that the network remains effective and in good working order should a large pluvial storm event occur. The FRA (CSEA, 2022) also concluded that the proposed development will not increase flood risk potential in any downstream third-party land.

6.3.7.1 Groundwater Flooding with pluvial influence

Groundwater flooding occurs when full storage in the underground aquifer is reached and rainfall (meteoric recharge) cannot discharge quick enough, causing the local water table to rise above the ground surface. According to the Geological Survey of Ireland (GSI), groundwater flooding in Ireland occurs mainly on the limestone lowlands to the west of the Shannon. The prevalence of groundwater flooding in the western counties is fundamentally linked to bedrock geology. The limestone bedrock in these areas has been dissolved over time in a process known as karstification, creating a subterranean network of water-bearing fractures and conduits with limited storage capacity. Surface drainage systems are frequently absent within well-developed karst landscapes. Instead, the groundwater conduit flow system acts as the main drainage mechanism for the region.

The following site-specific data was used to determine the potential of groundwater flooding across the site:

1. CFRAM flood maps.
2. Topography.
3. Walk over survey to assess water level marks and review of historical photographs of surface water features, including lakes.
4. Review of contemporary borehole logs drilled through both the overburden and the underlying bedrock.

These data have been used to assess the potential for groundwater flooding.

The topographical gradient is quite variable across the proposed development. Overall, the elevation falls from east to west/ southwest with detailed elevation of approx. +15mOD (meters above Ordnance datum) in the west and +46mOD in the east. The topography (presence of low-lying depressions) and presence of springs and discharge to ground points (swallow holes) is crucial in determining where groundwater flooding could occur at/ within the proposed development site boundary.

There are four water features of significance either within the site boundary or along the site boundary where historically flooding has occurred (see Figure 6-2). These are: Tooreen Lough to the south (within the proposed development boundary), Ardnamurry Lough farther to the east (outside but adjacent to the eastern site boundary line), and two separate pond features located to the north (2 no. ponds) and northeast (1 no. pond) – both lie within the proposed development boundary.

The two lake features discharge to ground at nearby swallow holes as presented in Figure 6-2 above. Ardnamurray Lough, Tooreen Lough and north ponds are likely to be a combination of groundwater contribution and ponding rainfall. While the northeast pond is an ephemeral surface water feature with no groundwater influence. There is approx. 5 to 7m of overburden comprising Peat/Clay/Silt hence the feature is a capture point for arterial run-off from elevated areas with levels controlled by rainfall, very slow infiltration to ground and evaporation effects. The latter two (i.e., Tooreen Lough and Ardnamurry Lough) are recorded as continuing to discharge during dry spells (observed on site in April/ May 2021). All four features are located within [locally] low-lying depressions within the landscape.

All these water features have been observed to expand in terms of lateral extent seasonally with autumn/ winter flooding and this footprint is generally followed by recession during drier conditions in summertime for example. Figure 6-2 above presents the local drainage map and historical water mark for each of these features. The historical water mark has been defined based on desk review of historical aerial imagery, field mapping of wetland vegetation as well as on the ground marking using fence posts to observe fluctuations in water levels (refer to below for the ponds to the north for example). These water levels are also based on available aerial imagery during high rainfall periods, see Insert 6.4 below. This filling and emptying/ lowering of water levels is likely based on exceedance/ enhancement of storage capacity of the karst conduit system in wetter months in addition to pluvial components.

Insert 6.3 presents [recent] imagery of the recession in water levels at the (2 no.) ponds to the north.

Insert 6.3 *Ponds to the north -Observed recession in water levels April to May 2021*

Water level loggers have also been installed since April 2021 to allow continuous water level monitoring for pre-construction seasonal variation monitoring at Tooreen Lough and the ponds to the north (eastern pond).

Based on available historical aerial imagery, the water level in Tooreen Lough appears to not dramatically fluctuate. The aerial image from February 2009 (significant flood in Ennis Town), flooding is noted in the west and south-west of the site due to the antecedental weather conditions. This is confirmed in the March 2012 aerial photograph where the features to the west and south-west almost recede completely and again, Tooreen Lough does not change, see Insert 6.4 below.

Tooreen Lough is likely fed by a smaller ‘spring’ which is located adjacent to the water feature. Tooreen Lough is directly connected to a nearby swallow hole which regulates the water levels in the lough (see also Appendix 5.3 in Chapter 5 hydrograph for SP2). Continuous datalogging of water levels in Tooreen Lough indicates a range from +14.24 mAOD (May 2021) to +14.51 mAOD (December 2021), i.e. very little variation in water levels due to the nearby swallow hole from which Tooreen Lough water discharges to the west towards the Ballymacahill River. No connection is recorded between this swallow hole (IP3) and the main spring (IP4).

Insert 6.4 *The fluctuation of Tooreen Lough based on high flood and rainfall events.*

In terms of bedrock geology, groundwater flooding is more susceptible in areas where karstification is more prominent than where competent limestone bedrock prevails. Defining the geological setting in which the full site boundary lies is based on a combination of data provided by studies carried out by the GSI as well as based on the site-specific exploratory hole drilling and geophysical studies. These investigations follow best practice and were undertaken in May-June 2021 to provide a comprehensive assessment of the water and soils environment and are described within Chapter 5 Land Soils and Water. Karst limestone with the presence of dolomite as the dominant bedrock geology has been identified in the western and south-western section of the site while more competent limestone rock is interpreted to prevail from the boundary with the karst in the west towards the centre of the site and extending eastwards towards Ardnamurry Lough, refer to Chapter 5 of this EIA Report.

Refer to Chapter 5 (Land, Soils, Geology & Hydrogeology) for further details on the underground connection potential of these features.

6.3.8 Ecology Receptors

As outlined in Chapter 7 (Biodiversity), there are a number of water habitats which are water fed/ maintained. These are described in Section 7.3.2.1. International and national habitats which are dependent on '*no measurable change in the natural water environment'* are summarised as follows:

Table 6. 2 *Ecological attributes within the site boundary*

Alluvial woodland [*91E0] (WN5 Riparian Woodland and WN6 Wet Willow-Alder-Ash Woodland) GW fed	International
Cladium Fen [*7210] (FS1) GW fed	International
Alkaline fen [7230] (PF1 – Rich Fen and Flush)	National
Molinia Meadows [6410] (GS4 Wet Grassland) GW fed	National

The above habitats are presented in Figure 6-4 below and Figure 7.8 of Chapter 7 (Biodiversity) of this EIA Report which shows the level of ecological importance of habitats at the development site. It is noted that an area of International Importance (alluvial woodland) is present at the edge of Fen habitat at Tooreen Lough and along the eastern boundary. Furthermore, the Reed and Large Sedge swamp (Cladium Fen) area is located along the eastern boundary of the proposed development site. Further information on the habitats is discussed in Chapter 7 (Biodiversity) of this EIA Report. There are no specific groundwater dependent species identified with the habitats present. As such the habitats are dependent on influx of flood water (rainwater and or groundwater) only.

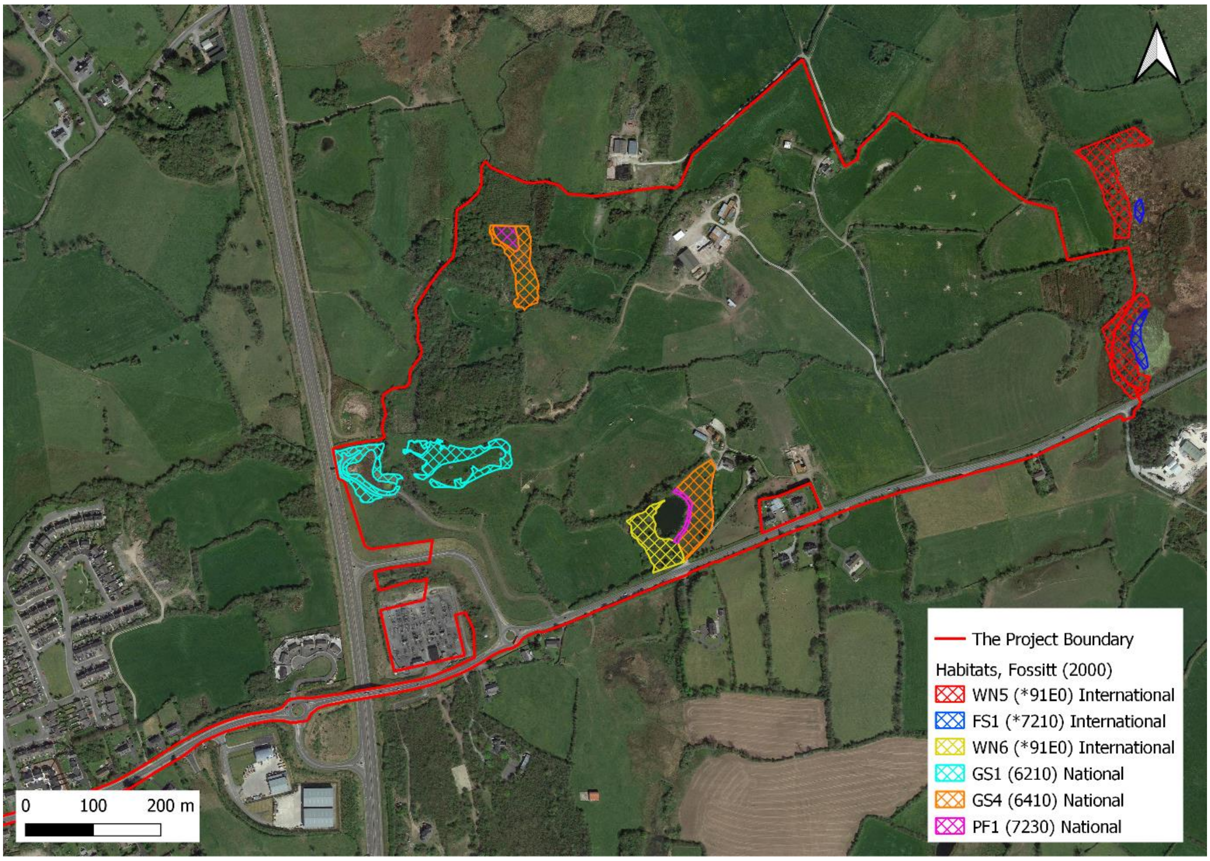


Figure 6-4 *Ecological Features of International and National Importance located within the site boundary.*

Fen type habitat was located in two different areas. These are considered of National Importance according to their species composition and structure.

The small area of rich fen and flush, located in the far northwest of the proposed development site, described as a wetland/pond feature, corresponded to a depression between wooded areas, and are naturally relatively species-rich vegetation communities. It is likely to have formed as a consequence of a lake infilling and can be described as a topogenous fen (i.e. forming in a valley or depression). A more-species-poor fen community occurs bordering on the landward side of reed and tall sedge swamp vegetation at Tooreen Lough.

Fen habitats located within these two particular areas corresponded to the description of the Annex I habitat Alkaline fen [7230], which are described as '*Wetlands mostly or largely occupied by peat- or tufa-producing small sedge and brown moss communities developed on soils permanently waterlogged, with a soligenous or topogenous base-rich, often calcareous water supply, and with the water table at, or slightly above or below, the substratum…*' within the Interpretation Manual of European Union Habitats (European Commission, 2013). The examples of rich fen and flush habitats within these two areas are considered to be of National Importance.

The areas of oak-ash-hazel woodland and immature woodland in the northwest, Tooreen Lough, the alluvial woodland (*91E0), Molinea meadows (6410) and alkaline fen (7230) surrounding Tooreen Lough and in the north west, and calcareous grassland (6210) adjacent to the attenuation pond by the M18 Motorway, will be protected as 'Ecological Buffer Space' designated by Clare County Development Plan Variation No. 1. These areas will be retained, protected from development and will not be directly impacted from the development.

The wetland in the north of the site will also not be impacted by the proposed hardstand footprint of the development.

6.3.9 Fisheries

Fish species are protected under the Fisheries Acts and by fishing by-laws. Atlantic salmon, river lamprey and the brook lamprey are listed on Annex II of the EU Habitats Directive. Electrofishing surveys were not carried out as part of the field surveys.

The proposed development site lies within the Fergus_SC_040 catchment. The EPA segment of the Spancelhill Stream which is contained within the study area is Spancelhill_010. Spancelhill_010 segment is c. 7.5km and consists of the channel of the Spancelhill Stream from its starting point in O'Briens Big Lough, to where it joins the River Fergus downstream of the proposed development site. The Spancelhill Stream and the River Fergus have not been surveyed by Inland Fisheries Ireland (IFI) for their Ecological Fish Status. There are five Annex II fish species found within the Lower River Shannon SAC, i.e., sea lamprey Petromyzon marinus, brook lamprey Lampetra planeri, river lamprey Lampetra fluviatilis, Atlantic salmon Salmo salar and twaite shad Alosa fallax, the four former species of which are Qualifying Interests of the SAC. The three lamprey species and Atlantic salmon have all been observed to be spawning in the Lower Shannon and its tributaries (NPWS, 2013d). There was one fish species record, sea lamprey, identified within c. 2km returned from the desk study.

Note: While fish surveys were not carried out in the waterbodies within the proposed development site boundary, both Tooreen Lough and the M18 Attenuation Pond have potential to hold populations of small fish species.

6.3.10 Areas of Conservation

According to the NPWS (2021) on-line database there are no special protected areas on or in the vicinity of the subject site. The closest European listed sites are as follows;

- Lower River Shannon Special Area of Conservation (SAC) (site code 002165) - circa. 2.1 km to the southwest of the site.
- Ballyallia Lake SAC and proposed National Hertiage Area (pNHA) (site code: 000014) - circa. 2.3 km to the west of the subject site.
- Ballyallia Lake Special Protection Area (SPA) (site code: 004041) - circa. 2.8 km to the northwest of the subject site.
- Newpark House (Ennis) pNHA (site code: 000061) - circa. 1.6 km to the southwest of the site.

A potential source-pathway-receptor (SPR) link exists between the proposed development site and the following European sites: Lower River Shannon SAC and River Fergus and River Shannon Estuaries SPA. This link is via the Ballymacahill (Spancelhill) River which flows along the north-western boundary of the proposed development site, flowing downstream before joining the River Fergus and finally discharging into the Fergus Estuary. The Dromore Woods and Loughs SAC is located

c. 4.5km northwest of the proposed development site and is upstream of the proposed development. A portion of the River Fergus flows through this European site. The River Fergus then flows c. 9.3km downstream, via Ballyallia Lough SAC, and combines with the outfall of the River Fergus that connects with the Ballymacahill River, upstream of this. There is therefore a hydrological link between the proposed development site and European sites therein.

Figure 6-5 below presents the location of these protected areas in the context of the subject development site.

Figure 6-5 *Natura Sites in the Context of the Subject Site (Source: NPWS, 2021)*

6.3.11 Rating of Importance of Hydrological Attributes

Based on the TII methodology (2009) (See Appendix 6.1) the importance rating of the hydrological features within the development boundary site is presented in Table 6. 3 below.

Table 6. 3 *Summary of Hydrological Evaluation of Identified Attributes*

Hydrological Feature	Importance of Attribute	Comment
Ardnamurry Lough	Medium to High	Based on habitat / ecological evaluation
Tooreen Lough and associated spring and swallow hole.	Medium to High	Based on habitat / ecological evaluation.
Pond to the North-East	Low	Based on habitat / ecological evaluation.
Ponds to the North	Low	Based on habitat / ecological evaluation.
Spring / seepage in wooded area to the east of Ballymacahill River	Medium to High	This feature is considered low to Medium to High with potential

Hydrological Feature	Importance of Attribute	Comment
		connection to the Ballymacahill River and therefore the Lower Shannon River SAC downgradient.
Ballymacahaill River	High	This feature is considered High as there is a direct connection to the Lower Shannon River SAC, 2.1 km downgradient from the proposed development site.

As there is a direct hydrological connection between the site and Lower Shannon River protected sites (SAC), the overall attribute significance is considered to be High to Very High.

6.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The proposed development is c. 58 hectares in area and comprises:

- Six (6) no. data centres buildings (DC1 to DC6).
- A gas-powered Energy Centre and Above Ground Installation (AGI).
- A new 110kV substation, two drop down masts and underground grid connection.
- Fibre connection.
- Connection and upgrade of foul sewer and mains supply extending along the existing R352.
- Undergrounding of two of the existing overhead 110kv circuits.
- Associated Infrastructure: including roads and a attenuation pond.

The proposed development represents an overall increase in hardstanding surfaces of approx. 17.3 hectares. The rest of the site comprises landscaping and undeveloped areas. Ecological buffer zones cover c. 10 ha of lands as seen in Figure 2.1 in Chapter 2 Description of the Proposed Development. These were delineated following assessment undertaken as part of the area assessment within the Clare County Development Plan 2017 – 2023 (Variation No. 1). Further assessment has been undertaken by the project ecologist to protect ecology during construction and operation of the proposed development.

The proposed development site boundary includes approx. 2.1 km of the existing Tulla Road for connection to sewer.

Two of the 110kV overhead circuits which currently traverse the site will be brought underground to the [existing] Ennis substation as they come on to the site on the eastern side.

Further details of the proposed development are described in Chapter 2 (Description of the Proposed Development). The details of the construction and operation of the development in terms of Hydrology are detailed in the subsections below.

6.4.1 Construction Phase

The key civil engineering works which will have a potential impact on the water and hydrological environment during construction of the proposed development are summarised below.

- Excavation of the proposed attenuation pond to the southwest of the site (proposed lowest surface water capture point within the main development site).
- Excavations are required for foundations of buildings and installation of associated services included within the development. This may include installation of load-bearing piles to target depth at select data centre footprints.
- Possible discharge of collected rainwater/ minimal dewatering during excavation works and groundworks (the extent of which is dependent on the time of year development works are carried out).
- Construction activities will necessitate storage of cement and concrete materials, temporary oils, and fuels on site. Small localised accidental releases of contaminating substances including hydrocarbons have the potential to occur from construction traffic and vehicles operating on site.
- Construction of culvert pipes to receive overflow water from Tooreen Lough as well as installation of a concrete ring and chamber at the existing swallow hole receiving stream water from the lough. There is also a proposed overflow pipe from this swallow hole (dimensions to include correction for climate change effects).
- Potential localised earthworks south of the existing pond to the north of the proposed Energy Centre.
- Localised excavations (cuts) and infill (build-up) as part of the designed elevation changes across the proposed development site.

6.4.2 Operational Phase

The key activities which will have a potential impact on the hydrological environment during operation of the proposed development are summarised below:

6.4.2.1 Increase in Hard Standing Area

The proposed surface water network(s) for the development will collect runoff from roofs, roads and other hard standing areas in a sealed system of pipes and gullies. The proposed development represents an overall increase in hardstanding surfaces of approx. 17.3 hectares. Refer also to Section 6.4.2.3 for additional detail on surface water management and maintaining existing surface water/ groundwater interaction.

6.4.2.2 Storage of Hazardous Materials:

In the event of a loss of power supply, the emergency generators are designed to automatically activate and provide power to the data storage facility. The generators will be supplied by low sulphur diesel. Fuel oil for the emergency generators is the only required bulk chemical required on site. Located within the services yard of three of the six datacentres, it is proposed to have up to 7 bunded above ground bulk storage tanks for fuel oil (440m^3 for three (3 no.) data storage facilities), distribution pumps, overground delivery pipeline to the belly tanks for diesel fired standby generators within each data storage facility.

The proposed Energy Centre will have back-up fuel storage with up to 20 fully bunded above ground bulk storage tanks for fuel oil (total of 1,440 m^3 of fuel oil). The total fuel store will be 2,900 m^3 (or 2,494 tonnes). All bunds will be capable of containing 110% of the volume of the largest drum/tank within the bund or 25% of the total volume of the substance stored and will designed in accordance with the EPA's guidelines for the storage and transfer of materials for scheduled activities (EPA, 2004).

The site is traversed by a high-pressure Gas Networks Ireland gas pipeline running in a S-N direction to the east of the development site. An Above Ground Installation (AGI) will be constructed to facilitate supply for the Energy Centre.

6.4.2.3 Surface Water Management:

The proposed surface water drainage system for the development comprises various drainage components including positive stormwater networks, attenuation systems and several Sustainable Drainage Systems (SuDS) elements. The proposed surface water drainage was designed in accordance with the SuDS Manuel 2015 and includes correction for climate change effects. The intention of the proposed surface water management plan is to maintain existing surface water (and groundwater) flow patterns. Drainage for non-paved areas will continue to discharge to ground. Drainage in areas of fuel storage will be fully sealed.

The developed area of the site is 17.3 ha and attenuation has been designed on site for the 1:100-year flood event including consideration of a 20% allowance for climate change effects. An overflow subsurface pipeline will discharge at current discharge rates (greenfield) to the Ballymacahill River. Drainage will be from a single lined fully designed attenuation pond feature to be located to the southwest of the site.

Rainwater run-off from the roofs of the six Data Centres will be collected and will feed water harvesting tanks with any excess overflow into the common road drainage network. This water will be available as cooling water. Other SuDS measures will include permeable paving and swales. These drains and swales will discharge to the surface water attenuation pond where the discharge will be controlled using a ‘Hydrobrake Optimum’ vortex flow control device to limit the maximum discharge to 95 l/s during the 1:100-year storm (the calculated Q-bar value attributed to the site is 98.61 l/s).

The attenuation pond will be constructed to retain a constant volume of water to promote settling and reduce conveyance of suspended solids and other particles to the receiving watercourse. An attenuation volume of 15,900 m³ is designed as part of the proposed development. A Class (I) by-pass separator with a suitable capacity will be installed downstream of the proposed hydrobrake unit. The function of the separator is to intercept pollutants (any petroleum/ oil) and prevent their entry to the Ballymacahill River. As such, there is no potential for increase either flooding or impact on water quality as a result of the proposed development. Further details are provided within the CSEA (2021) engineering report prepared for planning.

The attenuation pond has two (2) no. design levels. The two levels are summarised as follows:

(i) 1:100 + 20% climate change, and
(ii) 1:1000 year. Please see table below.

Additional details on the attenuation pond are provided in Table 6.5 below.

Table 6.4 *Design details for the attenuation pond*

Description	Data	Level mOD/remarks
Top Area	5184.3 m^2	+15.23
Bed Area	2591.0 m^2	+12.23, 3m total depth
Storage for 1/100 year + 20% CC	6864 m^3	+14.24 , FB = 990mm
Storage for 1/1000 year	9293 m^3	+14.79, FB= 440mm
Side-slope grading	1:3	-
Hydrobrake Max. outflow rate for 1/100 year +20% CC	108.7 l/s	-
Hydrobrake Max. outflow rate for 1/1000 year	122.4 l/s	-

6.4.2.4 Wastewater

Existing System

The site is currently not serviced by foul sewage.

According to Clare County Council and Irish Water drawings, there is an existing 225mm diameter foul drain that forms part of an existing foul drainage network that services the existing Knockanean area southwest of the proposed development along the existing Tulla Road/R352. This existing 225mm diameter foul drain discharges to the existing Pumping Station of Gort Na mBlath located approximately 550 metres farther west from the proposed development.

Proposed System Connection

The proposed Art Data Centre Development, subject to this planning application, comprises a gravity foul sewer networks consisting of 150mm diameter pipes size. As such, the overall wastewater discharges associated with the proposed development are in accordance the demand/ discharge rates outlined in the Pre-Consultation Enquiry (PCE) provided to Irish Water (IW).

The design Dry Weather Flow (DWF) of the development is 20.9 m^3/d for the entire site catchment. A peak of 0.6 l/s domestic/ staff wastewater flow was included as part of the submitted PCE to IW. The proposed foul drainage service attributed to the site will incorporate a foul pumping station and associated rising main which will also include a 24-hour emergency storage tank in the unlikely event that the proposed foul pump malfunctions. The proposed 24-hour emergency storage tank shall be situated in an open space located southwest of the proposed data storage buildings. Maintenance access to both the pump chamber and 24-hour emergency storage tank will be incorporated into the design. This proposed pumping system will transfer the generated wastewater via a rising main which runs along the Tulla Road (southwest of the site) to the existing Gort Na mBlath Pumping Station.

All wastewater works to be in accordance with the relevant Irish Water Code of Practice. It is proposed to use the 24-hour emergency storage tank as to avoid foul discharge from the development during peak domestic wastewater hours in the town. This might be achieved by allowing for the proposed pumping system to operate only during night times (typically between 00:00 hrs and 06:00 hrs). However, the operation of the proposed pumping station is subject to agreement with the Department of Water and Drainage in Clare County Council.

The final discharge point from the Ennis North WWTP is the River Fergus. This WWTP is required to operate under an EPA licence (D0048-01) and to meet environmental legislative requirements. A review of the available Annual Environmental Reports (AERs) provided as part of the EPA licence requirements, confirms the WWTP is generally operating in compliance. There were some minor exceedances which relates to chemical problems, equipment failure and maintenance issues. These were temporary and rectified within the normal response time by Irish Water.

The domestic/ staff wastewater peak design flow is 0.6 l/s (51.84 m^3/day) (Source: CSEA, 2021). The peak foul discharge calculated for the proposed development is well within the capacity of the WWTP. Even without treatment at the Ennis North WWTP, the peak effluent discharge, calculated for the proposed development, would equate to 0.79% of the licensed discharge at Ennis North WWTP. This would not impact on the overall water quality within River Fergus and therefore would not have an impact on the current Water Body Status (as defined within the Water Framework Directive). (Note: the peak effluent discharge equates to approx. 0.003% of the licensed maximum discharge (peak hydraulic capacity) at Ennis North WWTP). Therefore, the wastewater discharge volume from the proposed development site will not have a negative impact on the Ennis North WWTP and, as a consequence, will not have a negative impact on the receiving environment, e.g., River Fergus.

Further detail in relation to wastewater emissions is presented in the CSEA (2021) Engineering Planning Report – Drainage and Water Services (RPT-20_110-001).

6.4.2.5 Water Supply

A 450mm diameter mains runs along the Tulla Road. Following a proposed upgrade for connection (within the existing road), it will have capacity to supply adequate water for the proposed development.

Water is required for cooling equipment, cleaning, general potable supply for drinking and sanitary facilities. This will be sourced from mains water supply and on-site rainwater harvesting. The 450mm diameter mains runs along the Tulla Road and following a proposed upgrade for connection (within the existing road), has capacity to provide an adequate supply of water to the proposed development. Residual cooling water, associated with the evaporative cooling process, is to be discharged from the air handling units to the surface water drainage network. When evaporative cooling is required the average rate of demand for the proposed development is estimated to be less than 1,000 m^3/day for the whole site. It is proposed to store at least 48 hours' worth of rainwater at each data storage facility for the purpose of supplying the evaporative coolers prior to using the public water supply. Of the water supplied, only 40% will be discharged to the surface water system as the remainder will be lost to evaporation in the cooling process. This results in an average daily discharge of 400 m^3/day. The peak rate of discharge for the proposed development will be 205 l/s. As the cooling water will only be required during periods of hot dry weather (i.e., temperature exceeds, 27°C), the discharge to the surface water network will not coincide with any rainfall events.

Consultation with IW has confirmed that sufficient water and wastewater capacity is available. A PCE was submitted to IW which addressed water demand (and wastewater) for the proposed development (Appendix 13.1 of this EIA Report). The overall water demand associated with the proposed development is in accordance with the water demand outlined in the PCE.

Further detail in relation to water supply emissions is presented in the CSEA (2021) Engineering Planning Report – Drainage and Water Services (RPT-20_110-001).

6.4.3 Do Nothing Scenario

The proposed development land is currently agricultural land; the land is zoned 'enterprise' which provides for the use and development of land for high end research and development, business science and technology-based industry, financial services, call centres/telemarketing, software development, data centres, enterprise and incubator units, small/medium manufacturing or corporate office in high quality campus/park type development.' It is likely that the land use will change over time even if this development does not go ahead. The associated impact of any such development in accordance with the zoning objective will be similar to the proposed development for the surrounding hydrological environment.

6.5 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

An analysis of the potential impacts of the proposed development on the hydrological environment during the construction and operation is outlined below. Receptors include the Ballymacahill River, internal [shallow] drainage ditches running along some field boundaries, as well as ponds, Tooreen Lough and swallow holes which lead to underground conduits, all of which ultimately discharge to west/ southwest and to the Ballymacahill River.

The site is drained by an internal field drainage network and karst flow. This network ultimately flows in a west to south westerly direction towards the Ballymacahill River which in turn joins the Fergus River approx. 3.0 Km downstream. The River Fergus discharges to the sea at Shannon Estuary over 7.0 Km downstream of the site. The Ballymacahill River flows towards the Lower River Shannon SAC) located c. 2.1 Km to the southwest of the site.

6.5.1 Construction Phase

6.5.1.1 Increased Sediments Loading in Surface Water Run-off

Surface water runoff during the construction phase may contain increased silt levels or become polluted from construction related activities. Runoff containing large amounts of silt can cause damage to surface water systems and receiving watercourses (for example Tooreen Lough). Silt-laden water can arise from dewatering of excavations, exposed ground, stockpiling of subsoils/ rock material and from access/ haulage tracks and roads.

6.5.1.2 Accidental Spills and Leaks

As with all construction projects there is potential for water (rainfall and/ or groundwater) to become contaminated with pollutants associated with construction related activity.

During construction of the development, there is a risk of accidental pollution incidences from the following sources:

- Cement/ concrete (increase turbidity and pH) – arising from construction phase materials.

- Hydrocarbons (ecotoxic) – accidental spillages from construction plant or on-site storage.
- Wastewater (nutrient and microbial rich) – arising from accidental discharge from on-site toilets and washrooms.

Due to the distance to the Lower River Shannon SAC, the proposed development does not have the potential to affect the water quality, and therefore the integrity, of this Natura 2000 site due to:

- An accidental pollution event during construction or discharge of silt laden water (without mitigation) has the ability to locally affecting water quality in the Ballymacahill River. However, based on the low chemical loading (c. < 5000 litres of oil and alkaline run-off from cementing works), together with the available attenuation and dilution within the Ballmacahil river and the Fergus there is no potential for exceedance of SI thresholds (i.e. S.I. European Communities Environmental Objectives Regulations, 2009 [S.I. No. 272 of 2009 as amended by SI No. 77 of 2019]) at the SAC.
- Due to its close proximity to the proposed development site via connectivity with the Ballymacahill River there is potential for local disturbance and/ or change in morphology of the river if not appropriately attenuated and outfall designed appropriately.

6.5.1.3 Potential Blockage of Swallow Holes & Springs

Due to the proposed construction compound located immediately southwest of Data Centre DC6 and beside the existing swallow hole that receives water from Tooreen Lough stream flow, there is a potential that this feature could be blocked temporarily. Blockages could arise as a result of sediment runoff, or storage of subsoil/ rock material for example.

Similar to the swallow hole at DC6, the main spring located to the immediate north of DC6 may also potentially be impacted from adjacent earthworks (sediment run-off for example).

6.5.1.4 Summary of Construction Phase Impacts

A summary of construction phase impacts for the proposed development (with and without mitigation) following EPA (2017) EIA guidelines is provided in Table 6. 5 below.

Table 6. 5 *Impact Assessment of Proposed Construction Activities*

Water Feature	Summary of Works Proposed	Magnitude of Impact - without mitigation measures	Magnitude of Impact - with mitigation measures
Ardnamurry Lough	Outside of the Construction Works	No Impact predicted	No Impact predicted
Tooreen Lough	Excavations, infill and construction activities in the vicinity of this feature.	*Temporary, Significant impact*	*Temporary, Imperceptible impact*
Pond to the North-East (North of the Energy Centre)	Excavations, infill and construction works in the vicinity of this feature	*Temporary, Significant impact*	*Temporary, Imperceptible impact*

Water Feature	Summary of Works Proposed	Magnitude of Impact - without mitigation measures	Magnitude of Impact - with mitigation measures
Ponds to the North	Excavations, infill and construction works in the vicinity of this feature	*Temporary, Significant impact*	*Temporary, Imperceptible impact*
Swallow hole south of Tulla Road	Outside of the Construction Works	No Impact predicted	No Impact predicted
Main Spring north west of Tooreen Lough	Excavations, infill and construction works in the vicinity of this feature	*Temporary, Significant impact*	*Temporary, Imperceptible impact*
Stream and Swallow hole west of Tooreen Lough and south of DC6	Stream will be culverted, and swallow hole will be covered with a concrete manhole with cover.	*Temporary, Moderate impact*	*Temporary, Imperceptible impact*
Ballymacahaill River	Construction activities in the vicinity of features with direct connectivity to this waterbody.	*Temporary, Significant impact*	*Temporary, Imperceptible impact*
Lower River Shannon SAC	Downgradient (over 2.0 km) of the Ballymacahaill River.	*Temporary, Significant impact*	*Temporary, Imperceptible impact*

6.5.2 Operational Phase

6.5.2.1 Increase in hardstanding

The increase in hardstanding (17.3 ha), if not adequately attenuated on site, would result in an increase in run-off rate and potential downgradient flooding. As described in Section 6.4.2.3 above, the design has incorporated adequate attenuation for a 1: 100-year flood event including correction for climate change effects.

The increase in hardstanding can cause increases in surface water run-off which has the potential to impact on the water quality and quantity of the hydrological environment and especially the Ballyamachill River (with downstream links to the SAC). Furthermore, this increase in surface water runoff has the potential to increase off-site flooding to neighbouring lands if not appropriately attenuated.

Refer also to Section 6.4.2.3 for additional detail on surface water management and maintaining existing surface water/ groundwater interaction which is applicable also to the long-term operation of the proposed development.

6.5.2.2 Accidental Spill and Leaks

The development includes the storage and use of diesel fuel which has the potential to have water quality impacts if a leak/ spill occurs and is not adequately mitigated. The design incorporates containment measures and measures for treatment of any spills/ leaks (described in Section 6.6 below).

6.5.2.3 Summary of the Operational Phase Impacts

A summary of operational phase impacts for the proposed development (with and without mitigation) following EPA (2017) EIA guidelines is provided in the Table 6. 6 below.

Table 6. 6 *Impact Assessment of Proposed Operational Phase*

Water Feature	**Magnitude of Impact -without design measures** [1]	**Magnitude of Impact – with design and mitigation measures**
Ardnamurry Lough	No Impact predicted	No Impact predicted
Tooreen Lough	*Temporary, Significant impact*	*Long-term Imperceptible impact*
Pond to the North-East (North of the Energy Centre)	*Temporary, Significant impact*	*Long-term Imperceptible impact*
Ponds to the North	*Temporary, Significant impact*	*Long-term Imperceptible impact*
Swallow hole south of Tulla Road	No Impact predicted	No Impact predicted
Main Spring north west of Tooreen Lough	*Temporary, Significant impact*	*Long term, Imperceptible impact*
Stream and Swallow hole west of Tooreen Lough and south of DC6	*Temporary, Moderate impact*	*Long-term Imperceptible impact*
Ballymacahaill River	*Temporary, Significant impact*	*Long-term Imperceptible impact*
Lower River Shannon SAC	*Temporary, Significant impact*	*Long-term Imperceptible impact*

[1] The Impact Assessment without design mitigation measures assumes that the attenuation pond, interceptor and other measures in place fail during the operational phase. However, these mitigation measures are a part of the design of the proposed development. The majority of the failures would result in increased flows to the receiving waterbody.

6.6 REMEDIAL AND MITIGATION MEASURES

The design has taken account of the potential impacts of the development on the hydrology environment local to the area where construction is taking place and containment of contaminant sources during the operational phase of the site. These design measures and mitigation measures are described below.

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

6.6.1 Construction Phase

In order to reduce the potential for any adverse impacts on the existing hydrological environment, a number of mitigation measures will be adopted as part of the construction works on site.

A Construction Environmental Management Plan (CEMP) and Construction Surface Water Management Plan (SWMP) for the site are included with the planning documentation. The contractor will be obliged to implement the measures outlined in the CEMP and SWMP (refer to Chapter 13 of this EIA Report). The CEMP sets out the overarching vision of how the construction of the proposed development will be managed in a safe and organised manner by the Contractor.

The CEMP will be a live document and it will go through a number of iterations before works commence and during the works. It will set out requirements and standards which must be met during the construction stage and will include the relevant mitigation measures outlined in the EIA Report and any subsequent planning conditions relevant to the proposed development.

The SWMP follows 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.

6.6.1.1 Surface Water Run-Off

As there is potential for run-off to directly or indirectly discharge to a watercourse, the SWMP includes specific mitigation measures to manage run-off and water quality during the construction phase. These include:

- No direct run-off will be allowed to ecological buffer zones, any open water, or karst swallow holes as identified. Construction run-off will be collected and discharged through sediment traps/ siltbuster type settlement tanks prior to discharge to ground or to the on-site attenuation tank.
- Silt [trap] fencing will be emplaced around buffer zones and along open water courses and swallow holes to prevent any direct run-off to these areas.
- Provision of exclusion zones and barriers (e.g. silt trap/ fences) between earthworks, stockpiles and temporary surfaces to prevent sediment washing into the existing drainage systems and hence the downstream receiving water environment.
- Provision of temporary construction surface drainage and sediment control measures to be in place before earthworks commence.
- A hydrocarbon interceptor will be installed upgradient of the attenuation pond to provide treatment in the event of an accidental release of oil from construction vehicles.
- Any minor ingress of groundwater and collected rainfall in the excavation will be pumped out during construction. It is estimated that the inflow rate of groundwater will be low and limited across the site.
- Daily monitoring (visual inspection) will be adopted to ensure that the water is of sufficient quality to discharge from the attenuation pond. The outlet of the pond includes a shut off valve should the water quality be deemed to be poor and require further treatment prior to discharge.
- The temporary storage of excavated subsoil/ rock material will be carefully managed. Stockpiles will be tightly compacted to reduce runoff and graded to aid in runoff collection. This will prevent any potential negative impact on the stormwater drainage and the material will be stored away from any surface water drains. Movement of material will be minimised to reduce the degradation of soil structure and generation of dust.
- Excavations will remain open for as little time as possible before the placement of fill. This will help to minimise the potential for water ingress into excavations.
- Excavated soil/ rock material from site 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.
- A specific method statement will be prepared for the discharge outlet from the attenuation pond to the Ballymachaill River. The outfall structure will be designed with headwall, wingwalls and a bed apron to prevent local scouring of the banks and the channel bed. This, together with management of flow to mimic current run-off rates, will ensure no measurable impact on river morphology, existing surface water flow hydraulics or the potential for an increase in the risk of flooding.
- A method statement for installation of the discharge pipe and outlet structure from Tooreen Lough will be provided by the contractor for approval by CCC and IFI stakeholders.

6.6.1.2 Fuel and Chemical Handling

Any fuels or chemicals (including hydrocarbons or any polluting chemicals) will be stored in a designated, secure bunded area(s) within the designated contractor's compound to prevent any seepage of potential pollutants into the local surface water network. These designated areas will be clearly sign-posted and all personnel on site will be made aware of their locations and associated risks.

All mobile fuel bowsers shall carry a spill kit and operatives must have spill response training. All fuel containing equipment such as portable generators shall be placed on drip trays. All fuels and chemicals required to be stored on- site will be clearly marked. Care and attention will be taken during refuelling and maintenance operations. Particular attention will be paid to gradient and ground conditions, which could increase risk of discharge to waters.

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 within the contractor's compound. Oil and fuel storage tanks 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 within the contractor's compound which will be away from surface water gullies or drains. 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 storm water to the underlying subsoil. Wash down and washout of concrete transporting vehicles will take place at an appropriate facility offsite and no washing of concrete from vehicles will be done on site.

In the case of drummed fuel or other chemical 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, and upskilled where necessary.

6.6.1.3 Accidental Spills

A robust and appropriate Spill Response Plan and Environmental Emergency Plan will be prepared prior to works commencing and they will be communicated, resourced and implemented for the duration of the works. Emergency procedures/ precautions and spillage kits will be available and construction staff will be trained and experienced in emergency procedures in the event of accidental fuel spillages.

Machinery activities on site during the construction phase may result in contamination of runoff/ surface water. Potential impacts could arise from accidental spillage of fuels, oils, paints etc. which could impact surface water if allowed to infiltrate to runoff to surface water systems and/or receiving watercourses. However, implementation of the mitigation measures outlined in the CEMP and detailed above will ensure that this does not occur.

Concreting operations carried out near surface water drainage points during construction activities could lead to discharges to a watercourse. Concrete (specifically, the cement component) is highly alkaline and any spillage to a local watercourse would be detrimental to water quality and local fauna and flora. However, control of run-off from concrete work areas as outlined in the CEMP will ensure that any impact will be mitigated.

6.6.1.4 Foul Water

Welfare facilities (canteens, toilets etc.) will be available within the construction compound and these will remain in place for the construction phase of the proposed development. The offices and site requirements will initially need to have their own power supply (generator), water deliveries and foul water collection until connections are made to the mains networks (refer to Section 6.6.2 Operational Phase below). All welfare systems will be fully sealed and temporary in terms of usage.

6.6.1.5 Water Supply

The works Contractor will be obliged to put Best Practice measures in place to ensure that there are no interruptions to the public/ private water supply for the area unless this has been agreed in advance.

Strict quality control measures will be undertaken while laying pipes to minimise or eradicate infiltration and ex-filtration.

6.6.1.6 Earthworks - Subsoil/ Rock Removal and Compaction

Temporary storage of excavated subsoil and rock will be carefully managed in such a way as to prevent any potential negative impact on the receiving hydrological [and hydrogeological] environment. The material will be stored away from any surface water drains (see Section 6.4.2.3 above). Movement of material will be minimised to reduce degradation of soil/ rock structure and the 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 subsoil/ rock matrix excavated is contaminated, this will be segregated and appropriately disposed of by a suitably permitted/ licensed waste disposal contractor with appropriate record keeping from source to permitted disposal.

Ground investigations carried out by Ground Investigations Ireland (GII) at the site in 2021 (Refer to Chapter 5 where soil quality data and borehole data is assessed) found no signs of ground contamination at any of the exploratory holes (trial pits and boreholes) completed across the site. Nonetheless, all excavated materials will be visually assessed for signs of possible contamination such as staining and/ 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 subsoil has not occurred. Should it be determined that any of the soil/ rock matrix excavated is contaminated, this will be effectively segregated (and away from water features) and appropriately disposed of by a suitably permitted/ licensed waste disposal contractor (again with correct paper trail records maintained).

6.6.1.7 Protection of Hydrological / Hydrogeological Water Features

This section describes the specific mitigation measures implemented during construction for the protection of the existing identified surface water features and maintaining the existing surface water drainage system. Given the interconnectivity between the identified surface water features and groundwater type features in what is a karst environment then all mitigation measure which apply to hydrology will also apply to hydrogeology (Refer to Chapter 5, Section 5.6).

These measures will be implemented in association with the measures described above to ensure the protection of all hydrological [and hydrogeological] attributes. Mitigation measures are further discussed in the CEMP and SWMP for the development.

Tooreen Lough

There will be no construction works carried out within Tooreen Lough. There will be no oil or subsoil storage in the vicinity of this feature. An ecological buffer of at least 10 metres applies to this feature.

It is proposed that that overland stream discharging from Tooreen Lough will be culverted. The culvert will be designed in accordance with *Section 50 of the Arterial Drainage Act, 1945*, as amended and the overground pipe will be adequately for winter flows. This will ensure continued conveyance of existing flows without any upgradient or downgradient impacts on flow or water quality. The culvert will be adequately sized for current and future flow conditions.

Ardnamurry Lough

There are no construction activities planned for this area and this feature is located upgradient and outside of the red line boundary, along the eastern boundary of the proposed development. Therefore, no mitigation measures are needed for this feature.

Swallow Hole (Receiving water from Tooreen Lough) located south of DC6

Prior to commencement of construction works, the discharge stream from Tooreen Lough and swallow hole will be clearly delineated and marked. The swallow hole will be surrounded by a concrete ring with chamber and accessed by a manhole cover to avoid blockage during works on the site. This swallow hole will be monitored daily to ensure it is free flowing. i.e. ensuring no change to the existing flow regime there.

Main Spring located north of DC6

Prior to commencement of construction works, the spring and areas around this feature will be clearly delineated and marked. There are no proposed construction works within this spring area and a buffer zone of at least 10 metres will be implemented to ensure that the integrity of the spring is protected. Therefore, maintaining the flow and water quality of this spring. Daily to weekly monitoring of the spring in terms of flow and water quality will be recorded during construction phase works.

Furthermore, provision of exclusion zones and barriers (e.g. silt fences) between earthworks, stockpiles and temporary surfaces to prevent sediment washing into the existing drainage systems like this feature and hence protecting the integrity of this feature.

Pond located North of the Energy Centre

There are no construction activities proposed within this feature. It is proposed that the Energy Centre will be built up by infill material and a retaining wall will be built to protect the pond feature. An existing [field dividing] wall is in place and will be protected throughout the construction phase works.

As previously discussed, there will be no stockpiling of subsoil/ rock matrix by this feature as well as no fuel storage - fuel will be adequately stored in effective bunds located within the contractor compound. Provision of exclusion zones and barriers (e.g. silt fences) between earthworks, stockpiles and temporary surfaces to prevent sediment washing into the existing drainage systems such as this feature and hence protecting the integrity of this attribute.

Ponds located North of the DC4

There are no construction phase activities proposed within these two (2) no. features, however the proposed Data Centre building DC4 is located in close proximity. It is proposed that the DC4 structure will be 'built up' using engineered infill material.

As previously discussed, there will be no stockpiling of subsoil/ rock matrix or fuel storage within 10 m of this feature and no fuel storage within this area. Fuel will be adequately stored in fully contained bunds located within the contractor compound. Provision of exclusion zones and barriers (e.g. silt fences) between earthworks, stockpiles and temporary surfaces will be undertaken to prevent sediment washing into these ponds.

Karst Features - potential conduits/ flow paths

The protection and integrity of potential karst conduits (groundwater flow paths) and the associated mitigation measures during construction are discussed in Chapter 5 of this EIA Report.

6.6.2 Operational Phase

The development includes the storage of up to 7 no. bunded above ground bulk storage tanks for fuel oil distribution pumps, overground delivery pipeline to the belly tanks for diesel fired standby generators within each data storage facility. Both the Data Centres and Energy Centre building will have bulk oil storage. However oil storage is fully bunded, within areas of hardstand where rainage is designed to discharge through a petrol interceptor. These interceptors will ensure containment of any accidental leak/spill during refueling etc.

An additional oil interceptor will be installed upgradient of the attenuation pond to capture and treat any minor leaks from vehicles within car park areas.

The proposed surface water drainage service to the development comprises various drainage components including positive stormwater networks, attenuation systems and several Sustainable Drainage Systems (SuDS) elements. The proposed surface water drainage was designed in accordance with the SuDS Manual 2015.

6.6.2.1 *Emergency Response Procedures*

As normal for a development site of this type, all staff will be suitably trained in emergency response procedures and standard operating procedures (SOPs) to respond to an on-site fuel spillage incident. All employees will be provided with such equipment, information, training and supervision as is necessary to implement the emergency response procedures and SOPs.

6.6.2.2 *Environmental Procedures*

Containment measures are included within the design to reduce potential for environmental impact. There will be comprehensive emergency response procedures and SOPs to respond to chemical/ oil spillage of all types. All employees will be provided with such equipment, information, training and supervision as is necessary to implement the emergency response procedures and SOPs.

6.6.2.3 Fuel Storage

The provision of suitable spill kit facilities and training of operatives in use of same; should be undertaken at the operational stage in order to manage any leaks from fuel storage and vehicles resulting in water quality impacts.

All bunds will be capable of containing 110% of the volume of the largest drum/tank within the bund or 25% of the total volume of the substance stored and will designed in accordance with the EPA's guidelines for the storage and transfer of materials for scheduled activities (EPA, 2004). As oil is only required for emergency operation only and testing, refuelling requirement is very low therefore the risk from tanker movement is low. A dedicated tanker unloading area will be provided at each of these service yards which will be surrounded by a drainage channel to capture any run-off. A class 1 oil-water full retention separator will be installed to capture any oil in the run-off from the pad. A standard operating procedure for fuel unloading will be in place at the site and tanks will be fitted with high level alarms to prevent overfilling.

The storage of fuel oil for the emergency generators should be restricted to the generator yard, the bulk fuel tanks and belly tanks should be bunded, and the over ground delivery pipeline double-lined. The final design for the diesel storage will be contained within a bunded area in line with the requirements of the *Guidance to Storage and Transfer of Materials for Scheduled Activities* (EPA, 2005).

In terms of the risk to the underlying aquifer (with connectivity to surface water features) this is considered low due to the mitigation in place for containment, delivery and distribution and use of oil interceptors on the stormwater system downgradient of the off-loading area and prior to discharge from the site.

6.6.2.4 Foul Water

During the operational phase, the site will operate in compliance with the requirements of an Irish Water (IW) licence for discharge to sewer.

The proposed Art Data Centre Development, subject to this planning application, will comprise a gravity foul sewer network as discussed under Section 6.4.2.4 above.

All wastewater works to be in accordance with Irish Water Code of Practice and the final discharge point from the Ennis North WWTP will be the River Fergus, as discussed under Section 6.4 above – Characteristics of the Proposed Development. Consultation with CCC personnel has confirmed there is adequate capacity for the wastewater at the receiving WWTP and a review of the licence shows that the plant is generally in compliance with its licence requirements.

6.6.2.5 Storm Water & Surface water run-off

The proposed development will provide full attenuation for increase in hardstand area in compliance with the requirements of the Greater Dublin Strategic Drainage Study. The proposed surface water drainage service to the development comprises various drainage components including positive stormwater networks, attenuation systems and several Sustainable Drainage Systems (SuDS) elements. The proposed surface water drainage was designed in accordance with the SuDS Manual 2015. This is further detailed under Section 6.4.2.3 Characteristics of the Proposed Development - Operational Phase.

A number of measures will be put in place to minimise the likelihood of any spills entering the water environment to include the design of the car park, fitting of refuelling areas with hydrocarbon interceptors and on-site speed restrictions. Refer to the Infrastructure Report for further details (CSEA, 2021).

It is proposed to ultimately discharge surface water from the proposed development, post attenuation and outflow restrictions into the existing main drainage feature in the wider area namely the Ballymacahill River.

To minimise any impact to receiving water flows, the design incorporates effective attenuation to greenfield run-off rates for new hardstanding areas following the Institute of Hydrology Report Number 124 (IH 124) Methodology. The proposed attenuation storage volumes are sized to accommodate any potential increase in surface water run-off rates up to the 1000-year return period storm event with an allowance for climate change effects. Run-off rates are controlled by a hydrobrake system which discharges attenuated water at greenfield run-off rates. These rates will mimic existing run-off rates and will not change the morphology of the nearby river.

All outfall structures will be designed with an outlet structure that includes headwall, wingwalls and a bed apron to prevent local scouring of the banks and the channel bed. This, together with management of flow to mimic current run-off rates, will ensure no measurable impact on river morphology, existing surface water flow hydraulics or the potential for an increase in the risk of flooding.

To facilitate high flood conditions at Tooreen Lough an overflow will be provided at the swallow hole to direct water to a localised area within the proposed development site to alleviate flood levels. Refer to Flood Risk Assessment Report (CSEA, 2021).

6.6.2.6 Protection of Surface Water Features

Intermittent and ongoing inspection and maintenance of the swallow hole south of DC6 discharge from Tooreen lough will be undertaken to ensure free flowing discharge to Ballymacahill River along the western boundary of the proposed development.

6.7 CUMULATIVE IMPACTS

The cumulative impact of the proposed development with any/all relevant other planned or permitted developments (as described in Chapter 3 and Appendix 3.1)) are discussed below.

6.7.1 Construction Phase

Impacts to water during construction are associated with spillage and leakage of oils and fuels and potential silt deposition in watercourses due to disturbance of land. With the proposed mitigation in place (as outlined in Section 6.6 above) including the management of run-off using sediment ponds, stockpiling of soil away from open water, and management of accidental discharges, there is low potential for construction at the proposed development to impact on receiving waters. Contractors for the proposed development will be contractually required to operate in compliance with the CEMP which includes the mitigation measures outlined in this EIA Report. With these measures in place, there will be no change in water body status, water quality or flow as a result of construction for the proposed project and the impact as described above are concluded as being of *imperceptible* significance with a *neutral* impact *o*n water. The other developments will be required, during construction, to protect water quality in compliance with legislative standards for receiving water quality and having regard to the nature and extent of that development, the cumulative or in-combination impacts are considered to be of *imperceptible* significance with a *neutral* impact *o*n water.

6.7.2 Operational Phase

The operation of the proposed development will have a long-term *imperceptible* significance with a *neutral* impact on quality due to the measures in place to protect water quality and manage stormwater discharge within the design for the proposed development. The proposed development has incorporated suitable containment measures for proposed oil storage, incorporated interceptors in areas of potential accidental spills/leaks and provided sufficient attenuation to manage run-off rates to greenfield run-off rates. The impact is considered to be of *imperceptible* significance with a *neutral* impact on water having regard to the designed mitigation measures. The other developments considered, which ae identified in Chapter 3 and Appendix 3.1, will be required during operation to meet legislative requirements in relation to water quality and mitigate for hardstand in terms of run-off rates. As such the cumulative or in-combination impacts are considered to be of *imperceptible* significance with a *neutral* impact on water.

6.8 RESIDUAL IMPACTS OF THE PROPOSED DEVELOPMENT

6.8.1 Construction Phase

The implementation of mitigation measures outlined above (Section 6.6) will ensure that the predicted impacts on the hydrological [and therefore the hydrogeological] environment do not occur during the construction phase and that the residual impact will be **short-term-imperceptible-neutral**. Following the TII (2009) criteria (refer to Appendix 6.1) for rating the magnitude and significance of impacts on the hydrological related attributes, the magnitude of impact is considered **negligible**.

6.8.2 Operational Phase

The implementation of the design and mitigation measures highlighted above (Section 6.6) will ensure that the predicted impacts on the hydrological [and therefore the hydrogeological] environment do not occur during the operational phase and that the residual impact will be **long-term-imperceptible-neutral**. Following the TII (2009) criteria (refer to Appendix 6.1) for rating the magnitude and significance of impacts on the hydrological related attributes, the magnitude of impact is considered **negligible**.

6.9 MONITORING OR REINSTATEMENT

6.9.1 Construction Phase

During construction phase the following monitoring measures are proposed subject to planning conditions:

- Weekly checks will be carried out to ensure surface water drains are not blocked by silt, or any other items, and that all soil storage is located at least 10 metres from the nearest surface water receptors. A regular log of inspections will be maintained, and any significant blockage or spill incidents will be recorded for root cause investigation purposes and updating procedures to ensure incidents do not re-occur.
- Daily inspection of surface water run-off from the attenuation pond and sediment controls e.g. silt traps will be carried during the construction phase. Continuous monitoring system for pH, temperature, electrical conductivity and total organic carbon to be installed to ensure water quality discharging from site is of good quality and meets the respective S.I. threshold values.
- Regular inspection of construction mitigation measures will be undertaken e.g. concrete pouring, refuelling etc.
- Regular monitoring of the surface water drainage features and swallow holes to ensure all are free flowing.
- Regular monitoring of the silt traps/ trenches/ fences around established buffer zones to ensure on-going protection of all surface water attributes.

6.9.2 Operational Phase

Maintenance of the surface water drainage system and foul sewers as per normal urban developments is recommended to minimise any accidental discharges to ground.

Long term environmental monitoring will follow the approved Environmental Management Plan for the completed development and will include key details as per any permitted discharges.

Inspection and maintenance of the swallow hole south of DC6 discharge from Tooreen Lough to ensure free-flowing discharge to Ballymacahill River along the western boundary of the proposed development.

Three yearly inspection of bund integrity as per EPA guidance.

7.0 BIODIVERSITY

7.1 INTRODUCTION

This chapter provides an assessment of the potential ecological effects of the proposed data centre campus development at Toureen, Ennis Co. Clare (refer to Figure 7.1 for location). The proposed development site is approximately 60 hectares. The project will consist of the development of six data hall buildings, offices, a vertical farm, an electrical substation, an energy centre, a transformer compound, undergrounding of circuit cable, associated infrastructure and a number of car parking areas (hereinafter referred to as the proposed development). A detailed description of the proposed development is included in Chapter 2 with the characteristics in relation to biodiversity described in Section 7.4.

The proposed development site is located in the 10km Grid Square R37 at R 37315 79402, east of Ennis. The land within the site comprises mainly of agricultural fields, used for pasture of cattle and sheep. A number of barns and sheds utilised for agricultural use, and four residential houses are also present within the lands. In the north west of the site, a well-established oak-ash-hazel woodland is bordered by the Spancelhill Stream. Toureen Lough lies in the south of the site, with wetland habitats present in the west and north. The field boundaries within the site largely consist of hedgerows, dry stone walls, and treelines. The R352 bounds the proposed development site to the south, with agricultural lands surrounding the north, east and south of the site, and the townland of Ennis to the west.

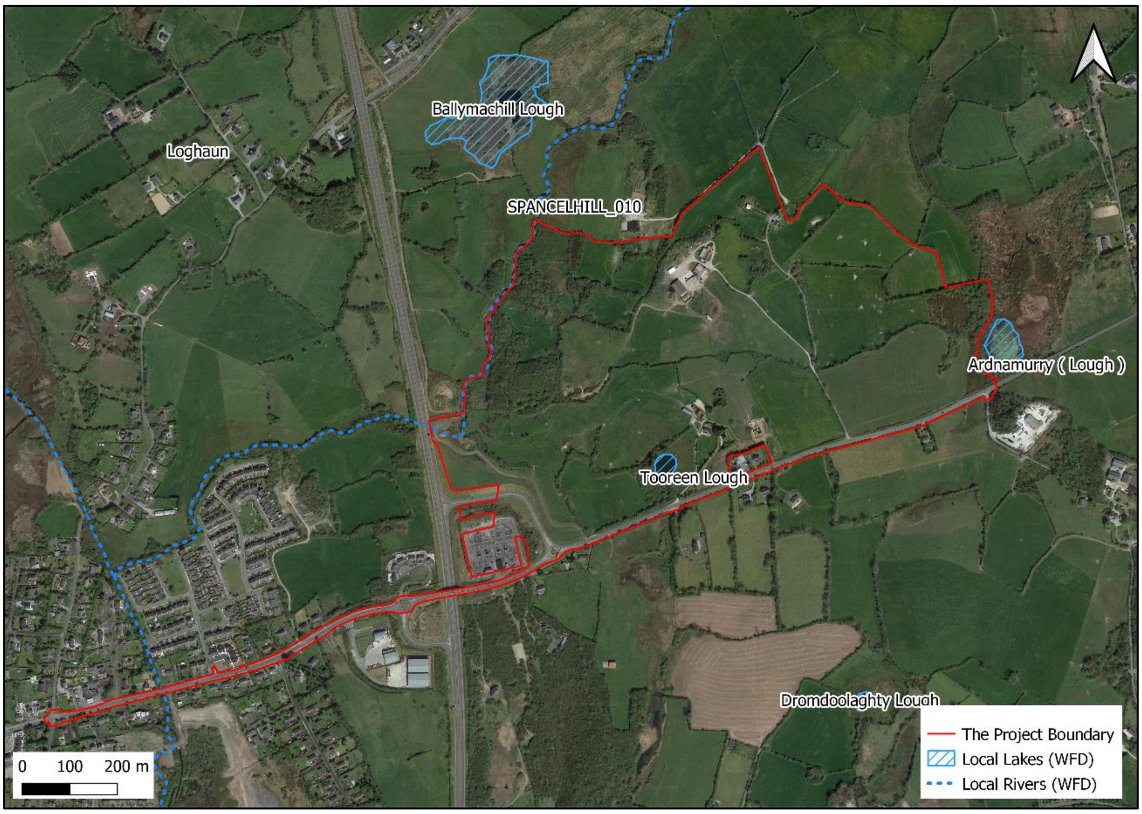


Figure 7.1 *The proposed development in relation to wider surroundings and waterbodies*

The purpose of the report is to:

- Establish and evaluate the baseline ecological environment, as relevant to the proposed development
- Identify, describe and assess all potentially significant ecological effects associated with the proposed development
- Set out the mitigation measures required to address any potentially significant ecological effects and ensure compliance with relevant nature conservation legislation
- Provide an assessment of the significance of any residual ecological effects
- Identify any appropriate compensation, enhancement or post-construction monitoring requirements

Planning, Policy and Legislation

The collation of ecological baseline data and the preparation of this assessment has had regard to the following legislation and policy documents. This is not an exhaustive list but the most relevant legislative and policy basis for the purposes of preparing this Chapter.

The following international legislation of particular relevance to the proposed development:

- Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora; hereafter, referred to as the 'Habitats Directive'. The Habitats Directive is the legislation under which the Natura 2000 network[1] was established and special areas of conservation (SACs) are designated for the protection of natural habitat types listed in Annex I, and habitats of the species listed in Annex II, of that directive.
- Directive 2009/147/EEC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds; hereafter, referred to as the 'Birds Directive'. The Birds Directive is the legislation under which special protection areas are designated for the protection of endangered species of wild birds listed in Annex I of that directive.
- Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy hereafter, referred to as the 'Water Framework Directive'. The Water Framework Directive' is the legislation requiring the protection and improvement of water quality in all waters (rivers, lakes, groundwater, and

[1] The Natura 2000 network is a European network of important ecological sites, as defined under Article 3 of the Habitats Directive 92/43/EEC, which comprises both special areas of conservation and special protection areas. Special conservation areas are sites hosting the natural habitat types listed in Annex I, and habitats of the species listed in Annex II, of the Habitats Directive, and are established under the Habitats Directive itself. Special protection areas are established under Article 4 of the Birds Directive 2009/147/EC for the protection of endangered species of wild birds. The aim of the network is to aid the long-term survival of Europe's most valuable and threatened species and habitats.

In Ireland these sites are designed as *European sites* - defined under the Planning Acts and/or the Birds and Habitats Regulations as (a) a candidate site of Community importance, (b) a site of Community importance, (c) a candidate special area of conservation, (d) a special area of conservation, (e) a candidate special protection area, or (f) a special protection area. They are commonly referred to in Ireland as Special Areas of Conservation (SACs) and Special Protection Areas (SPAs).

transitional coastal waters) with the aim of achieving good ecological status by 2015 or, at the latest, by 2027.

The following national legislation of particular relevance to the proposed development:

- Wildlife Acts 1976 to 2021; hereafter collectively referred to as the 'Wildlife Acts'. The Wildlife Acts are the principal pieces of legislation at national level for the protection of wildlife and for the control of activities that may harm wildlife. All bird species, 22 other animal species or groups of species, and 86 species of flora are protected under this legislation.
- Planning and Development Acts 2000 to 2021; hereafter collectively referred to as the 'Planning and Development Acts'. This piece of legislation is the basis for Irish planning. Under the legislation, development plans (usually implemented at local authority level) must include mandatory objectives for the conservation of natural heritage and for the conservation of European Sites. It also sets out the requirements in relation to environmental assessment with respect to planning matters, including transposition of the Habitats and Birds Directive into Irish law.
- European Communities (EC) (Birds and Natural Habitats) Regulations 2011 to 2015; hereafter the 'Birds and Habitats Regulations'. This legislation transposes the Habitats and Birds Directives into Irish law. It also contains regulations (49 and 50) that deal with invasive species (those included within the Third Schedule of the regulations).
- *European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003)*. This legislation transposes the Water Framework Directive into Irish Law.
- Flora (Protection) Order, 2022. This lists species of plant protected under Section 21 of the Wildlife Acts.
- Plans and policies that are relevant to the proposed development include:
    - National Biodiversity Action Plan 2017-2021 (Department of Culture Heritage and the Gaeltacht, 2017)
    - *Clare County Development Plan 2017 – 2023 (As Varied)* (Clare County Council, 2017) (specific objectives and policies can be found in Chapter 3 of the EIAR)
    - *Clare Biodiversity Action Plan 2017 – 2023* (Clare County Council, 2017)
    - *Clare County Development Plan 2017 – 2023 Variation No. 1,* (Clare County Council, 2019)
    - The *Limerick County Development Plan 2010-2016 (*Limerick County Council, 2010)
    - *Shannon Town and Environs Local Area Plan 2012-2018 (*Clare County Council, 2018)
    - *The Galway County Development Plan 2015-2021 (*Galway County Council, 2015)
    - *The Kerry County Development Plan 2015-2021 (Kerry County Council, 2015)*

7.2 METHODOLOGY

7.2.1 Scope of the Assessment

The study area is defined by the zone of influence of the proposed development with respect to the ecological receptors that could potentially be affected.

The Zone of Influence (ZoI), or distance over which potentially significant effects may occur, will differ across the Key Ecological Receptors (KERs), depending on 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 within, and in the vicinity of, the proposed development site. The ZoI and study area was then informed and defined by the sensitivities of each of the KERs present, in conjunction with the nature and potential impacts associated with the proposed development.

The ZoI of habitat loss impacts will be confined to within the proposed development boundary.

The ZoI of potential impacts on surface water quality in the receiving freshwater, estuarine and coastal ecosystems associated with waterbodies that are hydrologically connected to the proposed development via the Spancelhill Stream, which is located along the north-western boundary.

The ZoI of air quality effects related to dust deposition is likely to be located within and/or adjacent to the proposed development site boundary.

The ZoI of general construction activities (*i.e.* risk of spreading/introducing non-native invasive species, and disturbance due to increased noise, vibration, human presence and lighting) is not likely to extend more than several hundred metres from the proposed development.

7.2.2 Desk study

A desk study was undertaken in May 2022 to collate available information on the local ecological environment. The following resources were used to inform the assessment presented in this report:

- Data on European sites, Natural Heritage Areas (NHAs) or proposed Natural Heritage Areas (pNHAs) as held by the National Parks and Wildlife Service (NPWS) from https://www.npws.ie/protected-sites and https://www.npws.ie/maps-and-data – refer to Appendix 7.1 and Figure 7.5 for descriptions and locations of protected sites in the vicinity of the proposed development
- Records of rare and protected species for the 10km grid square(s), as held by the National Biodiversity Data Centre www.biodiversityireland.ie or the NPWS – refer to Appendix 7.2 for all desk study flora and fauna records
- Spatial information relevant to the planning process including land zoning and planning applications from Department of Housing Planning, Community and Local Government web map portal. Available from https://myplan.ie/
- Ordinance Survey Ireland mapping and aerial photography from http://map.geohive.ie/
- Data on waterbodies, available for download from the Environmental Protection Agency (EPA) web map service. Available from https://gis.epa.ie/EPAMaps/
- Information on soils, geology and hydrogeology in the area available from the Geological Survey Ireland (GSI) online Spatial Resources service. Available from https://www.gsi.ie/en-ie/data-and-maps/Pages/Groundwater.aspx
- Information on the conservation status of birds in Ireland from Birds of Conservation Concern in Ireland (Gilbert *et al.*, 2021)
- Information on the location, nature and design of the proposed development supplied by the applicant’s design team.

- University of Bristol Speleological Society – Irish caves locations. Available from http://www.ubss.org.uk
- Clare County Wetlands Survey 2008 (Clare County Council, 2008). Available from https://wetland.maps.arcgis.com
- Information contained within the Environmental Impact Assessment Report (EIAR) prepared for the proposed development planning application, including Chapter 3 Planning and Development Context, Chapter 5 Land, Soils & Geology and Hydrogeology, Chapter 6 Hydrology, Chapter 8 Air Quality & Climate, Chapter 9 Noise and Vibration, Chapter 10 Landscape and Visual.
- Site Lighting Analysis Report and Light Spill Modelling Study, produced by Hurley Palmer Flatt (February 2022)
- The Construction and Environmental Management Plan, produced by AWN Consulting Ltd. (February 2022)
- The Landscape and Biodiversity Management Plan produced by Nicholas de Jong Associates (June 2021)
- The Landscape Design Strategy produced by Nicholas de Jong Associates (June 2021)
- Construction & Demolition Waste Management Plan For A Proposed Development, "Art Data Centre", produced by AWN Consulting Ltd. (February 2022).
- Surface Water and Pollution Management Plan, Art Data Centre, produced by Clifton Scannell Emerson Associates (CSEA), (June 2021).
- *Appropriate Assessment Screening Report for: Art Data Centres, Ennis Campus* (Scott Cawley Ltd., 2022).
- *Natura Impact Statement for: Art Data Centres, Ennis Campus (Scott Cawley Ltd., 2022)*

7.2.3 Field survey

Ecological field surveys were carried out following the best practice professional guidelines between June – October 2018, July 2020 - April 2021, and March 2022. The surveys and survey dates are presented in Table 7.1.

Table 7.1 Ecological surveys and survey dates

Survey	Survey Date(s)	Surveyor(s)
Habitat surveys	27th July 2018 16th August 2018 8th – 10th July 2020 14th March 2022	Scott Cawley Ltd.
Badger surveys	7 – 9th July 2020 14th March 2022	Scott Cawley Ltd.
Otter surveys	7th – 9th July 2020 14th March 2022	Scott Cawley Ltd.
Breeding bird surveys	25th June 2020 6th July 2020 20th April 2021	Scott Cawley Ltd.
Wintering bird surveys	24th September 2020 20 – 21st October 2020 9th November 2020	Scott Cawley Ltd. and independent ornithologist, André Robinson

Survey	Survey Date(s)	Surveyor(s)
	4th December 2020 24th January 2021 17th February 2021 8th March 2021	
Bat surveys (Specific dates can be found in Table 7.6): Building surveys (internal and external) Static detector activity surveys Walked transect surveys Roost emergence/re-entry activity surveys	6th – 8th July 2020 15th March 2022 July – October 2018 July - October 2020 7th and 16th August 2018 July – August 2020 July – September 2020	Scott Cawley Ltd.

7.2.3.1 Habitats and Flora Survey

Terrestrial and aquatic habitat surveys were undertaken of the proposed development site on the 27th July and 16th August 2018 by Kate-Marie O'Connor B.A. (Hons) M.Sc. and Colm Clarke B.A. (Hons) M.Sc., on the 8th – 10th July 2020 by Siofra Quigley B.Sc. (Hons) M.Sc. and Alexis Fitzgerald B.A. (Hons) M.Sc., and on the 14th March 2022 by Síofra Quigley, following the methodology described in *Best Practice Guidance for Habitat Survey and Mapping*[2]. All habitat types were classified using the *Guide to Habitats in Ireland*[3], recording the indicator species and abundance using the DAFOR scale[4] and recording any species of conservation interest. Vascular and bryophyte plant nomenclature generally follow that of The National Vegetation Database[5], having regard to more recent taxonomic changes to species names after the New Flora of the British Isles[6] and the British Bryological Society's Mosses and Liverworts of Britain and

[2] Smith, G.F., O'Donoghue, P., O'Hora, K. & Delaney, E. (2011) *Best Practice Guidance for Habitat Survey and Mapping*. The Heritage Council Church Lane, Kilkenny, Ireland.

[3] Fossitt, J.A. (2000) *A Guide to Habitats in Ireland*. Heritage Council, Kilkenny.

[4] The DAFOR scale is an ordinal or semi-quantitative scale for recording the relative abundance of plant species. The name DAFOR is an acronym for the abundance levels recorded: Dominant, Abundant, Frequent, Occasional and Rare.

[5] Weekes, L.C. & FitzPatrick, Ú. (2010) The National Vegetation Database: Guidelines and Standards for the Collection and Storage of Vegetation Data in Ireland. Version 1.0. Irish Wildlife Manuals, No. 49. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

[6] Stace, C. (2019) New Flora of the British Isles. 4th Edition. C&M Floristics.

Ireland: A Field Guide[7]. Annex I habitat types were classified after the Interpretation manual of European Union Habitats EUR28[8] with reference to the corresponding national habitat survey reports and NPWS wildlife manuals, as applicable. The nomenclature for Annex I habitats follows that of the Interpretation manual of European Union Habitats EUR28 with abbreviated names after those used in The Status of EU Protected Habitats and Species in Ireland. Volume 1: Summary Overview[9]. Relevés (*i.e.* sampling points of a defined size) were also taken within the following areas of habitats in order to determine whether or not they conformed to Annex I habitats:

- Species-rich dry calcareous and neutral grassland (GS1)
- Wet grassland (GS4)
- Reed and Large Sedge Swamps (FS1)
- Riparian woodland (WN5)

The relevé size was $2m^2$ for all habitats except woodland habitats, which were sampled using a $10m^2$ relevé, and information collected included the following:

- A list of all plant species present along with their associated percentage cover;
- A habitat condition assessment based on criteria which were drawn from the national surveys of this Annex I habitat conducted on behalf of NPWS (*i.e.* Long et al., 2018; Martin *et al.*, 2018; O'Neill *et al.*, 2013; Perrin *et al.*, 2014; Wilson & Fernández, 2013); and,
- Notes on the threats and/or management of the overall surrounding area. Where applicable, the Annex I habitat was also assigned to a vegetation community.

7.2.3.2 Fauna Surveys

Terrestrial Mammals (excl. Bats)

A terrestrial fauna survey (excluding bats) was undertaken on the 7th to 9th July 2020 and on the 14th March 2022 by Síofra Quigley B.Sc. (Hons) M.Sc. The presence/absence of terrestrial fauna species were surveyed through the detection of field signs such as tracks, markings, feeding signs, and droppings, as well as by direct observation. The habitats on site were assessed for signs of usage by protected/red-listed fauna species, and their potential to support these species. Surveys to check for the presence of badger *Meles meles* setts and otter *Lutra lutra* holts within the study area, and to record any evidence of use, were undertaken. Indirect method of surveying for red squirrel *Sciurus vulgaris* and pine marten *Martes martes* were also undertaken, which included checking tree canopies for the presence of potential dreys and dens.

Infra-red motion-activated cameras were deployed in areas of suitable habitat to confirm usage of certain mammal species, specifically for badger, pine marten, and red squirrel within the woodland habitat in the north west, and to determine usage of Spancelhill Stream for foraging/commuting otters in the north west (under NPWS

[7] Atherton, I., Bosanquet, S. & Lawley, M. (2010) Mosses and Liverworts of Britain and Ireland: A Field Guide. Latimer Trend & Co., Plymouth.

[8] CEC. (Commission of the European Communities) (2013) Interpretation manual of European Union Habitats EUR28. European Commission, DG Environment.

[9] NPWS (2019). The Status of EU Protected Habitats and Species in Ireland. Volume 1: Summary Overview. Unpublished NPWS report.

Licence No. 007/2020). These cameras were deployed for a period of 27 nights between 23rd September – 20th October 2020. The mammal ledge located in the west of the site in the culvert beneath the M18 Motorway was also checked for signs of otter or other mammal usage during surveys carried out along the Spancelhill Steam in 2020 and 2022.

<u>*Breeding Birds*</u>

Breeding bird surveys were undertaken on the 25th June and 6th July 2020 by Shea O'Driscoll B.Sc. (Hons) M.Sc., and on the 20th April 2021 by Shane Brien B.Sc. M.Sc. using a methodology adapted from the *Bird Monitoring Methods - A Manual of Techniques for Key UK Species* [10] (see Table 7.2 for more details) The study area covered the lands within the proposed development site, which were slowly walked in a manner allowing the surveyor to come within 50m of all habitat features. Birds were identified by sight and song, and general location and activity were recorded using the British Trust for Ornithology (BTO) species and activity codes. Buildings and barns within the proposed development site were also checked for nesting barn swallows *Hirundo rustica*, house martins *Delichon urbicum* and barn owls *Tyto alba*.

Table 7.2 *Breeding bird survey details*

Date (Sunrise)	Survey Time	Weather Conditions
25/06/2020 (05:12)	05:00-08:00	Mild, partly sunny weather with temperatures around 16°C.
06/07/2020 (05:20)	05:15-08:30	Mild, sunny, dry weather with temperatures around 14°C and light breeze.
20/04/2021 (06:26)	06:45-10:45	Humid day, moderate, wet conditions from rain the day before, overcast (cloud 7/8), slight breeze, temperatures around 9°C.

<u>*Wintering birds*</u>

Wintering bird surveys were undertaken once a month during the period of September 2020 and March 2021 by Shane Brien B.Sc. (Hons) M.Sc. and Niall McHugh B.Sc. (Hons) both of Scott Cawley Ltd, and André Robinson, an independent ornithologist, using a methodology based on the *Bird Monitoring Methods - A Manual of Techniques for Key UK Species*. The study area covered the lands within the proposed development site within the red line boundary and the area under land ownership to the east of the site (not within the red line boundary). Lands were initially surveyed visually using binoculars/scope from a vantage point(s) at the edge of the study area followed by a walkover of the area to identify birds which may not be visible from a distance (*e.g.* waders) and evidence of usage by wildfowl such as swans or geese (*i.e.* droppings). Birds were identified by sight and general location and activity. They were recorded using the British Trust for Ornithology (BTO) species and activity codes.

Hen harrier

Vantage point surveys for the presence of hen harrier were carried out in accordance with best practice guidelines *Raptors – a Field Guide to Surveys and Monitoring*

[10] Gilbert, G., Gibbons, D.W. & Evans, J. (1998) Bird Monitoring Methods - A Manual of Techniques for Key UK Species. RSPB: Sandy

(Second Edition 2009) (Hardey *et al.*, 2009)[11]. The habitats within the site were assessed for suitability for roosting and/or foraging hen harrier. Suitable wintering roosting and foraging habitat was identified within the east of the site, where the wetland/swamp habitats were located. A suitable vantage point was determined that appropriately covered the area identified as potential wintering roosting and foraging habitat. This area was surveyed for two hours at dusk, during monthly visits between September 2020 and March 2021. The site is not suitable as foraging habitat during the breeding season, as this typically occurs on moorlands and young forestry plantations[12][13][14].

Table 7.3 *Wintering bird and hen harrier survey details*

Survey type	Date (Sunrise/sunset)	Survey Time	Weather Conditions
Wintering bird	24/09/2020 (07:25)	08:00-12:35	Dry, overcast weather with a slight breeze. Temperatures between 8°C and 14°C.
Hen harrier	24/09/2020 (19:29)	18:25 – 20:00	Dry, 50% cloud cover, strong winds blowing in a westerly direction. Temperature of 11°C.
Wintering bird	21/10/2020 (08:14)	08:00-15:15	Overcast with light breeze and occasional showers. Temperatures of 9 - 12°C.
Hen harrier	20/10/2020 (18:29)	17:05-18:48	Overcast with intermittent showers and north west moderate breeze. Temperatures of 10 - 13°C.
Wintering bird	09/11/2020 (07:49)	08:00-15:30	Overcast with east-south easterly winds. Temperatures of 11°C.
Hen harrier	09/11/2020 (16:50)	15:30-17:35	Overcast with slight winds in south easterly direction. Temperatures of 10°C
Wintering bird	04/12/2020 (08:30)	08:30-15:00	North westerly winds, mostly overcast with temperatures between 4-5°C. Shower of rain in last hour of survey.
Hen harrier	04/12/2020 (16:22)	15:00-17:00	Force 4 winds, with constant rain. Temperature of 4°C.
Wintering bird	24/01/2021 (08:35)	08:15-15:30	Southerly, light winds, partially overcast with temperatures of 2-3°C.
Hen harrier	24/01/2021 (17:06)	15:45-18:00	No rain, light winds, with temperatures of 2-3°C.

[11] Hardey J, Crick H, Wernham C, Riley H, Etheridge B and Thompson D (2009) Raptors: A Field Guide to Survey and Monitoring, 2nd Edition. TSO, Edinburgh.

[12] Ruddock, M., Mee, A., Lusby, J., Nagle, A., O'Neill, S. & O'Toole, L. (2016). The 2015 National Survey of Breeding Hen Harrier in Ireland. Irish Wildlife Manuals, No. 93. National Parks and Wildlife Service, Department of the Arts, Heritage and the Gaeltacht, Ireland.

[13] Barton, C., Pollock, C., Norriss, D.W., Nagle, T., Oliver, G.A. & Newton, S. (2006). The second national survey of breeding hen harriers Circus cyaneus in Ireland 2005. Irish Birds 8: 1-20.

[14] Norriss, D.W., Marsh, J., McMahon, D. & Oliver, G.A. (2002). A national survey of breeding hen harriers Circus cyaneus in Ireland 1998-2000. Irish Birds 7: 1–10.

Survey type	Date (Sunrise/sunset)	Survey Time	Weather Conditions
Wintering bird	17/02/2021 (07:49)	08:15-15:45	Westerly winds, mostly overcast with temperatures of 6-8°C.
Hen harrier	17/02/2021 (17:52)	16:15-18:45	West south west winds, mostly dry with intermittent light showers. Temperatures of 6°C.
Wintering bird	08/03/2021 (07:06)	08:00-16:45	North-easterly light winds, overcast with no rain. Temperatures between 6-9°C.
Hen harrier	08/03/2021 (18:23)	17:15-19:15	Intermittent drizzle with light winds. Temperature of 8°C.

Bats

Building and tree surveys

A ground-level assessment of trees, structures and buildings within the subject lands, to examine their suitability to support roosting bats and potential to act as important landscape features for commuting/foraging bats, was based on guidelines (see Table 7.4) in *Bat Surveys for Professional Ecologists: Good Practice Guidance* (Collins ed., 2016) and included inspections of trees, structures and buildings for potential roost features (PRFs), and for signs of bats (staining at roost entrances, droppings, carcasses, insect remains). This included internal access of barns and outbuildings to assess for the actual presence of bats, and for evidence as described above. Residential buildings were unable to be accessed due to Covid 19 restrictions, however all buildings were assessed externally, and barns/farm buildings were assessed internally and externally. Building and tree surveys were undertaken during surveys carried out in 2018, 2020 and 2022.

Table 7.4 *Guidelines for assessing the potential suitability of proposed development sites for bats, based on the presence of habitat features within the landscape, applied according to professional judgement. (Collins (2016)*

Suitability	Description Roosting habitats	Commuting and foraging habitats
Negligible	Negligible habitat features on site likely to be used by roosting bats.	Negligible habitat features on site likely to be used by commuting or foraging bats.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation). A tree of sufficient size and age to contain PRFs but with none seen from the ground or features seen with only very limited roosting potential.	Habitat that could be used by small numbers of commuting bats such as a gappy hedgerow or unvegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by other habitat. Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Moderate	A structure or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for

Suitability	Description Roosting habitats	Commuting and foraging habitats
	type only – the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed).	foraging such as trees, scrub, grassland or water.
High	A structure or tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat.	Continuous, high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. High-quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, treelined watercourses and grazed parkland. Site is close to and connected to known roosts.

Transect surveys

Two extended dusk and one all night bat activity walked transect surveys were undertaken within the subject lands. The extended dusk surveys commenced 15 minutes before sunset and lasted for approximately two hours. One full night survey was also undertaken from 15 minutes before sunset, until just before sunrise. This full night survey was carried out to determine how bats use the proposed development site throughout the night. Details of dates, timings, weather, and other details are shown in Table 7.5 below. Two routes were walked by two surveyors during each visit, the routes are illustrated on Figure 7.2. The focus of the routes was to survey linear vegetation features and field boundaries. However, this was also dependent on access between fields. Direct observations of how bats use the landscape were recorded, and handheld ultrasound detectors (Elekon Batlogger M) were used to identify the bat species by their calls. Data generated from the transect surveys was analysed using Elekon BatExplorer software, whereby calls were identified to species level (where this was possible), through professional judgement and with reference to *British Bat Calls: A Guide to Species Identification* (Russ, 2012). Transect surveys were undertaken in 2018 and 2020, however in 2018, two dusk transects were carried out, and in 2020 two dusk surveys and one full night survey were undertaken.

Table 7.5 *Details of transect surveys undertaken within the proposed development site.*

Date (Sunset/Sunrise)	Survey Time	Survey Type	Weather Conditions
08/07/2020 (22:00)	21:47- 23:39	Dusk transect survey	Mild, wet weather with temperatures around 16°C and light breeze. Overcast with light to moderate rain throughout the night.
28-29/07/2020 (21:35/05:20)	21:20 – 05:00	All night transect survey	Dry and partially overcast, with temperatures between 13 - 14°C.
18/08/2020 (20:55)	20:42 – 22:31	Dusk transect Survey	Dry, mild partly cloudy weather with temperatures around 16°C and light breeze.

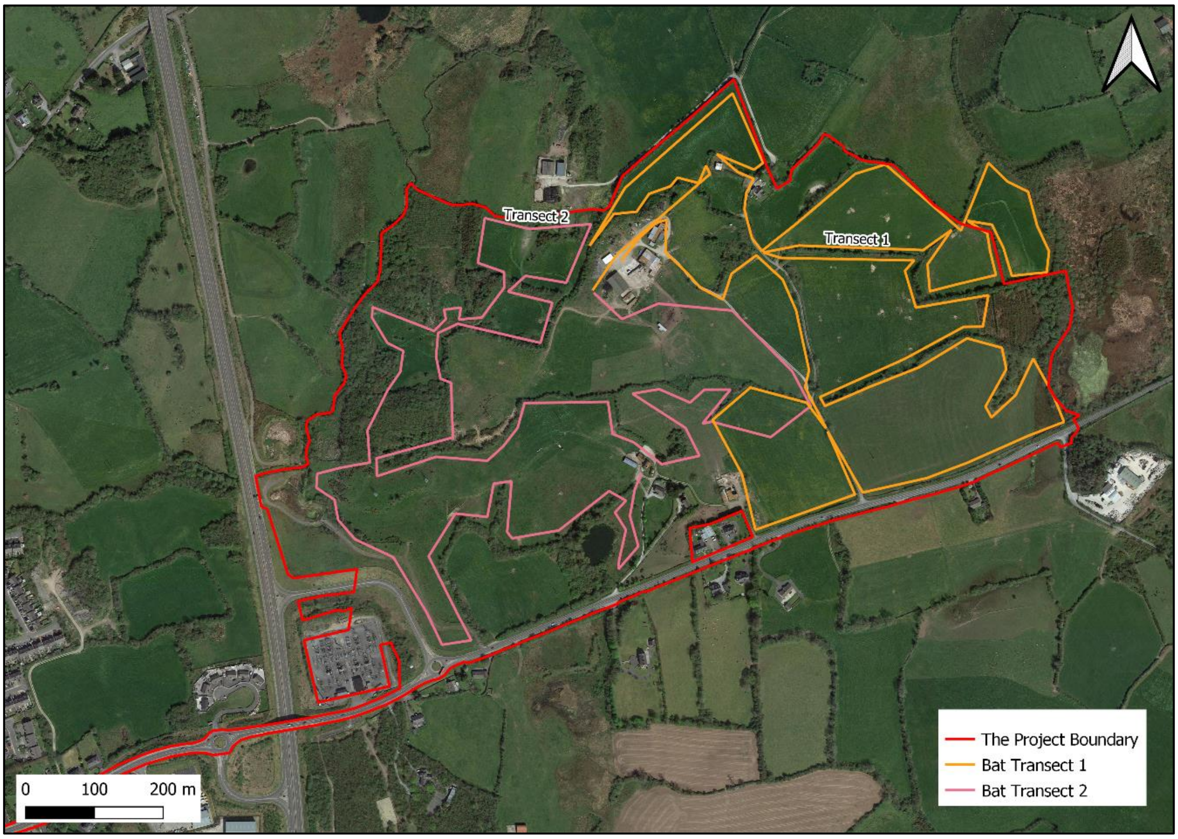


Figure 7.2 *Indicative transect routes walked within the site*

Automated static detectors

The walked transect surveys were supplemented by automated static bat detectors (*i.e.* Song Meter SM2). This use of static bat detectors at a fixed location for an extended period of time increases the likelihood of recording lesser horseshoe bats present on site compared to walked transects only. Detectors were deployed for a minimum period of 8 nights at 15 different locations within the subject lands between the 6th July and 20th October 2020. Locations of these deployments were chosen with an emphasis on areas identified as being potentially suitable for commuting and/or foraging bats, whilst also ensuring the site was covered as best as possible. Locations of the deployed static detectors can be found in Figure 7.3. Once the detectors had been deployed for a minimum of 7 nights, they were collected, and the data was analysed using Kaleidoscope bat analysis software. This software identifies each individual bat call recorded by the detectors, which can then be used to identify the calls by species.

The average number of calls recorded per night for each species was calculated for each individual static detector. These averages were then examined against the transect survey results, and based on this analysis the features, which are important for commuting and/or forging bats within the proposed development boundary, were identified. 14 static detectors were also deployed in 2018, in similar positions to 2020.

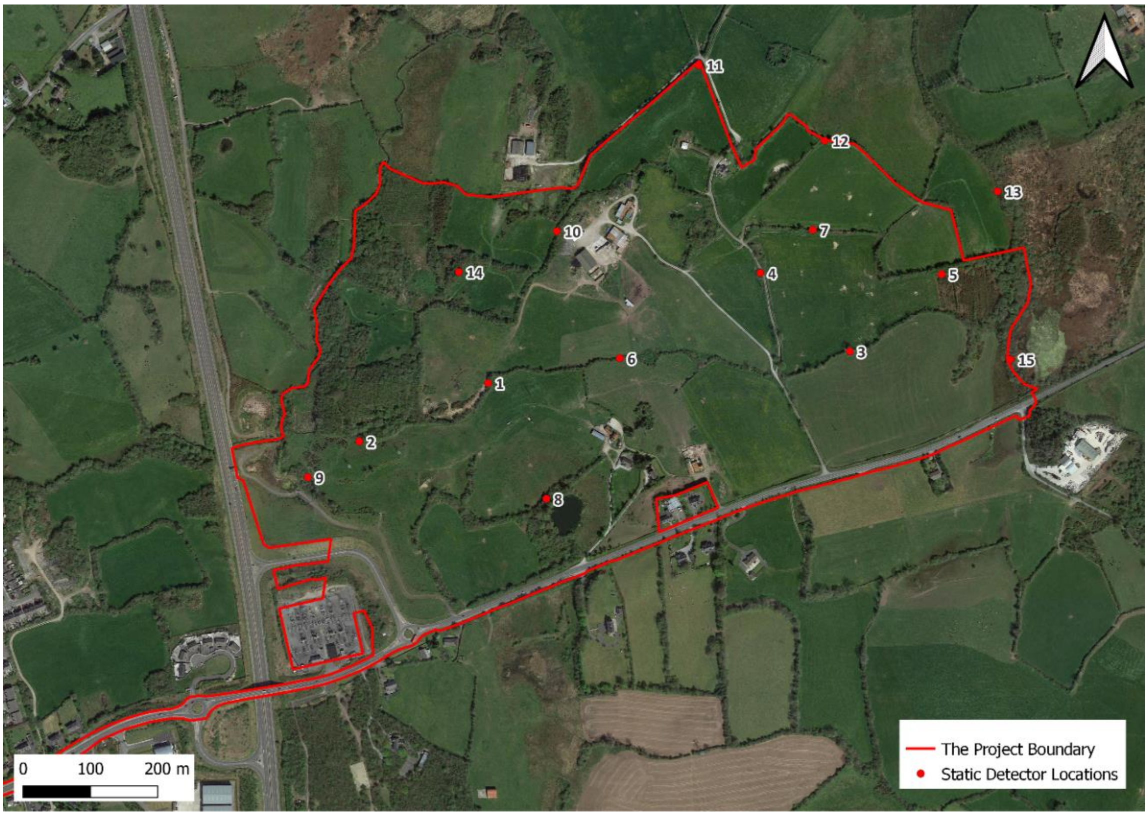


Figure 7.3 *Locations of deployed static bat detectors*

Roost emergence/re-entry activity surveys

A number of bat roost emergence/re-entry activity surveys were undertaken at six buildings and 10 structures within the lands by surveyors who are experienced in bat activity surveys. The surveys were designed with reference to methodologies in *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (3rd edn.) (Collins, 2016), survey details and map showing building locations are provided in Table 7.6 and Figure 7.4. Observations of bat activity were recorded, with data generated from the surveys analysed using Elekon BatExplorer software, whereby calls were identified to species level (where this was possible), through professional judgement and with reference to *British Bat Calls: A Guide to Species Identification* (Russ, 2012). Roost emergence/re-entry surveys were only carried out in 2020.

Table 7.6 *Details of emergence/re-entry bat surveys undertaken within the proposed development site*

Building ID Number	Building suitability, surveyed internally/externally	Number of emergence/re-entry surveys	Date of surveys	Survey time (sunset/sunrise)	Weather Conditions
BB 1A and 1B	Low Internals carried out on BB 1A, unable to carry out internals on BB 1B due to safety concerns. Externals carried out on both	2 (1 dusk, 1 dawn)	09/07/2020	21:47 – 23:37 (21:59)	Dry, clear skies, temperatures between 12 - 14°C.
			19/08/2020	04:54 – 06:24 (06:24)	Dry, overcast, light breeze with temperatures of 17°C.

Building ID Number	Building suitability, surveyed internally/externally	Number of emergence/re-entry surveys	Date of surveys	Survey time (sunset/sunrise)	Weather Conditions
BB 2	Moderate Externals only carried out	2 (1 dusk, 1 dawn)	10/07/2020	03:22 – 05:22 (05:24)	Clear, dry night with no wind, temperatures between 12 - 14°
			21/09/2020	19:20 – 21:02 (19:37)	Dry, overcast with no wind, temperatures of 15°C
BB 3	High Externals only carried out	3 (2 dusks, 1 dawn)	07/07/2020	21:47 – 23:37 (22:00)	Overcast, light to heavy rain with no wind, temperatures of 15 - 16°C
			31/07/2020	04:20 – 05:51 (05:53)	Overcast, light rain with no wind, temperatures of 17°C
			19/08/2020	20:39 – 22:22 (20:52)	Overcast, no rain, light breeze, temperatures of 19°C
BB 4A, 4B, 4C, and 4D	Low Internals and externals carried out	1 (dusk)	06/07/2020	21:47 – 23:30 (22:01)	Light rain, overcast with no wind, temperatures of 15 - 17°C
BB 5A and 5B	Moderate (3 surveys undertaken due to poor survey conditions on first survey) Externals carried out on both, internal on BB 5B.	3 (2 dawns, 1 dusk)	27/07/2020	21:18 – 23:10 (21:36)	Overcast, with heavy rain for brief period during survey then dry for rest of survey, no wind, temperatures of 13 - 15°C
			18/08/2020	04:53 – 06:24 (06:23)	Overcast, no rain, light winds, temperatures of 16 - 17°C
			22/09/2020	05:24 – 07:25 (07:22)	Clear skies, no rain or wind, temperatures of 11 - 13°C
BB 6A, 6B, and 6C	Low Externals and internal surveys carried out	1 (dawn)	28/07/2020	03:47 – 05:48 (05:48)	Overcast, light rain, no wind, temperatures of 12 - 13°C
BB 7	Moderate (3 surveys undertaken due to	3 (2 dusks, 1 dawn)	29/07/2020	21:16 – 22:56 (21:33)	Overcast with light to moderate rain, gusty winds,

Building ID Number	Building suitability, surveyed internally/externally	Number of emergence/re-entry surveys	Date of surveys	Survey time (sunset/sunrise)	Weather Conditions
	poor survey conditions) External and internal survey carried out				temperatures of 15°C
			21/08/2020	04:55 – 06:22 (06:28)	Overcast, no rain, moderate winds, temperatures of 15°C
			22/09/2020	19:24 – 21:00 (19:34)	Overcast, no rain or wind, temperatures of 13°C
BB 8	Moderate External survey only	2 (2 dawns)	30/07/2020	04:20 – 06:05 (05:51)	Overcast, light rain, no wind, temperatures of 16 - 19°C
			23/09/2020	05:54 – 07:20 (07:24)	Clear skies, light rain towards the end of the survey, no wind, temperatures of 11 - 12°C
BB 9	Moderate External survey only	2 (2 dusks)	30/07/2020	21:20 – 23:01 (21:31)	Overcast, dry, with no wind, temperatures of 16 - 17°C
			23/09/2020	19:20 – 21:03 (19:31)	Clear skies, dry, no wind, temperatures of 8 - 12°C

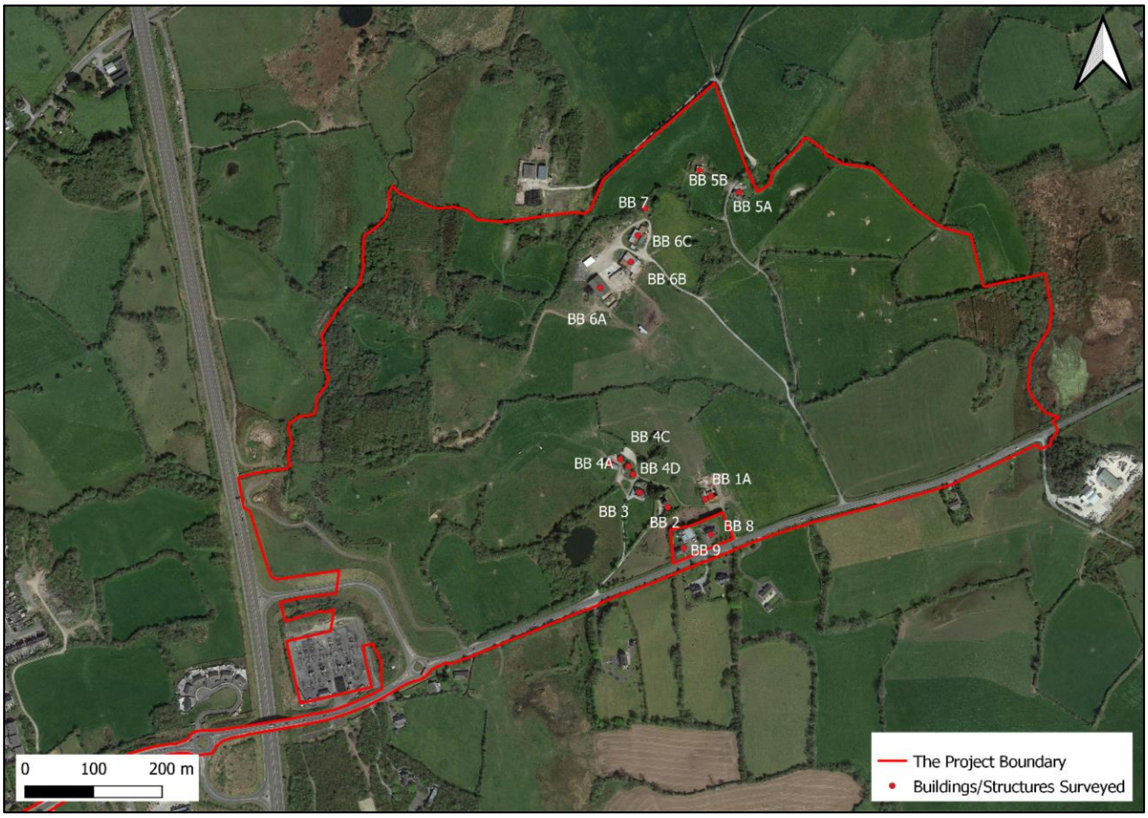


Figure 7.4 *Location of buildings surveyed and associated ID number*

<u>Amphibians and Reptiles</u>

A survey for suitable habitat for amphibians and reptiles was undertaken during surveys in July 2020. Suitable habitat for amphibians, such as ponds and wet ditches, and reptiles, such as habitats with stone walls, rocks or logs suitable for basking, were recorded and mapped, as well as any direct observations of individuals.

Survey limitations

Occupied residential houses (*i.e.* BB 2, BB 3, BB 5, BB 8 and BB 9) could not be surveyed internally for the presence of roosting bats due to health and safety concerns associated with COVID-19. The absence of an internal inspection does not compromise the assessment of the structure's potential to support roosting bats as buildings that were assessed as having moderate potential (according to BCT guidelines), had at least two emergence/re-entry surveys within the active bat season and during optimal survey conditions.

A number of surveys experienced poor weather during surveys, *i.e.*, bat surveys, and wintering bird surveys, which could have implications for results. Any bat activity surveys that experienced poor weather, were repeated when weather had improved. For wintering bird surveys, the visibility was considered acceptable for all surveys undertaken. Therefore, bad weather is not considered a limitation.

Bat hibernation surveys were not undertaken within this site, as the majority of buildings with suitability for hibernation, will be retained within the development. There were no suitable roosting sites for lesser horseshoe bat which roost in caves during hibernation. The barns/sheds are not suitable for hibernation for any bat species and will be removed as part of the development. However, one building (BB 7) which does have low hibernation potential will be removed, and as pipistrelle bat species can use buildings as winter roosting sites, a precautionary approach is employed, with any removal of buildings requiring mitigation measures to check for bats pre-demolition. Whilst a hibernation survey was not carried out on BB 7, the features suitable for hibernating bats were inaccessible and could not be inspected. This is not considered a limitation as mitigation measures have been included.

Five of the 15 statics were deployed in late September which would be considered late in the season. However, weather conditions during September and October 2020 were unseasonably mild and as such, it was considered that all static deployments were undertaken in suitable conditions for recording bat activity. As 2018 surveys included static detector surveys, two seasons of bat activity (2018 and 2020) within the site have been carried out, providing a robust baseline. Whilst surveys carried out in 2018 are considered out of date in the context of guidelines (CIEEM, 2019), results from 2018 are included to provide a better understanding of bat usage of the proposed development site. Bat surveys in April and October, where they meet certain weather conditions and temperature requirements, are also considered acceptable within BCT guidelines.

Although a lot of the routes walked during transects did not pick up any calls, the difficulty in picking up brown long-eared bat calls during transect surveys due to their quiet echolocation calls and late emergence, may have impacted the results from transect surveys. However, this is not considered to be a limitation as a more accurate description of how brown long-eared bat use the lands can be predicted from the static detector deployments.

The surveys for amphibians in July 2020 included habitat suitability assessment surveys only. Common frog surveys are typically carried out in February and March and include searches for their spawn, whereas smooth newt surveys include specialist surveys involving trapping and/or night-time torching of suitable waterbodies between March and June. The aforementioned factors are not considered to pose any limitation on the ecological assessment as a precautionary approach is employed and any suitable habitat is assumed to contain these species and mitigated for appropriately.

Specific fish and invertebrate surveys were not undertaken within the proposed development. However, this is not considered to be a limitation to the assessment as a precautionary approach is applied and it is assumed any suitable habitat identified could hold populations of species based on local records.

Despite the limitations noted above, sufficient survey data was gathered to fully inform the assessment of impacts, the mitigation measures described in this report and the assessment of residual impacts predicted in relation to the proposed development.

7.2.4 Consultations

The following organisations with relevance to ecology were consulted:

- The National Parks & Wildlife Service (NPWS) section of Department of Housing, Local Government and Heritage (formerly Department of Culture, Heritage and the Gaeltacht)
- The Vincent Wildlife Trust

A summary of these consultations with relevance to Appropriate Assessment is provided in Table 7.7 below.

Table 7.7 *Ecological issues raised during consultations.*

Consultee	Date of Consultation	Issues Raised	Relevant Section of the NIS where this is addressed
NPWS - Department of Housing, Local Government and Heritage (formerly Department of Culture, Heritage and the Gaeltacht)	15/01/2021	NPWS raised concerns regarding light spill from the proposed development on important ecological features for commuting and/or foraging bats, specifically in relation to lesser horseshoe bat, and that a light spill model would be a key factor in informing mitigation. NPWS highlighted the critical timing needed for compensatory planting of ecological corridors. NPWS queried whether hen harrier winter roost surveys would be undertaken. NPWS queried the culvert with otter ledges in place for the M18 Motorway and whether they discharge onto the site, and if they had been checked for otter usage. NPWS queried whether translocating calcareous grassland would be assessed fully and appropriately. NPWS noted hydrological issues in the northern part of the site and that further investigations were required to assess any potential hydrology constraints. NPWS queried if hibernation surveys were undertaken for bats.	Section 7.6.1.1 and 7.6.1.4 addresses mitigation required for light spill and early planting regimes. Section 7.2.4.2 details specific surveys undertaken for the site (including hen harrier). Section 7.2.4.2 details the otter surveys undertaken within the site. Section 7.6.1.3 addresses mitigation necessary for the translation of calcareous grassland.
Vincent Wildlife Trust	13/01/2021	Topics discussed included: Additional areas for planting were recommended within the proposed development site. Linear habitats for bats along Toureen Laneway was recommended to be maintained and kept completely dark. The Light Spill Model would be crucial in informing our assessment. Planting of native species on site was recommended.	Section 7.2.5 of the NIS addressed mitigation required for light spill and planting regimes.
Public consultations, including landowners, neighbours and local councillors.	22/04/2021	No issues were raised during these consultations regarding ecology.	-

7.2.5 Ecological Evaluation and Impact Assessment

7.2.5.1 Ecological Evaluation

Ecological receptors (including identified sites of ecological importance) are valued with regard to the ecological valuation examples set out in *Guidelines for Assessment* *of Ecological Impacts of National Roads Schemes: Revision 2*[15] and the guidance provided in *Guidelines for Ecological Impact Assessment in the UK and Ireland* [16] – refer to Appendix 7.7 for examples of how ecological importance is assigned. In accordance with these guidelines, important ecological features within what is referred to as the Zone of Influence (ZoI) of the proposed development which are "both of sufficient value to be material in decision making and likely to be affected significantly" are deemed to be 'Key Ecological Receptors' (KERs). These are the ecological receptors which may be subject to significant effects from the proposed development, either directly or indirectly. KERs are those biodiversity receptors with an ecological value of local importance (higher value) or greater.

7.2.5.2 Impact Assessment

Ecological impact assessment is conducted following a standard source-pathway-receptor model, where, in order for an impact to be established all three elements of this mechanism must be in place. The absence or removal of one of the elements of the mechanism is sufficient to conclude that a potentially significant effect would not occur.

- Source(s) – *e.g.* pollutant run-off from proposed works
- Pathway(s) – *e.g.* groundwater connecting to nearby qualifying wetland habitats
- Receptor(s) – *e.g.* wetland habitats and the fauna and flora species they support

Characterising and Describing the Impacts

The parameters considered in characterising and describing the potential impacts of the proposed development are per the EPA's *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*[17] and CIEEM's *Guidelines for Ecological Impact Assessment in the UK and Ireland*: whether the effect is positive, neutral or negative; the significance of the effects; the extent and context of the effect; the probability, duration and frequency of effects; and, cumulative effects.

Cumulative effects can result from individually insignificant but collectively significant actions taking place over a period of time or concentrated in a location. The following development types are included in considering cumulative effects:

- Existing projects (under construction or operational)
- Projects which have been granted consent but not yet started
- Projects for which consent has been applied for which are awaiting a decision, including those under appeal
- Projects proposed at a plan level, if relevant (*e.g.* future strategic infrastructure such as roads or greenways)

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[15] NRA (2009) Guidelines for Assessment of Ecological Impacts of National Roads Schemes: Revision 2. National Roads Authority.

[16] CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland. Chartered Institute of Ecology and Environmental Management, Winchester, UK.

[17] Environmental Protection Agency. (2022) Guidelines on the information to be contained in Environmental Impact Assessment Reports. Draft, May 2022. (refer to Table 3.3)

The likelihood of an impact occurring, and the predicted effects, can also be an important consideration in characterising impacts. In some cases, it may not be possible to definitively conclude that an impact will not occur. In these cases, the evaluation of significant effects is based on the best available scientific evidence but where reasonable doubt still remains then the precautionary principle is applied and it may need to be assumed that in the absence of mitigation significant effects may occur. Professional judgement is used in considering the contribution of all relevant criteria in determining the overall magnitude of an impact.

Significant Effects

In determining whether potential impacts will result in significant effects, the CIEEM guidelines were followed. The approach considers that significant effects will occur when there are impacts on either:

- the structure and function (or integrity) of defined sites, habitats or ecosystems; or
- the conservation status of habitats and species (including extent, abundance and distribution).

Integrity

The term "integrity" may be regarded as the coherence of ecological structure and function, across the entirety of a site that enable it to sustain all of the biodiversity or ecological resources for which it has been valued (NRA, 2009).

The term 'integrity' is most often used when determining impact significance in relation to designated areas for nature conservation (*e.g.* SACs, SPAs or pNHA/NHAs) but can also be the most appropriate method to use for non-designated areas of biodiversity value where the component habitats and/or species exist with a defined ecosystem at a given geographic scale.

An impact on the integrity of an ecological site or ecosystem is considered to be significant if it moves the condition of the ecosystem away from a favourable condition: removing or changing the processes that support the sites' habitats and/or species; affects the nature, extent, structure and functioning of component habitats; and/or, affects the population size and viability of component species.

Conservation Status

Similar definitions for conservation status given in the EU Habitats Directive 92/43/EEC, in relation to habitats and species, are also used in the CIEEM (2018) and NRA (2009) guidance which are summarised as follows:

- For natural habitats, conservation status means the sum of the influences acting on the natural habitat and its typical species, that may affect its extent, structure and functions as well as its distribution, or the long-term survival of its typical species, at the appropriate geographical scale
- For species, conservation status means the sum of influences acting on the species concerned that may affect the abundance of its populations, as well as its distribution, at the appropriate geographical scale

An impact on the conservation status of a habitat or species is considered to be significant if it will result in a change in conservation status, having regard to the definitions of favourable conservation status provided in the EU Habitats Directive

92/43/EEC – *i.e.* into the future, the range, area and quality of habitats are likely to be maintained/increased and species populations are likely to be maintained/increased.

According to the CIEEM methodology, if it is determined that the integrity and/or conservation status of an ecological receptor will be impacted on, then the level of significance of that impact is related to the geographical scale at which the impact will occur (i.e. local, county, national, international). In some cases an impact may not be significant at the geographic scale at which the ecological feature has been valued but may be significant at a lower geographical level. For example, a particular impact may not be considered likely to have a negative effect on the overall conservation status of a species which is considered to be internationally important. However, an impact may occur at a local level on this internationally important species. In this case, the impact on an internationally important species is considered to be significant at only a local, rather than an international level.

7.3 RECEIVING ENVIRONMENT

7.3.1 Designated sites

7.3.1.1 European sites

Special Areas of Conservation (SAC) are designated under the EC Habitats Directive (92/43/EEC) for the protection of habitats listed on Annex I and/or species listed on Annex II of the Directive. Special Protection Areas (SPAs) are designated under the Birds Directive (2009/147/EC) for the protection of bird species listed on Annex I of the Directive, regularly occurring populations of migratory species (such as ducks, geese or waders), and areas of international importance for migratory birds.

SACs and SPAs are offered additional protection under county development plans, as is the case for the *Clare County Development Plan 2017-2023 Variation no 1*, through Objective CDP14.9 on Natura 2000 sites which requires that planning authorities give due regard to their protection in planning policies and decisions (Clare County Council, 2017).

The proposed development does not overlap with any European sites. There are 23 European sites within the vicinity of the proposed development. The nearest European site is the Lower Shannon SAC, located *c.* 1.4km south-west of the proposed development site. The next closest European site is Ballyallia Lake SAC, located *c.* 2.2km north west of the proposed development, designated for Natural eutrophic lakes habitat type (NPWS, 2017). A section of this European site also overlaps with Ballyallia Lough SPA, located c. 2.5km north west of the proposed development site.

The Spancelhill River flows along the north-western boundary of the proposed development site, flanked by the woodland on the southern bank and improved agricultural grassland and scrub on the northern bank. It flows between two attenuation ponds located within and adjacent to the western section of the proposed development site, before exiting the site through a culvert under the M18 Motorway to Ennis. Spancelhill River then flows *c.* 2.1km downstream into the River Fergus, which in turn discharges into the Fergus Estuary *c.* 4.9km downstream. The River Fergus overlaps with the Lower River Shannon SAC where the Spancelhill Stream joins the River Fergus, and the Fergus Estuary overlaps with the River Shannon and River Fergus Estuaries SPA *c.* 4.9km downstream. Therefore, the closest European site to the proposed development, is the Lower River Shannon SAC, located 2.1km downstream, or 1.4km south west (as the crow flies) to the proposed development.

The Dromore Woods and Loughs SAC is located *c.* 4.5km north west of the proposed development site. A portion of the River Fergus flows through this European site. The River Fergus then flows *c.* 9.3km downstream, via Ballyallia Lough SAC, and combines with the outfall of the River Fergus that connects with the Spancelhill stream, upstream of this. There is therefore a hydrological link between the proposed development site and European sites.

There are 12 SACs designated for populations of lesser horseshoe bat within 15km of the proposed development. The nearest SAC designated for populations of lesser horseshoe bat is the Old Domestic Building (Keevagh) SAC, located *c.* 4.3km south west of the proposed development. A detailed analysis of how lesser horseshoe bat use the proposed development site can be found in Section 7.3.3.5.

There are four SPAs within 15km of the site. The nearest SPA is Ballyallia Lough SPA, located *c.* 2.5km north west of the site, designated for its wetlands and wildfowl, including: wigeon *Anas penelope*, gadwall *Mareca strepera*, teal *Anas crecca*, mallard *Anas platyrhynchos*, shoveler *Spatula clypeata*, coot *Fulica atra*, and black-tailed godwit *Limosa limosa*. The River Shannon and River Fergus Estuaries SPA also designated for its wetlands and waterbirds, is located *c.* 7km downstream of the site, via Spancelhill River which flows along the western boundary of the site, and the River Fergus.

The SAC and SPA sites in the vicinity of the proposed development, their distance from the proposed development and their qualifying interests/special conservation interests are presented in Appendix 7.2.

The locations of those SAC and SPA sites relative to the proposed development are illustrated on Figure 7.5 below.

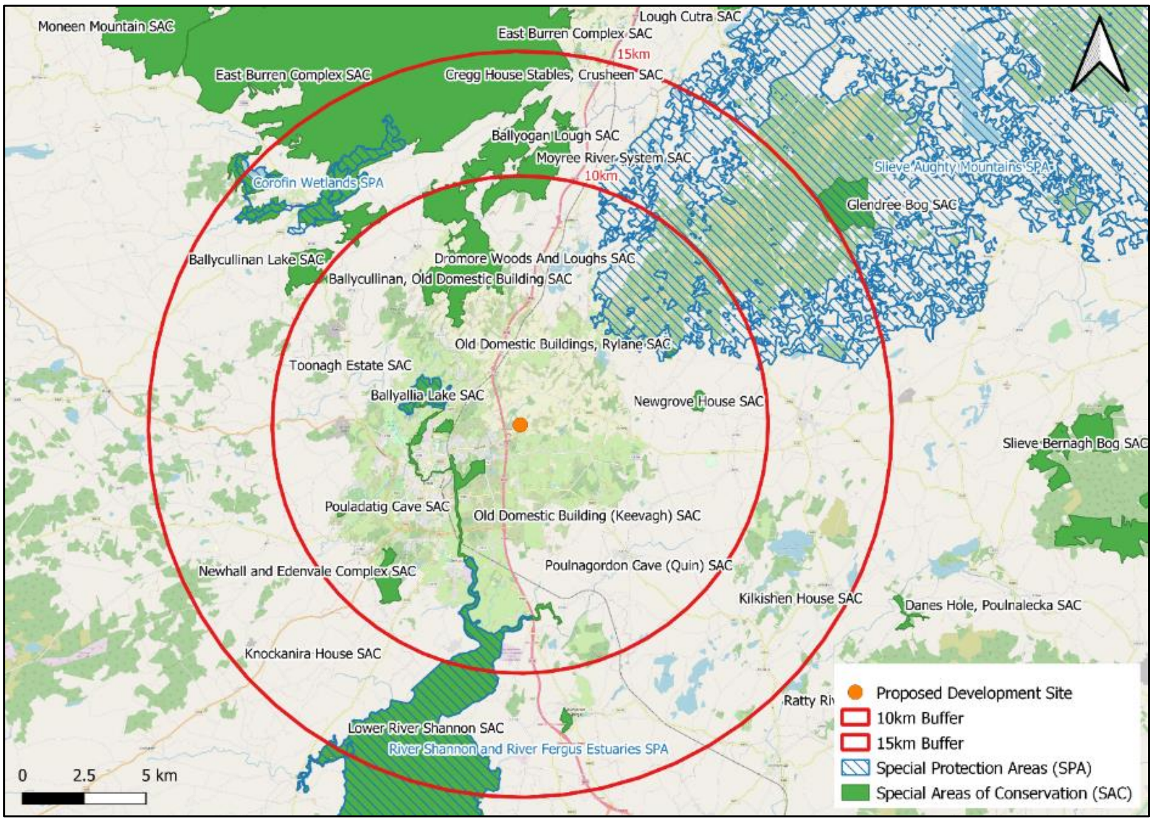

Figure 7.5 *European sites in the vicinity of the proposed development*

7.3.1.2 Nationally designated sites

Natural Heritage Areas (NHAs) are designated under the Wildlife Acts to protect habitats, species or geology of national importance. In addition to NHAs there are proposed NHAs (referred to as 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. Proposed NHAs are offered protection in the interim period under county or city development plans, as is the case for the *Clare County Development Plan 2017 – 2023* through Objective B3 which requires that planning authorities give due regard to their protection in planning policies and decisions (Clare County Council, 2017).

The proposed development does not overlap with any National sites. There are 24 National sites within the vicinity of the development, two of them being NHAs, and 22 pNHAs. The closest NHA is Oysterman's Marsh NHA, located c. 5.6km north-east of the proposed development. The closest pNHA is Newpark House (Ennis) pNHA, located c. 1.5km west of the proposed development.

The Spancelhill River which flows along the north western boundary of the site, flows under the M18 through a culvert, before flowing *c.* 2.1km downstream into the River Fergus, which then discharges into the Fergus Estuary, *c.* 4.9km downstream. The Fergus Estuary and Inner Shannon, North Shore pNHA overlaps with the Fergus Estuary at this outfall of the River Fergus. There is therefore a hydrological link between the proposed development site and National sites downstream.

The NHA and pNHA sites in the vicinity of the proposed development, their distance from the proposed development and their qualifying interests/special conservation interests are presented in Appendix 7.1. The locations of those NHA and pNHA sites relative to the proposed development are illustrated Figure 7.6 below.

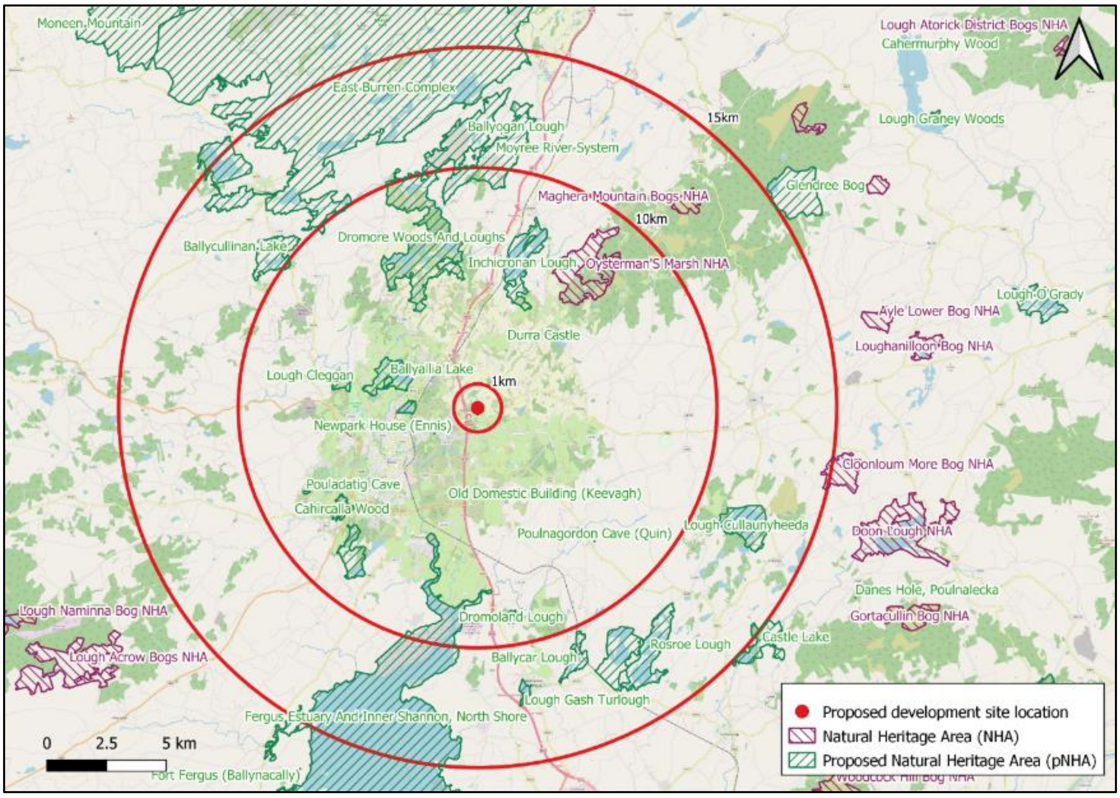

Figure 7.6 *National sites in the vicinity of the proposed development*

7.3.2 Habitats and Flora

7.3.2.1 Habitats

No protected plant species contained within the Flora (Protection) Order, 2022 were recorded within the proposed development site during surveys undertaken in 2018, 2020, or 2022. *Galium uliginsosum*, a rare plant species (of least concern) contained within *Ireland Red List No. 10: Vascular Plants* (Wyse Jackson *et al.*, 2016), was identified within the proposed development site, in the rich fen and flush habitat in the north of the site. There were no species listed on *Ireland Red List No. 8: Bryophytes* (Lockhart *et al.*, 2012) recorded within the proposed development site in either year. No non-native, invasive plant species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations, 2011 were recorded within the proposed development site in 2018, 2020 or 2022.

Each habitat identified within the proposed development site was classified according to Fossitt (2000)[3] and their corresponding level of ecological importance was determined in accordance with CIEEM (2018) and NRA (2009) guidelines. A detailed description of each habitat valued as being local importance (higher value) or higher is provided below along with an overall summary of all other habitats. Habitats valued as being of local importance (higher value) or higher include the following:

- Mesotrophic lake (FL4)
- Other Artificial Lakes and Ponds (FL8)
- Reed and large sedge swamps (FS1) including the Annex I habitat *Cladium* Fens [*7210]
- Depositing/Lowland Rivers (FW2)
- Marsh (GM1)
- Dry calcareous and neutral grassland (GS1) including the Annex I habitat Calcareous grassland [6210]
- Wet grassland (GS4) including the Annex I habitat *Molinia* meadows [6410]
- Rich Fen and Flush (PF1) including the Annex I habitat Alkaline fens [7230]
- Hedgerows (WL1)
- Treelines (WL2)
- Oak-ash-hazel woodland (WN2)
- Riparian woodland (WN5) including the Annex I habitat Alluvial Woodland [*91E0]
- Wet Willow-alder-ash woodland (WN6) including the Annex I habitat Alluvial Woodland [*91E0]
- Immature woodland (WS2)

Several areas of some of these habitats (*i.e.* dry calcareous and neutral grassland, wet grassland, oak-ash-hazel woodland and hedgerows) were valued as being of local importance (lower value) due to being less species diverse, improved in nature, and in poor quality due to cattle poaching.

Figure 7.7 presents all habitats identified and mapped within the proposed development site, while Figure 7.8 presents the level of ecological importance of these habitats. Habitats beyond the red line boundary that are considered to be of international importance are included in Figure 7.8 as they are within the ground water ZoI from the proposed development site. Species lists for each of the habitats valued as being of local importance (higher value) or higher are provided in Appendix 7.3.

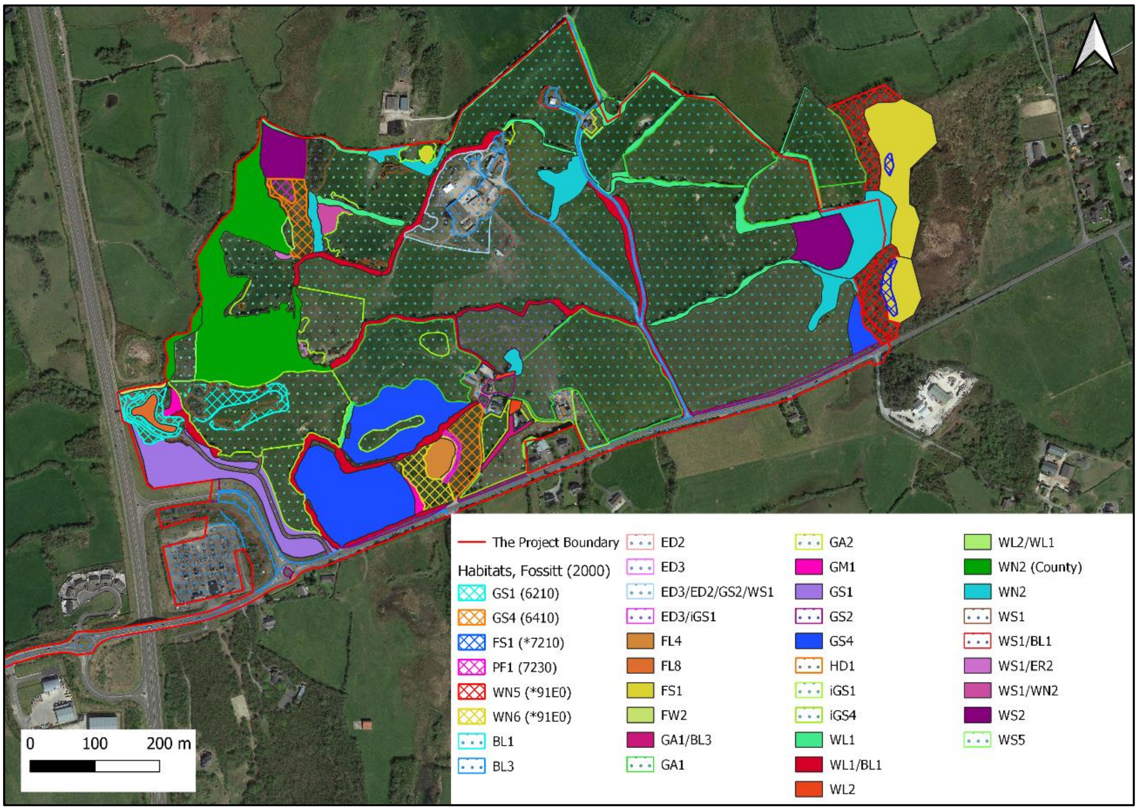

Figure 7.7 *Habitats identified within the proposed development site, as classified according to Fossitt, J.A (2000) and the Interpretation manual of European Union Habitats EUR28 (CEC, 2013)*

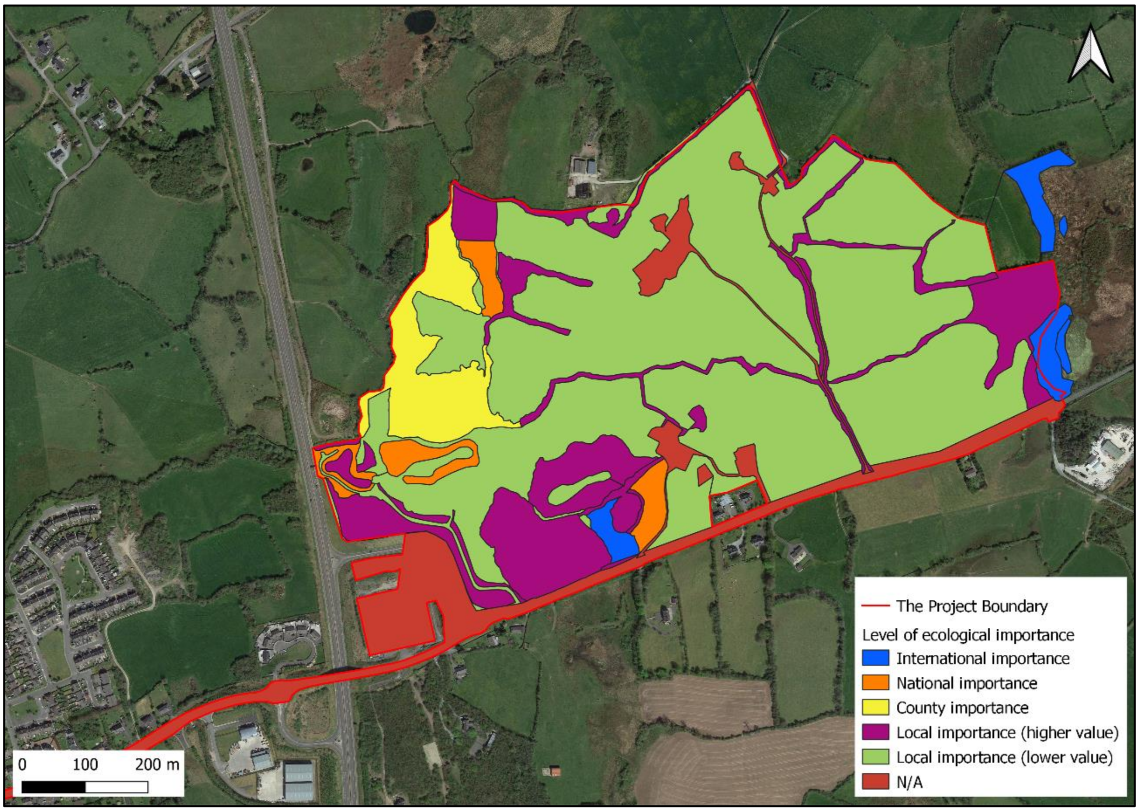

Figure 7.8 *Level of ecological importance of each habitat identified within the proposed development site, as determined in accordance with CIEEM (2018) and NRA (2009) guidelines*

Habitats valued as being of national, county, or local importance (higher value)

Mesotrophic Lakes (FL4), c. 0.21ha in total area (see Plate 1)

A small mesotrophic lake, referred to as Toureen Lough (ITM grid reference 537343 679385), was identified in close proximity to the southern boundary of the proposed development site, directly north of an existing farm laneway. Lake water was clear with no signs of algal growth. *Nuphar alba* was noted in the centre of the lake, while reed vegetation forms the dominant feature fringing the lake edge. At a few smaller locations along the lake's eastern boundary, *Nasturtium officinale* and *Apium nodiflorum* occurred where cattle were accessing the lake to drink. Other species found here included; *Potamogeton natans*, *Lemna minor*, and *Ranunculus flammula*. This habitat is valued as being of local importance (higher value) due to the diversity of plant species present in the context of the surrounding local environment.

Plate 1. *Toureen Lough, with evidence of cattle poaching along its periphery*

Other Artificial Lakes and Ponds (FL8), c. 0.13ha in total area (see Plate 2)

This habitat consisted of an existing attenuation pond of the M18 Motorway (ITM grid reference 536891 679457) located adjacent to the western boundary of the proposed development site, directly south of the Spancelhill Stream. It contained a variety of macrophytes, which included floating plant species, such as *Lemna minor* and *Potamagon* species, as well as emergent plant species, such as *Typha latifolia*, *Alisma plantago-aquatica* and *Sparganium erectum*. It was bordered by a fringe of reed and large sedge swamps habitat, which was dominated by *Phragmites australis*.

The level of importance of this habitat was valued as being of local importance (higher value) due to the diversity of plant species present in the context of the surrounding local environment, and relatively good quality of the habitat due to it being fenced off from the surrounding agricultural lands.

Plate 2 *Existing attenuation pond of the M18 Motorway dominated by various macrophytes species*

Reed and Large Sedge Swamps (FS1) c. 2ha in total area (See Plate 3)

Reed and large sedge swamp (FS1) also occurs across an extensive area to the east of the red line boundary, adjacent to the riparian woodland habitat described below. Here the conditions are too wet and inundated to support true riparian woodland, and instead a swamp habitat occurs, interspersed with scattered inundation-tolerant shrubs and scrub vegetation (WS1). This habitat hosts a number of typical species of swamp habitat, including the dominant common reed and the occasional large sedge species, *Cladium mariscus*, along with *Carex rostrata* and *Carex paniculata. Menyanthes trifoliata* provides a dense mat of floating vegetation, whilst on the open water itself, *Lemna minor* is abundant, alongside *Nuphar lutea*. The scattered scrubby areas are dominated by *Salix cinerea*, hybrid willow and some *Myrica gale*, and mostly occur on the somewhat higher, drier parts of the swamp.

Some swamp vegetation with great fen-sedge in Ireland may be classified as the EU Habitats Directive Annex I habitat *Cladium* fen [*7210], which is described in detail by NPWS (2019). Eight positive indicator species (namely *Cladium mariscus*, *Juncus articulatus*, *Carex paniculata, Carex rostrata*, *Equisetum fluviatile*, *Galium palustre*, *Lythrum salicaria* and *Mentha aquatica* – “typical species” as per NPWS, 2019) in total for this Annex I habitat were recorded in the wider swamp habitat here, but no high-quality indicator species were recorded. *Cladium mariscus* was also recorded within the relevés themselves. It is occasionally present in this habitat and is not generally forming dense stands, as it is largely out-competed by common reed. This vegetation represents a relatively species-poor calcareous swamp/fen habitat. Nonetheless, NPWS (2019) state that areas/stands of great fen-sedge “*including areas that support species-poor vegetation*” are referrable to the Annex I 7210 habitat. Therefore, following a precautionary principle, this swamp habitat located in east beyond the red line boundary, must classify as Annex I *Cladium fen* 7210 habitat. This habitat is currently considered to be stable in Ireland (NPWS, 2019). The habitat in the east is considered to be of international importance as it is a priority Annex I habitat.

The margins of the aforementioned mesotrophic lake (Toureen Lough) were dominated by *Typha latifolia* and *Phragmites australis* vegetation, with occasional colonising *Salix* spp. This habitat formed a tall and dense buffer between the lake and surrounding vegetation and occurs within the lake shallows. Likewise, the margins of the attenuation pond were comprised of this habitat. It is a naturally relatively species-poor habitat; however, it is considered to be of local importance (higher value), due to its rarity in the wider local environment. The habitat at Toureen Lough merged with alkaline fen at its outward edge. This transition area was marked by the emergence of *Carex paniculata* as the dominant species.

Plate 3. *Reed and large sedge swamp habitat to the east of the red line boundary, with common reed and great fen-sedge present*

Depositing/lowland Rivers (FW2) (See plate 4)

The Spancelhill Stream, a tributary of the River Fergus, is located only partially within the proposed development site as it flows along the north-western and western boundaries in proximity of the oak-ash-hazel woodland. From there, it flows under the M18 Motorway via an existing culvert. Plant species growing in association with the stream included a variety of emergent macrophytes such as *Filipendula ulmaria*, *Typha latifolia*, *Mentha aquatica*, *Apium nodiflorum* and *Phragmites australis*. The ground substrate of the Stream was mixed, with some areas dominated by gravel, with other areas extremely soft and silty. Depth ranged from *c.* 50cm – 1m, and was *c.* 2-3m wide. Whilst this habitat is badly poached by cattle, resulting in a partially degraded habitat, the level of importance of this habitat was valued as being of local important (higher value) due to the connectivity it provides to areas downstream.

Plate 4 *Spancelhill Stream with evidence of cattle poaching along banks*

Marsh (GM1), c. 0.13ha in total area

This habitat was located within the southern section of the proposed development site adjacent to a wet grassland field, and directly east of the Spancelhill Stream in close proximity to the attenuation pond. In both areas, ground conditions were damp under foot with water of a depth of *c.* 5cm noted in parts. The level of importance of this habitat was valued as being of local important (higher value) due to the diversity of plant species present in the context of the surrounding local environment.

It was dominated by species typical of wet, marshy ground conditions such as *F. ulmaria*, *L. salicaria*, *M. aquatica*, *A. nodiflorum*, *Epilobium hirsutum*, *P. australis* and *Salix* species. This habitat, located adjacent to the wet grassland field, gradually graded into wet woodland as tree species, such as *Salix* species, became more dominant. There was no evidence of extensive grazing or poaching within these areas located.

Dry Calcareous and Neutral Grassland (GS1), c. 2.2ha in total area (see Plate 5)

This habitat was present:

- on the hillslopes of undulating, neutral grassland fields located within the south-western section of the proposed development site;
- either side of the existing laneway leading to the attenuation pond; and,

- on top of the banks of the attenuation pond.

The level of importance of this habitat within these different areas varied (*i.e.* national importance and local importance (higher value)) according to their species composition and structure.

A variety of calcicole plant species were recorded across this habitat. These included *Briza media* and *Linum catharticum*, which are high quality positive indicator species of the Annex I habitat Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) [6210], hereafter referred to as calcareous grassland [6210] (as per O'Neill *et al.*, 2013), and *Daucus carota*, *Leontodon saxatilis* and *Galium verum*, which are positive indicator species of this same-said Annex I habitat. Common grass species were also recorded, including *Festuca rubra*, *Holcus lanatus*, *Agrostis stolonifera*, *Cynosurus cristatus* and *Dactylis glomerata*, as were forb species typical of more improved agricultural grassland, such as *Senecio jacobaea*, *Ranunculus repens* and *Trifolium repens*. These species were notably more dominant in areas valued as being of local importance (higher value) in comparison to the areas valued as being of national importance. There was evidence of heavy grazing and poaching on the hillslopes. Both areas located at the attenuation pond and within the adjacent field within the south-western corner of the proposed development site were stockproof.

Two areas of this habitat were valued as being of national importance as they corresponded to the Annex I habitat calcareous grassland [6210] due to their species composition and structure as recorded in the respective relevés. The overall conservation status of this Annex I habitat is "*Bad*" (NPWS, 2019) and as such this habitat is considered to be of high conservation concern at a national level. These areas were located on the hillslopes located within an improved neutral grassland field and on top of the banks of the attenuation pond. Two high quality positive indicator species and four positive indicator species of this Annex I habitat (as per O'Neill *et al.*, 2013) were recorded in both relevés taken in these areas. These areas did not correspond to the priority Annex I habitat[18], *i.e.* the orchid-rich variant of 6210, as no orchid species were identified within these areas. Both these areas are considered to be of poor quality (or "*unfavourable*" conservation status, O'Neill *et al.*, 2013) as they failed the condition assessment on the criterion of number of indicator positive indicator species being less than seven and in the case of the former area, the criterion of evidence of serious grazing or disturbance in the local vicinity. This area is under threat from scrub encroachment.

[18] A priority status is accorded to Annex I habitats that are in danger of disappearance and whose natural range falls within the territory of the European Union (O'Neill *et al.*, 2013).

Plate 5 *Area of Annex I habitat dry calcareous grassland [6210], valued as being of national importance, located on top of the banks of the attenuation pond*

Wet Grassland, c. 4ha in total area (see Plate 6)

The majority of this habitat was located:

- within the south-western section of the proposed development site in close proximity to Toureen Lough, a shallow drainage ditch and an area of wet woodland;
- within the north-western section of the proposed development site located east of the woodland; and,
- along the south-eastern boundary of the site, directly west of Ardnamurry Lough which is located outside the proposed development site.

The level of importance of this habitat within these different areas varied (*i.e.* national importance and local importance (higher value)) according to their species composition and structure.

Typical wet grassland species recorded included *Molinia caerulea*, *F. ulmaria*, *Galium palustre* and *Lotus pedunculatus*, which are positive indicator species of the Annex I habitat *Molinia* meadows on calcareous, peaty or clayey-silt laden soils (*Molinion caeruleae*) [6410], hereafter referred to as *Molinia* meadows [6410] (as per O'Neill *et al.*, 2013). Other species typical of wet habitats recorded included *L. salicaria*, *Iris pseudacorus*, *Cardamine flexuosa* and *Hypericum tetrapterum*. Common grass species recorded included *H. lanatus*, *Anthoxanthum odoratum*, *C. cristatus* and *Alopecurus geniculatus*, while rush species recorded included *Juncus articulatus*, a positive indicator species of the Annex I habitat *Molinia* meadows [6410], and *J. effusus* and *J. inflexus*. Species typical of more improved grassland habitats, such as *Lolium perenne*, *T. repens*, *R. repens* and *Plantago lanceolata* were also recorded. Overall these species did not dominate the species composition; however, they were notably more dominant in areas valued as being of local importance (higher value) in comparison to those valued as being of national importance. There was evidence of extensive heavy grazing and poaching within the fields located within the southern section of the proposed development site.

There were two areas of this habitat that were valued as being of national importance as they corresponded to the Annex I habitat *Molinia* meadows [6410] due to their species composition and structure as recorded in a relevé. The overall conservation status of this Annex I habitat is "*Bad*" (NPWS, 2019) and as such this habitat is considered to be of high conservation concern at a national level. These areas were located within the north-western section of the proposed development site, east of the oak-ash-hazel woodland and south of the planted immature woodland and rich fen and flush, and in a field by Toureen Lough. One high quality positive indicator species and four positive indicator species of this Annex I habitat (as per O'Neill *et al.*, 2013) were recorded within the relevé taken in the north-western area. The high quality positive indicator species *Dactylorhiza fuchsia* and positive indicator species *Juncus articulatus* were both recorded outside, but within close proximity to the relevé. No relevé was taken within the field by Toureen Lough; however, it was noted that a total of eight positive indicator species of this Annex I habitat (as per O'Neill *et al.*, 2013) were recorded within this area, but no high-quality positive indicator species were recorded. It was also noted that the sward was diverse throughout and had a high proportion of forbs to grasses. The field by Toureen Lough was heavily grazed and poached at the time of survey. The most abundant species was articulated rush *Juncus articulatus*, although its total cover was limited by the high grazing levels.

This area is considered to be of poor quality (or "*unfavourable*" conservation status, O'Neill *et al.*, 2013) as it failed the condition assessment on the criteria of number of indicator positive indicator species being less than seven and the ration of forb to graminoid species.

Plate 6 *Area of Annex I habitat Molinia meadows [6410], valued as being of national importance, located within the north-western section of the proposed development site*

Rich Fen and Flush (PF1), c. 0.13ha in total area (see Plate 7)

This habitat was located in two different areas, one of which was located within the northern section of the proposed development site, while the second was located within the southern section. The level of importance of this habitat within these different areas were both of national importance according to their species composition and structure.

The small area of rich fen and flush, located in the far north west of the proposed development site, described as a wetland/pond feature, corresponded to a depression between wooded areas, and are naturally relatively species-rich vegetation communities. It is likely to have formed as a consequence of a lake infilling and can be described as a topogenous fen (*i.e.* forming in a valley or depression). It was notable for the presence of Typha *latifolia*, *Sparganium erectum* in combination with a sward dominated by *Schoenus nigricans*, and sedge species such as *Carex flacca*, *C. paniculata* and *C. nigra*, over a brown moss understorey, which included the abundant

Calliergonella cuspidata. The characteristic *Galium uliginosum* was relatively abundant, as was *M. aquatica*. This habitat merged with the adjacent Annex I habitat *Molinia* meadows [6410] characterised by rushes and purple moor-grass at its edge.

A more-species-poor fen community occurs bordering on the landward side of reed and tall sedge swamp vegetation at Toureen Lough. Here the overstorey is a near monoculture of *Carex paniculata*, with occasional *Lychnis flox-cuculi* and a few forb species of the adjacent wet grassland habitat, with which it merges at its edge.

Fen habitats located within these two particular areas corresponded to the description of the Annex I habitat Alkaline fen [7230], which are described as "*Wetlands mostly or largely occupied by peat- or tufa-producing small sedge and brown moss communities developed on soils permanently waterlogged, with a soligenous or topogenous base-rich, often calcareous water supply, and with the water table at, or slightly above or below, the substratum…*" within the *Interpretation Manual of European Union Habitats* (European Commission, 2013). The conservation status of alkaline fens [7230] in Ireland is "*bad*" due to ongoing losses in national area, and due to the poor condition of a large proportion of the habitat within the country (NPWS, 2019).

The examples of rich fen and flush habitats within these two areas are considered to be of national importance. The total area of this habitat within the lands is relatively small, however they are a naturally species-rich habitat type and correspond to an Annex I habitat type, which is of "*bad*" conservation condition in Ireland. It is considered likely that similar examples of this habitat occur within the surrounding area based on the author's knowledge of the geography of the surrounding landscape and a review of orthophotography of the locality, and for this reason the habitat is not considered to be rare or unusual locally.

Plate 7 *Fen habitat in north western section of the site*

Hedgerow (WL1), c. 5.38km in total length (see Plate 8)

The majority of the field boundaries located across the proposed development site consisted of this habitat. Several of which were growing adjacent to stone walls, while others were adjacent to drainage ditches. The level of importance of some hedgerows was valued as being of local importance (higher value) due to their structure and plant species composition. These hedgerows were notably more diverse in comparison to those valued as being of local importance (lower value).

Overall, these hedgerows were dominated by *Corylus avellana*. Other woody species present included *Crataegus monogyna*, *Fraxinus excelsior*, *Ilex aquifolium* and *Rubus* *fruticosus*. *Acer pseudoplatanus*, *Sambucus nigra* and *Rosa sp.* were also present in some of these hedgerows; however generally in lower abundances. *Hedera helix* was often recorded growing in association with several of these woody species. The understorey of these hedgerows were not especially species rich. It generally included species common to more shaded environments, such as *Arum maculatum*, *Geranium robertianum* and *Asplenium scolopendrium*, and others common to hedgerows, such as *Galium aparine* and *Anthriscus sylvestris.* A number of these hedgerows were growing adjacent to stone walls, which formed field boundaries.

Plate 8 *Hedgerow, valued as being of local importance (higher value), located in the southern section of the proposed development site*

Oak-ash-hazel Woodland (WN2), c. 5.5ha in total area (see Plate 9)

The majority of this habitat, which was generally dominated by a low canopy of *C. avellana*, was identified within the north-western section of the proposed development site, adjacent to semi-natural and improved grassland fields and planted immature woodland. There were also four other relatively small, isolated blocks of this habitat, ranging from *c.* 0.34-0.08ha in total area, that were located: in close proximity to the northern boundary; in the centre of the proposed development site north-east of existing farm buildings; and, adjacent to the eastern boundary of the proposed development site.

The level of importance of this habitat within these different areas varied (*i.e.* county importance and local importance (higher value)) according to their structure (including geological structure) and plant species composition. The most important area is the largest woodland block (*c.* 3.6ha in total area) located within the north-western section of the proposed development site, east of the Spancelhill stream. This block of woodland is valued as being of county importance, while all other areas of this habitat are valued as being of local importance (higher value).

Overall, the woodland canopy was relatively low and dominated by *C. avellana*, *C. monogyna* and *Fagus sylvatica*. *F. excelsior*, *I. aquifolium* and *S. nigra* were also recorded; however, in lower abundances in comparison to the former three species. Below this, the shrub layer was dominated by *Rubus fruticosus* and *Prunus spinosa*, while the field layer contained a variety of herbaceous species typical of shaded woodlands such as *Oxalis acetosella*, *Geum urbanum, Circaea lutetiana*, *G. robertianum* and *A. maculatum*. *H. helix* was also noted densely covering the field layer, as well as growing on the woody tree species. Other herbaceous species recorded included those typical of more improved habitats including *Urtica dioica* and *R. repens*. A limited number of fern species were recorded. These comprised of

Dryopteris filix-mas and *A. scolopendrium*. Exposed rocky limestone outcrops of varying sizes were present, often densely covered in moss species *Fissidens spp.* and *H. helix*. There was evidence of grazing and poaching by livestock throughout this habitat with numerous paths passing through the woodland, resulting in relatively large areas of exposed soil.

A relevé was taken within this area to confirm whether or it corresponded to the wooded variant of Annex I priority habitat Limestone pavement [*8240]. Whilst this area did contain 12 positive indicator species of this Annex I habitat (as per Wilson & Fernández, 2013), it was determined that it did not correspond to this Annex I habitat for the following reasons:

- It lacked the distinctive clint and gryke and/or shattered limestone pavement geological structure that is characteristic of this Annex I habitat (as per Wilson & Fernández, 2007);
- It lacked a sufficient percentage cover of exposed rock (*i.e.* at least 50%, the percentage cover of exposed bare soil was 60%[19]); and,
- The average depth of soil present was *c.* 14cm, which in the context of this Annex I habitat is not considered to be not shallow enough (> 2cm).

The other areas of this habitat that are valued as being of local importance (higher value) were less species-rich compared to this large block of woodland and generally lacked the more typical woodland structure (*i.e.* a relatively well-developed understorey layer) and the exposed rocky outcrops. Significant encroachment from scrub species (*i.e. R. fruticosus*, *Ulex euroaepus* and *P. spinosa*) was noted within two of the four isolated woodland blocks valued as being of local importance (higher value). This may be have resulted in the stunted growth of *C. avellana*, *C. monogyna* and *F. sylvatica* within these particular areas. Consequently, these areas may be described as a mosaic of woodland and scrub habitats. All these areas are valued as being of local importance (higher value) primarily due to their importance in maintaining ecological corridors.

[19] According to the *Interpretation Manual of European Union Habitats EUR28* (Commission of the European Communities, 2013), "*The rock surface* [of this Annex I habitat] *is almost devoid of overlying soils (considerably less than 50% cover) except for some patches of shallow skeletal or loessic soils, although more extensive areas of deeper soil occasionally occur; sometimes there is encroachment of peat.*"

Plate 9 *Oak-ash-woodland habitat dominated by C. avellana with exposed rocky outcrops and valued as being of county importance, located within the north-western section of the proposed development site.*

Riparian woodland (WN5), c. 1.03ha in total area

Riparian woodland (WN5) occurs along the margins of the wider swamp area to the east of the red line boundary of the proposed development site. This habitat hosts a number of classic riparian woodland plant species, including the dominant canopy species *Salix cinerea* subsp. *oleifolia* and *Salix* × *multinervis,* as well as shrub and low woody shrub species like *Myrica gale*, *Hedera helix* and *Rubus fruticosus* agg., and a herb layer of such species as *Filipendula ulmaria, Juncus effusus, Angelica sylvestris, Galium palustre* and *Carex paniculata*. The inundated condition of the herb layer is indicated by the presence of *Comarum palustre* and *Menyanthes trifoliata*.

Some areas of riparian woodland habitat in Ireland may be classified as the EU Habitats Directive priority Annex I habitat *[91E0] Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*). The description of the Irish variant of this habitat is outlined within O'Neill & Barron (2013) and is based on the outcomes of the *National Survey of Native Woodland 2003-2008* (Perrin *et al.*, 2008). A minimum of seven indicator species of Perrin *et al.* (2008), at least one of which must be *Alnus glutinosa*, *Fraxinus excelsior* or *Salix* sp., must be present in the monitoring plot for vegetation to correspond to *[91E0] Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*), based on the assessment methodology of Perrin *et al.*, (2008). The status of Alluvial woodland *91E0 primarily depends on; the canopy being dominated by *Salix* sp., the woodland is flooded routinely, and that the woodland is more than 4m in width, all of which this habitat possesses. As only three positive indicator species (namely *Filipendula ulmaria, Angelica sylvestris* and *Stellaria palustris*) were recorded in this riparian woodland habitat, this habitat is of poor quality, however this habitat is under threat in Ireland from habitat loss (NPWS, 2019). Therefore, the habitat here is considered to be of international importance. It has been valued as such due to the overall naturalness of the vegetation type, as it has the three factors that the status of Alluvial woodland habitat relies on (as previously described), as well as considering the conservation status of the habitat in Ireland and its status as a priority habitat.

Wet Willow-Alder-Ash Woodland (WN6), c. 1.5ha in total area, (see Plate 10)

A small area of wet woodland is located on the southern and western shores of Toureen Lough, where the dominant overstorey tree is grey willow *Salix cinerea*. It occurs in an area between Toureen Lough and the southern boundary of the lands with the R352 road.

As mentioned, grey willow was the most abundant canopy species, with some goat willow *S. capraea* and very occasional eared willow *S. aurita*. The canopy is low, *c.* 5-10m high, with many of the willow species with partially collapsed branches. Alder *Alnus glutinosa* appears occasionally, while hazel *Corylus avellana* begins to appear where the ground is drier. Understorey species noted included canary reed-grass *Phalaris arundinacea*, with abundant meadowsweet and enchanter's-nightshade *Circaea lutetiana,* and occasional wild Angelica *Angelica sylvestris*, flag iris *Iris pseudacorus* and greater tussock-sedge. Part of the canopy has recently been cleared by coppicing, which is probably linked to the presence of overhead power lines.

While a relevé was not undertaken within the woodland, a comparison of species composition against communities described within the Irish Vegetation Classification

(IVC) indicates that it most closely aligns with the IVC category "WL3F *Salix cinerea* – *Phalaris arundinacea* woodland". This is a community of heavy, base-rich soils. It is rare in the west of the country, with the exception of Clare (Perrin *et al.*, 2008).

This woodland type within the proposed development site corresponds to the Annex I priority habitat *"[91E0] alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)*", herein referred to as "alluvial woodland [*91E0]", based on its location within 20m of Toureen Lough, and due to the presence of typical alluvial woodland [*91E0] species, as per Perrin *et al.* (2008). Seven positive indicator species were recorded within the woodland, while a single negative indicator species, sycamore *Acer pseudoplatanus*, was recorded, albeit with very low abundance. Alluvial woodland [*91E0] is a priority habitat, meaning it is a habitat in danger of disappearance at a European level, and whose natural range falls mainly within the territory of the European Union (European Commission, 2013). The conservation status of alluvial woodland [91E0] in Ireland is "*bad*" (NPWS, 2019), because it is a highly fragmented habitat occurring as small pockets of woodland, with a very limited total area within the country. The example within the subject lands is considered to be of international importance. It has been valued as such due to the overall naturalness of the vegetation type, and the diversity of species present, as well as considering the conservation status of the habitat in Ireland and its status as a priority habitat.

Plate 10 *Wet willow-alder-ash woodland habitat dominated by grey willow, with typical [91E0] alluvial woodland understorey.*

Immature woodland (WS2), c. 1.1ha in total area

This habitat was located along the northern boundary of the proposed development site adjacent to fen habitat and along the eastern boundary of the proposed development site adjacent to an improved grassland field. Both areas had been recently planted with tree saplings. The former area was fenced-off and inaccessible; therefore, it was surveyed from the existing fenceline. It was dominated by planted *Alnus glutinosa* and *Salix cinerea*, while *Viburnum opulus* was occasionally present. The latter area was partially accessible. It contained tree species *Quercus sp.*, *Betula sp.*, *F. sylvatica*, *Sorbus aucuparia* and *C. avellana*. This area gradually became more dominated by scrub species, such as *R. fruticosus*, *U. europaeus* and *Pteridium aquilinum*, to the east. The level of importance of this habitat was valued as being of local important (higher value) primarily due to its importance in maintaining ecological corridors.

<u>Overall summary of the habitats valued as being of local importance (lower value) and/or of artificial nature</u>

The majority of the proposed development site (*i.e.* c. 41ha in area) consisted of habitats that were valued as being of local importance (lower value) or of artificial nature. These predominantly comprised relatively large fields of improved agricultural grassland (Plate 11). Some of these fields located within the western section of the proposed development site were identified as neutral calcareous grasslands as they exhibited significant signs of land improvement. Whilst some calcicole species were recorded within these fields *Daucus carota* and *Lotus corniculatus*, they were in very low abundances and overall, these fields were dominated by species typical of more improved agricultural grassland habitats.

One improved wet grassland field was noted along the southern boundary of the proposed development site, directly north of the R352. Likewise, whilst it contained some species that were typical of wet grassland, it was dominated by those more typical of improved grassland habitats. Dry meadows and grassy verges was recorded along the bank of the M18 Motorway, which was dominated by large tussocks of *Arrhenatherum elatius,* along the roadside verge of the R352 and within the existing farmyard located off the R352. There were also some relatively small areas of amenity grassland, i.e. lawns located within private gardens.

Some hedgerows located within the proposed development site were valued as being of local importance (lower value) as they were species-poor, often containing only one species, recently planted and heavily pruned. There was a species-poor treeline/hedgerow of planted young saplings of *Crataegus monogyna* and *Fraxinus excelsior* considered to be of local importance (lower value) located along the boundaries of a field located in close proximity to the southern boundary.

There were two relatively small blocks of oak-ash-hazel woodland that were valued as being of local importance (lower value), due to species-poor upper storey, dominated by *Corylus avellana*, and very species poor understorey, which was in parts dominated by scrub encroachment. There were a number of relatively small patches of scrub habitat scattered across the site, often in association with hedgerows, woodland and stone wall habitats. There was also a relatively small area dominated by *P. aquilinum* located directly west of the wet woodland within the south-western section of the proposed development site.

Recolonising bare ground comprised the private laneway from the R352 to the attenuation pond located within the western section of the proposed development site and two other patches located with improved dry calcareous and neutral grasslands which consisted of exposed ground which had been recolonised.

There were drainage ditches located across the site in association with hedgerows. These generally contained shallow stagnant water and in parts were heavily poached by livestock. A locally fed spring was identified in the west of the site, between the improved grassland habitat and the oak-ash-hazel woodland. This flowed eastwards along a drainage ditch and into Spancelhill Stream in the west of the site. There was limited macrophyte species present within this habitat. They were valued as being of local importance (lower value).

An area of recently felled woodland (WS5) was identified within the Oak-Ash-Hazel Woodland (WN2) on the western side of the proposed development site, along the banks of the Spancelhill Stream.

Habitats valued as being of artificial nature included spoil and bare ground, buildings and artificial surfaces, such as the existing residential and farm buildings, private roads and other areas of concrete/hard standing such as farm yards, and stone walls and other stonework that were not associated with any other habitat.

Plate 11. *An example of improved agricultural grassland that dominates the habitats within the site.*

7.3.3 Fauna

7.3.3.1 Terrestrial Fauna (Excluding bats)

Badger

Badger *Meles meles*, and their breeding and resting places, are protected under the Wildlife Acts. The NBDC data search returned 40 records of badger within *c.* 2km of the proposed development with the latest from 2018 (Appendix 7.2).

Evidence of badger activity was found within the woodland area in the north-western section of the proposed development site. Two confirmed badger setts, badger hair, snuffle holes, and mammal paths were identified within this woodland habitat. One sett (located *c.* 180m west from the footprint of the proposed development) consisted of a single entrance and is likely to be a subsidiary or outlier sett (Figure 7.9). This sett is being actively used by badger as confirmed with the identification of badger hair at its entrance, and fresh, heaped soil in front of the sett. Mammal paths were evident throughout the woodland, however these paths cannot be confirmed as solely badger as cattle traverse the area frequently. A second sett was also identified in this woodland, *c.* 30m north-east of the other sett and *c.* 200m from the footprint of the proposed development. This sett consisted of three entrances with varying levels of activity. Badger scratching was evident on an adjacent tree. This sett is also likely used as a subsidiary or annex. A badger was confirmed using this sett from the deployed camera trap. Snuffle holes were also identified in the area around the sett.

A potential sett was identified amongst mounds of rocks within the woodland area, located *c.* 170m from the footprint of the proposed development. Large crevices were evident here, that may extend underground. At least one badger was identified on the deployed cameras traversing over the rocks, possibly emerging and/or entering a crevice. Pine martens were also identified using this area possibly for refuge.

During surveys in 2022, an additional sett was identified in the east of the proposed development site, in the area of oak-ash-hazel woodland adjacent to the wetland habitat. This area is located on a steep slope and comprised of three holes along this ridge. These holes were deemed active due to fresh bedding identified in front of two of the holes, badger hair and snuffle holes. Mammal trails leading to and from the sett were also noted.

The habitats within the proposed development site (*i.e.* grassland, scrub, hedgerow and woodland), provide suitable foraging and commuting habitat for badger.

Due to their stable Irish populations, badger are considered to be of “Least concern” in terms of conservation (Nelson *et al.*, 2019). The local badger populations are valued to be of local importance (higher value), as there is an abundance of suitable habitat within the proposed development site and its vicinity, which has been confirmed by the presence of a number of active badger setts, and from the NBDC desk study search with 40 records within 2km.

Otter

Otter *Lutra lutra*, and their breeding and resting places, are protected under the Wildlife Acts. Otter are also listed on Annex II and Annex IV of the EU Habitats Directive and are afforded strict protection under the Habitats Directive and the European Communities (Birds and Natural Habitats) Regulations, 2011. The NBDC data search returned 16 records for otter within *c.* 2km of the proposed development, with the latest from 2018 (Appendix 7.2). Locations of these records included along a section of the River Fergus through Ennis town, and the eastern banks of Ballyallia Lough, both of which have hydrological connections with the proposed development site.

No holts or couches were identified along Spancelhill Stream, Toureen Lough, or the attenuation ponds located within the western section of the proposed development site. Two otter spraints were identified on rocks within Spancelhill Stream, adjacent to the woodland located within the north-eastern section of the site *c.* 180m west of the footprint of the proposed development at its closest point (Figure 7.9). The mammal ledge located underneath the M18 Motorway culvert in the west of the site was also checked for otter usage, and whilst no evidence was identified during surveys carried out here in 2020, an otter spraint was identified on the M18 mammal ledge in 2022. No other evidence of otter activity was recorded within the proposed development site.

The banks of Toureen Lough were deemed to be unsuitable for otter holt creation as they consisted of waterlogged soils frequently poached by cattle. Fish are present in Toureen Lough and therefore, it is suitable foraging habitat for otter. Whilst there is no surface hydrological connection between Spancelhill Stream and Toureen Lough, otter may still cross the site from the Spancelhill Stream to Toureen Lough (c. 385 in distance). No evidence of this was recorded during any of the surveys.

Spancelhill Stream is suitable for otter holt/couch creation, and for commuting or foraging otter. Evidence of otter activity was identified within the Stream. The Stream is subject to frequent pollution from cattle manure and feeding areas, which may limit its suitability for otters. Otters were not identified on the camera trap that was deployed along the Stream.

Otters are Qualifying Interest (QI) species of nearby European Sites: Lower River Shannon SAC located *c.* 2.1km downstream of the proposed development site, via the Spancelhill Stream and the River Fergus; and, Dromore Woods and Loughs SAC, located c. 4.5km from the proposed development site as the crow flies and *c.* 12.9km upstream of the proposed development, via the River Fergus and the Spancelhill Stream. The local otter population is valued as being of international importance as it may be connected with the Qualifying Interest otter populations of these European sites, which are hydrologically connected to the proposed development site, and is discussed in more detail in the Natura Impact Statement (NIS) in Section 5.1.3.1.

Pine Marten

Pine marten *Martes martes* are protected under the Wildlife Acts. Pine marten are also listed on Annex V of the EU Habitats Directive and are afforded strict protection under the Habitats Directive and the European Communities (Birds and Natural Habitats) Regulations, 2011. The NBDC database search returned two records of pine marten within *c.* 2km of the proposed development site (Appendix 7.2).

A potential pine marten den was identified within the woodland in the north-eastern section of the proposed development site (*c.* 170m from the footprint of the proposed development), amongst a large collection of limestone rocks and boulders, where holes and crevices were identified (Figure 7.9). A camera that was deployed opposite this pile of rocks identified a pine marten amongst the rocks on three separate occasions. On one occasion, an individual also appeared to leave it’s scent on a rock near to a potential entrance. This is likely to be a potential pine marten den or refuge site; however, as pine marten are known to use multiple den sites, it is likely to be used sporadically (Vincent Wildlife Trust, 2020). The woodland and surrounding scrub habitat is suitable for foraging pine marten and would provide ample foraging opportunities for their varied diet of berries, insects, birds, small mammals, and frogs.

Pine martens are listed as a species of “least concern” conservation wise (Nelson *et al.*, 2019) due to the recent increases in populations numbers across the country. In consideration of this the presence of records of the species in the surrounding area, and the abundance of suitable habitat in the area, the local pine marten population is valued to be of local importance (higher value).

Other Mammals

Red squirrel *Sciurus vulgaris*, hedgehog *Erinaceus europaeus*, Irish hare *Lepus timidus hibernicus*, pygmy shrew *Sorex minutus* and Irish stoat *Mustela erminea hibernica* are protected under the Wildlife Acts. The NBDC database search identified one record of pygmy shrew and Irish stoat, two records of red squirrel, Irish hare and pine marten, and three records of hedgehog within *c.* 2km of the proposed development site (Appendix 7.2).

During the field surveys, an *ad-hoc* observation of an Irish hare was recorded in the grassland habitat adjacent to the woodland. No evidence or sightings of red squirrel, hedgehog, pygmy shrew, or Irish stoat was recorded within the proposed development site. However, the woodland located within the proposed development site (*c.* 40m from footprint of the proposed development) would provide suitable breeding and/or foraging habitat for all of the aforementioned species. Red squirrels are more commonly found within mixed woodlands and/or coniferous woodlands due to a steadier food source year round (Lawton *et al.*, 2020); however they can also be found within deciduous woodlands, specifically where oak *Quercus* sp. and/or hazel *Corylus avellana* tree species are present as red squirrel are known to forage acorns and hazelnuts. Pygmy shrews, hedgehogs and Irish stoat are found in a range of habitats; however, they are predominantly present in habitats with a rich ground cover, and as such the woodland and scrub habitats within the site are considered suitable for these species. In addition, the dense hedgerows and stone walls present would also provide cover and commuting corridors for these species. Irish hare is also found in a range of habitats, from coastal dunes to mountain tops, and densities vary from year to year and habitat to habitat[20].

All small mammal species returned in the NBDC search are of "Least" conservation concern (Nelson *et al.*, 2019). They are widely distributed throughout Ireland. The habitats on site and in the surrounding environs are suitable for all of the aforenoted mammal species, and as such the mammal species are therefore valued as being of local importance (higher value).

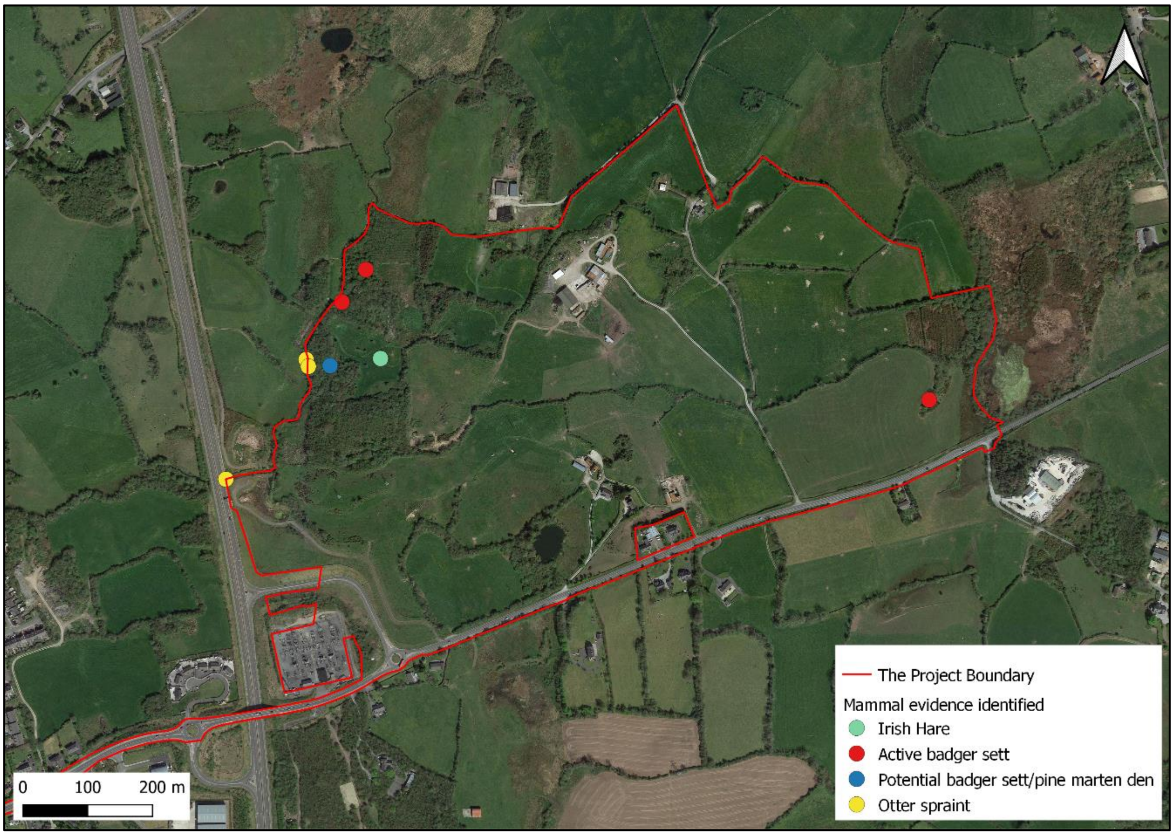

Figure 7.9. *Location of mammal signs recorded within the proposed development site*

<u>*Non-native Invasive Mammals*</u>

The NBDC database search returned no records for any fauna species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations, 2011 within 2km of the proposed development site. There were no sightings or evidence of any of these species on site during surveys in 2018, 2020 or 2022 either.

A greater white-toothed shrew *Crocidura russula* was identified on the eastern bank of Toureen Lough within the proposed development boundary on the 19th March 2019. This species is listed as a 'medium impact' species, from the Invasive Species in Ireland prioritisation risk assessment. Two records of Bank Vole *Myoydes glareolus*, and European rabbit *Oryctolagus cuniculus,* also listed as *'medium impact'* species,

[20] *Species Profile: Irish Hare, Vincent Wildlife Trust Ireland*. Accessed here: https://www.vincentwildlife.ie/species/irish-hare

were returned from the NBDC database study for records within *c.* 2km of the proposed development site. Records of 'high impact' species, fallow deer *Dama dama*, house mouse *Mus musculus*, and sika deer *Cervus nippon*, were also returned from the NBDC search. Rabbit and greater white-toothed shrew were the only species identified using the site during field surveys of the site.

7.3.3.2 Birds

Breeding Birds

All wild birds, and their nests and eggs, are protected under the Wildlife Acts. Some bird species are also listed on Annex I of the EU Birds Directive. The following birds were observed within or in the vicinity of the proposed development site:

- Green listed species (*i.e*. of low conservation concern): Blackbird *Tardus merula*, blackcap *Sylvia atricapilla*, blue tit *Cyanistes caeruleus*, buzzard *Buteo buteo*, coal tit *Periparus ater,* chaffinch *Fringilla coelebs*, chiffchaff *Phylloscopus collybita*, dunnock *Prunella modularis*, hooded crow *Corvus cornix*, , jackdaw *Corvus monedula*, , magpie *Pica pica*, pheasant *Phasianus colchicus,* robin *Erithacus rubecula,* rook *Corvus frugilegus*, song thrush *Turdus philomelos*, wood pigeon *Columba palumbus*, and wren *Troglodytes troglodytes*. Other species noted onsite but less frequently encountered included, bullfinch *Pyrrhula pyrrhula*, goldfinch *Carduelis carduelis, , and* lesser redpoll *Acanthis cabaret*.
- Amber list species (*i.e.* of medium conservation concern): house sparrow *Passer domesticus,* swallow *Hirundo rustica,* goldcrest *Regulus regulus*, linnet *Carduelis cannabina,* willow warbler *Phylloscopus trochilus,* short-eared owl *Asio flammeus* and starling *Sturnus vulgaris*
- Red list species (*i.e.* of high conservation concern): grey wagtail *Motacilla cinerea*

Grey wagtail are red-listed (*i.e.* of high conservation concern) due to declines in breeding populations. This species was recorded during multiple site visits near Toureen Lough and adjacent to the wetland area in the north western section of the proposed development site. Both male and female individuals were identified during the March wintering bird visit. Thirteen records of this species were identified within c. 2km of the site, with the most recent from 2011.

There are a number of habitats within the proposed development site that are suitable for breeding birds to nest in, including trees, barns, hedgerows and scrub. The proposed development site is likely to encompass and/or form part of the breeding territories of a number of bird species recorded during the surveys. Breeding behaviour of the majority of species was observed within the proposed development site, predominately along or close to hedgerows and the woodland areas within the site. Barn swallows were observed nesting in a barn in the north-eastern section of the proposed development site (*i.e.* building code: BB 5B), with three nests identified along the wooden rafters. A pair of buzzards were observed on numerous surveys throughout 2020 soaring and calling above the proposed development site. Whilst a nest was not identified, it is likely they are nesting nearby in the local area.

Whilst there were a number of farm buildings and barns within the site, there were no buildings suitable for barn owls, due to lack of potential nest places within the barns present *i.e.* a concave or level surface or cavity, that is elevated and well hidden[21]. No evidence of barn owls was identified within the proposed development site. A short-eared owl was identified during a bat survey carried out in 2019, flying over the east of the site.

Due to the presence of a potential breeding population of grey wagtail, a red-listed species, and lack of recent local records, grey wagtails are considered to be of county importance. The other breeding bird populations within the proposed development site are considered to be of local importance (higher value).

Wintering Birds

The desk study records from the NBDC include 42 wintering waterfowl, gull and wader species. Including 10 species listed under Annex I of the Birds Directive within *c.* 2km of the proposed development site. These records are present in Appendix 7.2.

Table 7.8 below provides a summary of the findings of the winter bird surveys with respect to those species which are of highest conservation concern, and were recorded within winter bird survey sites:

- Special Conservation Interests (SCIs), for a wintering population, of nearby SPAs
- Species listed under Annex I of the Birds Directive (2008/144/EC)
- Red, Amber and Green BoCCI species listed for their wintering populations

Table 7.8 Details of wintering bird species found within the proposed development site

Common name/Latin name/BoCCI Code	Distribution in the study area	Peak count/Site/Date	Conservation Importance		
			BoCCI (Breeding)	Annex I	SCI
Black-headed gull *Chroicocephalus ridibundus* (BH)	Observed flying over site, did not land within site during three visits.	22 birds, flying high above the central area of the site and headed west, seventh visit	Amber (B/W)	-	✓
Coot *Fulica atra* (CO)	Observed on the wetland feature in the north of the site during one visit.	2 birds, on wetland/pond feature in the north, on first visit	Amber (B/W)	-	-
Common gull *Larus canus* (CM)	Observed circling c. 40m high above site during one visit. Did not land within site.	43 birds, in central area of site, on seventh visit.	Amber (B/W)	-	-
Gadwall *Mareca strepera (*GA)	Observed wading in wetland meadow adjacent to Toureen Lough during one visit , and on the wetland feature in the north during one visit.	2 birds, on Toureen Lough in October	Amber (B/W)	-	✓

[21] Barn Owl Roosting and Nesting Places, The Barn Owl Trust (2015). Accessed here: https://www.barnowltrust.org.uk/how-to-manage-land-for-barn-owls/roosting-nesting-places/

Common name/Latin name/BoCCI Code	Distribution in the study area	Peak count/Site/Date	Conservation Importance		
			BoCCI (Breeding)	Annex I	SCI
Grey heron *Ardea cinereal* (H.)	Observed in the bank of Toureen Lough, during one visit.	1 bird, Toureen Lough, on fourth visit	Green (B/W)	-	-
Kestrel *Falco tinnunculus* (K.)	A female observed hunting high above the west of the site during sixth visit; one individual observed flying over north of the site during 3rd visit.	1 bird observed in the west adjacent to M18 Motorway, and 1 bird observed in the north.	Red (B)	-	-
Lesser black-backed gull *Larus fuscus* (LB)	Observed flying above the site in the west during second visit, did not land.	1 bird observed in the west in October	Amber (B)	-	-
Little egret *Gallinula chloropus (ET)*	Observed on banks of Toureen Lough during second visit.	1 bird observed in Toureen Lough in October.	Green (B/W)	✓	-
Snipe *Gallinago gallinago* (SN)	2 birds observed during fourth visit wading in attenuation pond in the west; 1 bird observed in attenuation pond during fifth visit; one bird observed in meadow adjacent to Toureen Lough and wading in attenuation pond during sixth visit.	2 birds in attenuation pond in December visit.	Red (B/W)	-	-
Teal *Anas crecca* (T.)	Observed on the wetland/pond feature in the north of the site during three visits.	10 birds, on the wetland feature in the north, on third visit in November	Amber (B/W)	-	✓
Tufted duck *Aythya fuligula* (TU)	Observed on wetland/pond feature in the north during second visit.	1 bird, on wetland/pond feature in the north, in Octobers visit.	Amber (B/W)	-	-
Mallard *Anas platyrhynchos* (MA)	Observed on Toureen Lough during three visits, on the wetland feature in the east during one visit and on the wetland feature in the north during one visit	2 birds, on Toureen Lough, and on feature in the north.	Amber (B/W)	-	✓

During wintering bird surveys carried out between September 2020 and March 2021, five SCI species from nearby European sites were identified within the lands; coot, mallard, gadwall, and teal being SCI species of Ballyallia Lough SPA c. 2.7km north west of the site, and black-headed gull and teal, SCI species for the River Shannon and River Fergus Estuaries SPA, located c. 5.1km south west of the site, and teal also being an SCI species for the River Shannon and River Fergus Estuaries SPA and Corofin Wetlands SPA, c. 10.7km north west of the site. Suitable habitat for these species was identified within the proposed development, and included; Toureen Lough, the M18 Motorway Attenuation Pond, the wetland habitats in the east of the lands (small section of this habitat within the red line boundary), and the wetland features in the north west. The lands provide some areas of suitable foraging habitat (e.g. open amenity, arable and improved agricultural grassland), for specific wintering birds such as geese and swans. However, these suitable habitats, while they are present on site, are grazed, mostly located in hilly areas giving limited sight lines, and therefore would have limited suitability for these species. There is ample habitat however for waterfowl and some wader species within the wetland habitats found in the proposed development site. The habitats offer suitable foraging habitat and shelter for smaller overwintering species such as passerine species fieldfare *Turdus pilaris* and redwing *Turdus iliacus*, green-listed species which were both recorded during the wintering bird surveys carried out in October and November 2020. Peak numbers of 40 for redwing and 30 for fieldfare were observed, with both species identified in the north west of the site moving along the hedgerows. Grey wagtail was also identified during three visits, in the attenuation pond in the west, and feeding on cattle adjacent to the farm buildings in the south (BB 4A), farm buildings in the north (BB 6A), with a peak count of two individuals. Grey wagtail is a red-listed species (*i.e.* of high conservation concern)

The proposed development is within the normal foraging range of SCI species of the River Shannon and River Fergus Estuaries SPA, Ballyallia Lough SPA, the Slieve Aughty SPA, and the Corofin Wetlands SPA. The lands provide limited areas of suitable foraging habitat (*e.g.* open amenity grassland) due to the largely agricultural habitats on site, for specific wintering birds such as geese and swans. There is ample habitat however for waterfowl and some wader species within the wetland habitats found in the proposed development site.

The habitats offer suitable foraging habitat and shelter for smaller overwintering species such as passerine species fieldfare and redwing, which were both recorded during the wintering bird surveys carried out between September 2020 and March 2021.

Considering the above, the local populations of wintering birds (excluding SCI species), are considered to be of local importance (higher value). The SCI bird species populations are considered to be of international importance.

Hen harrier

The desktop search returned records for hen harrier and merlin *Falco columbarius*, both Annex I species on the Bird Directive, within c. 2km of the proposed development. Whilst there is no suitable summer breeding and foraging habitat within the proposed development (*i.e.* heather moorland, open non-afforested habitats, and young forestry plantations[13][14]), suitable habitat for wintering hen harrier was identified within the marsh/reed habitat in the east of the site (Ardnamurry Lough), beyond the red line boundary of the proposed development site. The site was deemed unsuitable for merlin, as they are typically associated with forestry plantations and moor and heathlands (Lusby et al., 2017)[22].

Dedicated surveys for hen harrier were carried out monthly between September 2020 and March 2021(optimum time for winter roost survey[23]), in this area of suitable roosting habitat. No hen harriers were recorded within or near the proposed development site during these surveys. The nearest European site for which both these species are designated is the Slieve Aughty Mountains SPA, located c. 4.5km north west of the proposed development site.

7.3.3.3 Reptiles

The Wildlife Acts provide protection to Ireland's only reptile species, common lizard*, Zootoca vivipara*

The NBDC data search did not return any records for common lizard within *c.* 2km of the proposed development site. No evidence or sightings of common lizards were noted during surveys on site, however suitable habitat for reptiles does exist within the site. The majority of the field boundaries are composed of dry stone walls, which provide ample basking opportunities for reptiles, adjacent to hedgerows and scrub habitat for cover from predators. Within the woodland areas of the site, mounds of limestone rock can be found in various places, this may provide areas of refuge below ground during colder periods.

Local reptile populations are considered to be of local importance (higher value).

7.3.3.4 Amphibians

The Wildlife Acts provide protection to Ireland's two amphibian species, common frog *Rana temporaria* and smooth newt *Lissotriton vulgaris*.

The NBDC data search returned three records of amphibians within *c.* 2km of the site, all of which were common frog (Appendix 7.2). No evidence of amphibians was found within the lands; however suitable breeding and foraging/resting habitat was identified within the wetland features of the site, including: Toureen Lough, the wetland/fen area in the east of the site, and the marsh/fen area in the northern section of the proposed development site. Drainage ditches that may contain stagnant water during and after periods of heavy rain may also provide suitable breeding habitat for amphibians.

Local amphibian populations are considered to be of local importance (higher value).

7.3.3.5 Bats

Bats, and their breeding and resting places, are protected under the Wildlife Acts. All bat species are also listed on Annex IV of the EU Habitats Directive (with the Lesser horseshoe bat also listed on Annex II) and are afforded strict protection under the Habitats Directive and the European Communities (Birds and Natural Habitats) Regulations, 2011. The NBDC database search returned records for the following bat species: lesser horseshoe bat *Rhinolophus hipposideros*, brown long-eared *Plecotus*

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[22] Lusby, J., Corkery, I., McGuiness, S., Fernández-Bellon, D., Toal, L., & Norriss, D. et al. (2017*). Breeding ecology and habitat selection of Merlin Falco columbarius in forested landscapes. Bird Study*, *64*(4), 445-454.

[23] *Irish Hen Harrier Winter Survey, Survey Guide*. Found here http://www.ihhws.ie/

auritus, Leisler's *Nyctalus leisleri*, common pipistrelle *Pipistrellus pipistrellus*, and soprano pipistrelle *Pipistrellus pygmaeus*.

The review of records held by Bat Conservation Ireland returned 125 records of bat roosts from within *c.* 10km of the proposed development site (Appendix 7.2). The closest bat roosts to the proposed development site were all lesser horseshoe bat, located *c.* 405m, *c.* 800m and *c.* 830m south of the proposed development site, respectively. The closest roost to the site for lesser horseshoe bat in Kilfelim, is a common pipistrelle and Leisler's bat roost. Six additional lesser horseshoe bat roosts lie within *c.* 2km of the proposed development site as well as one known Daubenton's bat roost located *c.* 2km south west of the proposed development site.

Bat survey details and results undertaken in 2020 and 2022 is discussed below, bat surveys and results from 2018 can be found in Appendix 7.8. A summary of each of the survey types undertaken within the proposed development site is described below, followed by a detailed description and evaluation of each of the species found within the proposed development site, with associated figures.

<u>Building Inspection Surveys</u>

All buildings within the lands were assessed externally for evidence of bats, with barns and shed also accessed internally and externally. Residential houses could not be accessed internally due to health and safety concerns associated with COVID-19. Summary results of each building surveyed, the suitability for roosting bats, and any evidence of bats identified can be found below in table 7.9 and in Appendix 7.4. A more detailed analysis for each species is described below in relation to building surveys.

Table 7.9 *Description of buildings within the proposed development site*

Building ID no.	Roost	Rating	Details of building and surrounding habitat
BB 1A	Yes	Low	Cattle shed with concrete block and corrugated metal walls and corrugated metal roof. Open on side of shed. Surrounding landscape - pasture fields to the north, east and west, and treelines to the south.
BB 1B	No	Low	Adjacent to 1A. Concrete external walls with corrugated roof. Not accessible inside due to safety concerns. Creamery machinery within. Same surroundings as 1A
BB 2	Yes	Moderate	Large residential house, brick walls with rendering, slate roof, two stories. Surrounded by treelines and hedgerows, and Torreen Lough closeby. Most likely more features present near roof but due to height of house difficult to assess fully.
BB 3	Yes	High	Residential house, bungalow, slate roof with concrete walls.
BB 4A	No	Low	Corrugated cow shed with part concrete walls, and wooden beams within. Pasture fields bordered by hedgerows/treelines. Adjacent to meadow with Tooreen Lough
BB 4B	No	Low	Stone/Stipling walls with corrugated roof, cow shed. Adjacent to 4A
BB 4C	No	Negligible	Tall barn building, very open with wooden beams, no walls on two sides, very exposed. Corrugated roof and sides
BB 4D	No	Low	Small building with stone walls, partly collapsed roof on one side and very open, small room at end with some potential
BB 5A	Yes	Moderate	Brick house with flat slated roof. Wooden sheds in garden, treelines and hedgerows adjacent to house, surrounding habitat pasture field

Building ID no.	Roost	Rating	Details of building and surrounding habitat
BB 5B	Yes	Low	Wood shed close to BB 5A, exposed on two sides, concrete block walls and corrugated metal roof. Wooden beams inside. Thick ivy on western end of shed. Surrounded by pasture fields, very exposed. Swallows nesting in here
BB 6A, 6B, 6C	No	Low	Three cattle barn sheds, all with corrugated steel roofs and concrete block walls. Very exposed buildings, mostly open with very little features. Suitable for foraging but little roosting features, any present would only house small numbers of bats. Hedgerows and treelines nearby, with pasture fields surrounding.
BB 7	No	Moderate	Residential unoccupied house. Very run down, concrete walls with slate roof. Dense ivy at northern gable end where stone shed used to be. Well connected to hedgerows and treelines nearby.
BB 8	Yes	Moderate	Modern residential building, stone walls with flat slated roof. Garage building behind house. Hedgerow surrounding building (*Leylandii* spp.), and main road along southern boundary.
BB 9	Yes	Moderate	Modern residential building, with stone walls and flat roof slates. Large slated shed/building (Edward casey kitchens workshop) beside house. Hedgerows and treelines along boundary, road along southern boundary.

Summary of Roost Emergence/Re-entry Activity Surveys

The details of emergence and re-entry surveys can be found in Appendix 7.5.

In summary, during these surveys 19 roosts were identified across 16 buildings located within the proposed development site. Full details of these roosts are provided in Table 7.10 and their locations are presented in Figure 7.10. An additional roost was identified during building inspection surveys carried out in March 2022, totalling the number of roosts within the proposed development to 20.

Table 7.10 *Summary of roosts recorded within the proposed development site (see Figure 7.10 for location of buildings)*

Building Code	Description of building	Species roosting	Number roosting and total roosts	Description of roost (s)
BB 1A	Cattle shed with corrugated iron roofing.	Soprano pipistrelle	One individual bat emerging from one roost.	Bat seen emerging from underneath corrugated metal sheeting.
BB 2	Residential house	Soprano pipistrelle	Four roosts with max 2 individuals in each.	Four roosts mainly located on the roof of building.
BB 3	Residential house	Soprano pipistrelle	Five roosts, with 30 individuals from one, nine from another and one to two from remaining.	Mainly located near chimney and under lead flashing. Also above porch.
BB 5A	Residential house	Soprano pipistrelle and common pipistrelle	Four roosts with max two bats in each	Located across the house, two under roof flashing, and under slates.
BB 5B	Wood shed	Brown long-eared	One roost with two individual bats	Observed emerging from dense ivy growing within shed.
BB 6C	Barn shed	Leisler’s bat	One roost with one bat	Observed roosting during the daytime building inspections

				between a crack within the outside wall of the shed.
BB 8	Residential house	Soprano pipistrelle	Three roosts, one with 13 bats, other two with one to two individual bats	One roost on the garage, and two within house by conservatory.
BB 9	Residential house	Soprano pipistrelle	One roost with max eight individuals.	Emerged above porch.

The majority of roosts recorded within the proposed development site were small, single pipistrelle roosts, likely to be either male and/or night roosts. Two potential soprano pipistrelle maternity colonies were identified at BB 3 and BB 8, with 30 and 13 individual bats observed emerging and/or re-entering the roosts during the surveys. All of the barns were considered to be of low potential, and this was evident from the results of the activity surveys (*i.e.* the lack of roosts identified in all except one). One barn (BB 1A) had one soprano pipistrelle re-entry, and another barn (BB 5B) was found to be a brown long-eared roost, with two individuals observed on the walls and rafters within the barn, and warming up before leaving the barn for foraging. All of the occupied residential houses within proposed development site had at least one roost, and BB 3 contained the highest number of roosts and bats recorded across the proposed development site.

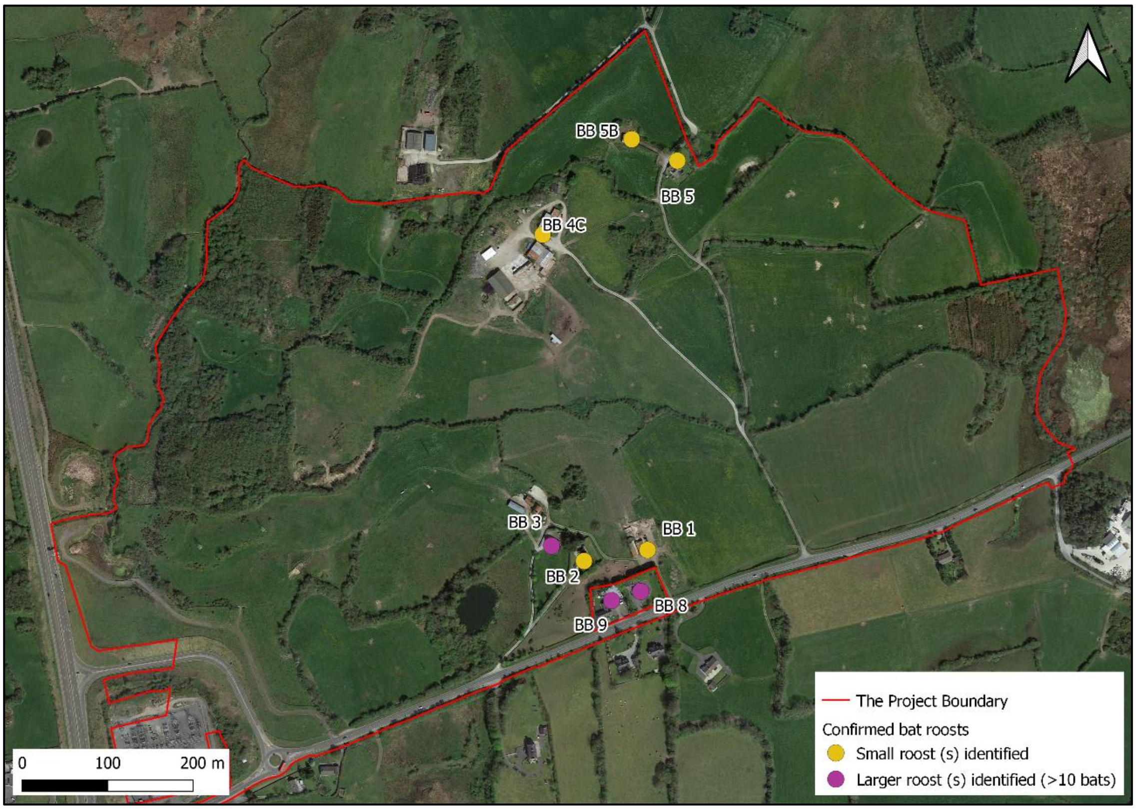

Figure 7.10 *Location of roost buildings within the proposed development site*

<u>Summary of Transect Surveys</u>

A range of bat survey types were carried out in 2018 and 2020, in order to determine what bat species were using the proposed development site and to establish the level of importance of the proposed development site for local bat species.

Bats recorded during these surveys were associated with the hedgerows and treelines, along field boundaries, foraging and/or commuting within the proposed development site. Specific areas had higher rates of activity as based on the total number of calls across all three transects for each species and diversity of bat species recorded. These areas included:

- Toureen Laneway, a double hedgerow track lined with mature trees, within the south-eastern section of the site (176 total number of calls recorded, 5 species);
- Toureen Lough in the south-western section of the site adjacent to R352, and the lands immediately around it (70 total number of calls recorded, four species);
- The woodland in the north-western section of the site, specifically the edges along treelines/hedgerows (186 total number of calls recorded, 5 species); and
- The hedgerows coming off Toureen Laneway, towards the eastern section of the site (60 total number of calls recorded, 4 species).

Areas that were walked but exhibited lower levels of activity included:

- Along the southern most boundary of the site, parallel to R352;
- The south western corner, south of the attenuation pond;
- North of BB 6A, 6B and 6C (Figure 7.4) along the northern boundary; and
- In the north eastern corner along the boundary with riparian woodland.

The most commonly recorded species across all three transect survey visits was soprano pipistrelle bat, followed by common pipistrelle, Leisler's bat, brown long-eared bat, *Myotis* spp., and lesser horseshoe bat.

Full details of these 2020 surveys are provided in Appendix 7.8 and the locations of the transect routes are presented in Figure 7.2. A summary for each species is provided below.

Surveys undertaken in 2018, had largely similar results to those in 2020, with the addition of a single lesser horseshoe bat call identified during the second visit in 2020 (Appendix 7.6, Figure 7.11). Brown long-eared bat was also identified during the 2020 transect surveys, whilst no calls were recorded for this species during the 2018 surveys. Three surveys were undertaken in 2020 however, including an all night survey, with just two dusk transects completed in 2018. Bat activity levels were similarly high in both years in the areas listed above.

<u>Automated Static Detectors</u>

In total, six bat species were recorded on automated static bat detectors deployed within the survey area, including: Leisler's bat, common pipistrelle bat, soprano pipistrelle bat, brown long-eared bat, lesser horseshoe bat and unidentified *Myotis* bats. Unidentified Pipistrelle bats were also identified[24].

Full details of the static detector results are provided in Table 7.11 and the locations of the transect routes are presented in Figure 7.2.

[24] In some instances, it can be difficult to differentiate between calls of both pipistrelle species, where their peak frequency approaches 50kHz, and in this instance we have assigned the generic category *Pipistrellus* species. Calls of this type have been incorporated into soprano and common pipistrelle results.

Table 7.11 *Results of bat activity surveys per location using automated static bat detectors*

Location	Habitat description	Deployment dates	Number of nights recorded	Species recorded [25] (overall total number of calls and average number of calls per night)
1	Automated detector placed within a hawthorn hedgerow located directly east of woodland area.	6th July 2020 – 28th July 2020	7	Lesser horseshoe bat (138) (19.71) Common pipistrelle (12) (1.71) *Myotis* sp. (52) (7.43) Soprano pipistrelle (11) (1.58) Leisler's bat (1) (0.14)
2	Automated detector placed within a hawthorn hedgerow south of woodland area, within the west of the subject lands.	6th July 2020 – 28th July 2020	16	Soprano pipistrelle (753) (47.06) Pipistrelle sp. (336) (21) Common pipistrelle (39) (2.44) *Myotis* sp. (20) (1.25) Lesser horseshoe bat (2) (0.13) Leisler's bat (2) (0.13)
3	Automated detector was deployed west of Toureen Laneway attached to a hawthorn tree on lower field boundary	6th July 2020 – 28th July 2020	2	Common pipistrelle (5) Soprano pipistrelle (2) Brown long-eared (1)
		21st September 2020 – 20th October 2020	12	Common pipistrelle (426) (35.5) Soprano pipistrelle (210) (17.5) *Myotis* sp. (2) (0.17) Lesser horseshoe bat (1) (0.08)
4	Automated detector was deployed on an ash tree along Toureen Laneway	6th July 2020 – 28th July 2020	14	Soprano pipistrelle (1,146) (81.86) Common pipistrelle (858) (61.29) *Pipistrellus* sp. (335) (23.93) Leisler's bat (221) (15.79) Brown long-eared (96) (6.86) *Myotis* sp. (65) (4.64)

[25] The number of bat calls is provided beside each species in brackets. To note, this does not necessarily correspond to the exact number of bats using the lands; however, it does provide an indication of usage by a particular bat species at that location

Location	Habitat description	Deployment dates	Number of nights recorded	Species recorded [25] (overall total number of calls and average number of calls per night)
5	Automated detector deployed on oak tree on the edge of scrub habitat in the east of the site.	6th July 2020 – 28th July 2020	18	Soprano pipistrelle (1,399) (77.11) Lesser horseshoe bat (409) (22.72) Common pipistrelle (178) (9.89) *Pipistrellus* sp. (93) (5.17) *Myotis* sp. (77) (4.28) Leisler's bat (8) (0.44) Brown long-eared (6) (0.33)
6	Detector was deployed within a hawthorn hedgerow north of barn buildings in the south of the site.	7th July 2020 – 28th July 2020	20	Soprano pipistrelle (610) (30.5) Common pipistrelle (337) (16.85) Leisler's bat (65) (3.25) Brown long-eared (29) (1.45) *Myotis* sp. (20) (1) *Pipistrellus* sp. (17) (0.85) Lesser horseshoe bat (15) (0.75)
7	Automated detector was deployed within a hedgerow along a field boundary adjacent to Toureen Laneway, in the north of the site.	7th July 2020 – 27th July 2020	4	Soprano pipistrelle (12) Common pipistrelle (3) Ble (1)
		21st September 2020 – 20th October 2020	8	Lesser horseshoe bat (101) (12.63) *Pipistrellus* sp. (51) (6.38) *Myotis* sp. (22) (2.75) Leisler's bat (18) (2.25) Soprano pipistrelle (15) (1.88) Common pipistrelle (14) (1.75) Ble (3) (0.38)
8	Automated detector was placed within hedgerow/Treeline adjacent to Toureen Lough	28th July 2020 – 17th August 2020	4	Soprano pipistrelle (1726) (431.5) *Pipistrellus* sp. (264) (66) Common pipistrelle (25) (6.25) Leisler's bat (21) (5.25) *Myotis* sp. (8) (2) Ble (3) (0.75) Lesser horseshoe bat (2) (0.5)

Location	Habitat description	Deployment dates	Number of nights recorded	Species recorded [25] (overall total number of calls and average number of calls per night)
9	Automated detector was placed within hedgerow adjacent to attenuation pond in the west of the site.	28th July 2020 – 27th July 2020	20	Lesser horseshoe bat (36) (1.8) *Myotis* sp. (7) (0.35) Leisler's bat (2) (0.1) Ble (2) (0.1)
10	Automated detector was placed on a hawthorn tree behind the barn buildings in the north of the site.	30th July 2020 – 18th August 2020	16	Soprano pipistrelle (3,431) (214.44) Common pipistrelle (1,279) (79.94) *Pipistrellus* sp. (812) (50.75) Leisler's bat (244) (15.25) Lesser horseshoe bat (42) (2.63) Brown long-eared (36) (2.25) *Myotis* sp. (30) (1.88)
11	Automated detector was deployed on a blackthorn tree in the very north east boundary corner of the site.	21st September 2020 – 20th October 2020	8	Common pipistrelle (1,440) (180) Soprano pipistrelle (1,215) (151.88) *Pipistrellus* sp. (246) (30.75) Leisler's bat (107) (13.38) Brown long-eared (23) (2.88) Lesser horseshoe bat (8) (1) *Myotis* sp. (7) (0.88)
12	Automated detector was deployed on a hazel tree within a hedgerow in the north eastern boundary of the site.	21st September 2020 – 20th October 2020	18	Soprano pipistrelle (1,135) (63.05) Common pipistrelle (321) (17.83) Ble (87) (4.83) Leisler's bat (66) (3.67) *Pipistrellus* sp. (31) (1.72) Lesser horseshoe bat (28) (1.56) Myotis sp. (13) (0.72)
13	Automated detector was deployed on the eastern boundary within a hedgerow adjacent to riparian woodland.	21st September 2020 – 20th October 2020	9	Soprano pipistrelle (181) (20.11) *Myotis* sp. (77) (8.56) Common pipistrelle (59) (6.56) Lesser horseshoe bat (34) (3.78) Ble (16) (1.78)

Location	Habitat description	Deployment dates	Number of nights recorded	Species recorded [25] (overall total number of calls and average number of calls per night)
				Leisler's bat (3) (0.33) *Pipistrellus* sp. (1) (0.11)
14	Automated detector was deployed on a hazel tree in the north west adjacent to the woodland and fen areas.	28th July – 18th August 2020	22	Common pipistrelle (562) (25.55) Soprano pipistrelle (422) (19.18) Leisler's bat (155) (7.05) Lesser horseshoe bat (29) (1.32) Brown long-eared (25) (1.14) *Pipistrellus* sp. (5) (0.23) *Myotis* sp. (2) (0.09)
15	Automated detector was deployed in the south eastern corner adjacent to marsh and wet grassland habitats	18th August – 21st September 2020	7	Soprano pipistrelle (755) (107.86) Common pipistrelle (422) (60.29) *Myotis* sp. (68) (9.71) Brown long-eared (12) (1.71) Leisler's bat (2) (0.29) *Pipistrellus* sp. (2) (0.29) Lesser horseshoe bat (2) (0.29)

<u>Evaluation per bat species</u>

Lesser horseshoe bat

Transect surveys

One lesser horseshoe bat call was recorded during the second transect survey in July 2020, in the south of the proposed development site. No other calls of this species were identified during these surveys. This species was not identified during transect surveys in 2018.

Static detector surveys

Lesser horseshoe bat calls were identified on 14 out of 15 of the deployed static detectors, with varying degrees of activity. Highest numbers of calls per night were recorded in the east at the boundary of scrub/woodland habitat, in the west along a hedgerow bordering the woodland area, and along a hedgerow adjacent to Toureen Laneway, all of which are bordered by pasture fields. This is the ideal habitat for lesser horseshoe bat, and is considered to be important for commuting and foraging for this species within the proposed development site, as is the case for all other bat species identified within the proposed development site. Full details of the number of calls per night and number of nights static bat detectors were deployed are presented in Table 7.11, and in Figure 7.11 and Figure 7.12 below.

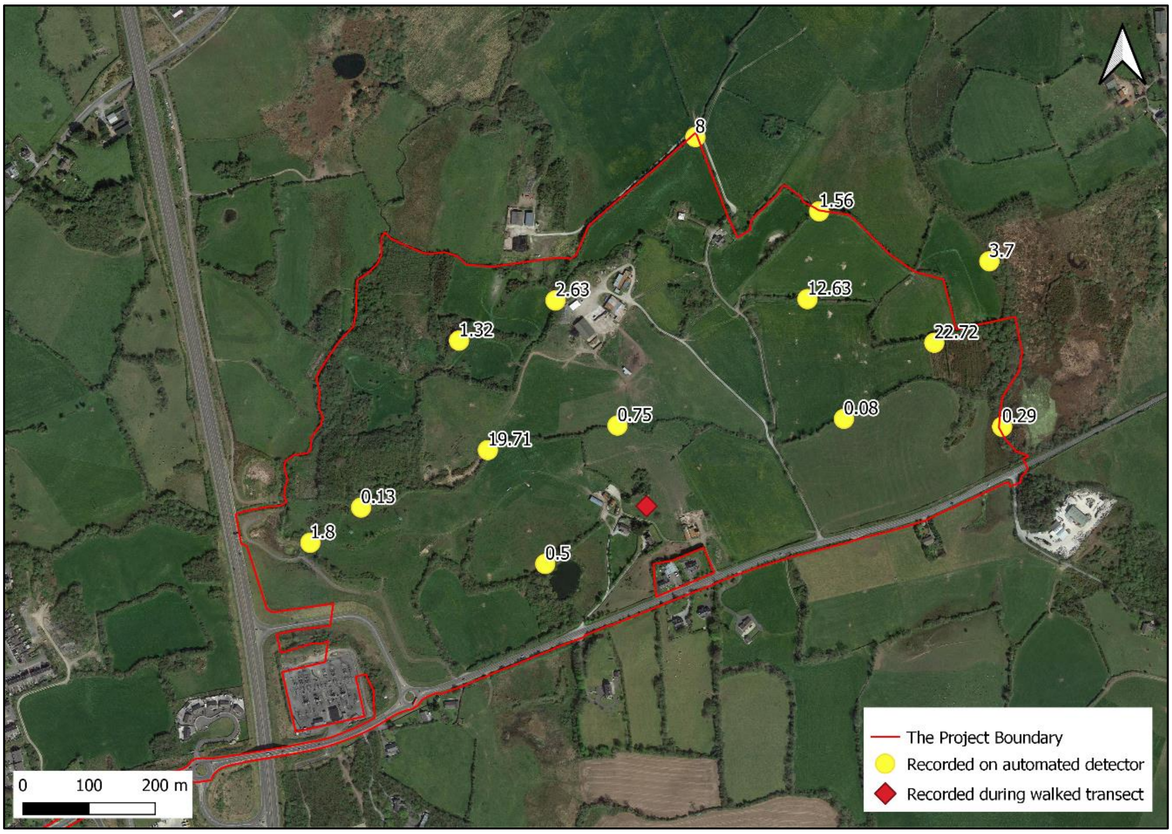

Figure 7.11 *Location of lesser horseshoe bat calls recorded during both walked transects and automated static bat detector deployment, along with the average number of lesser horseshoe bat calls recorded per night during the static deployment only*

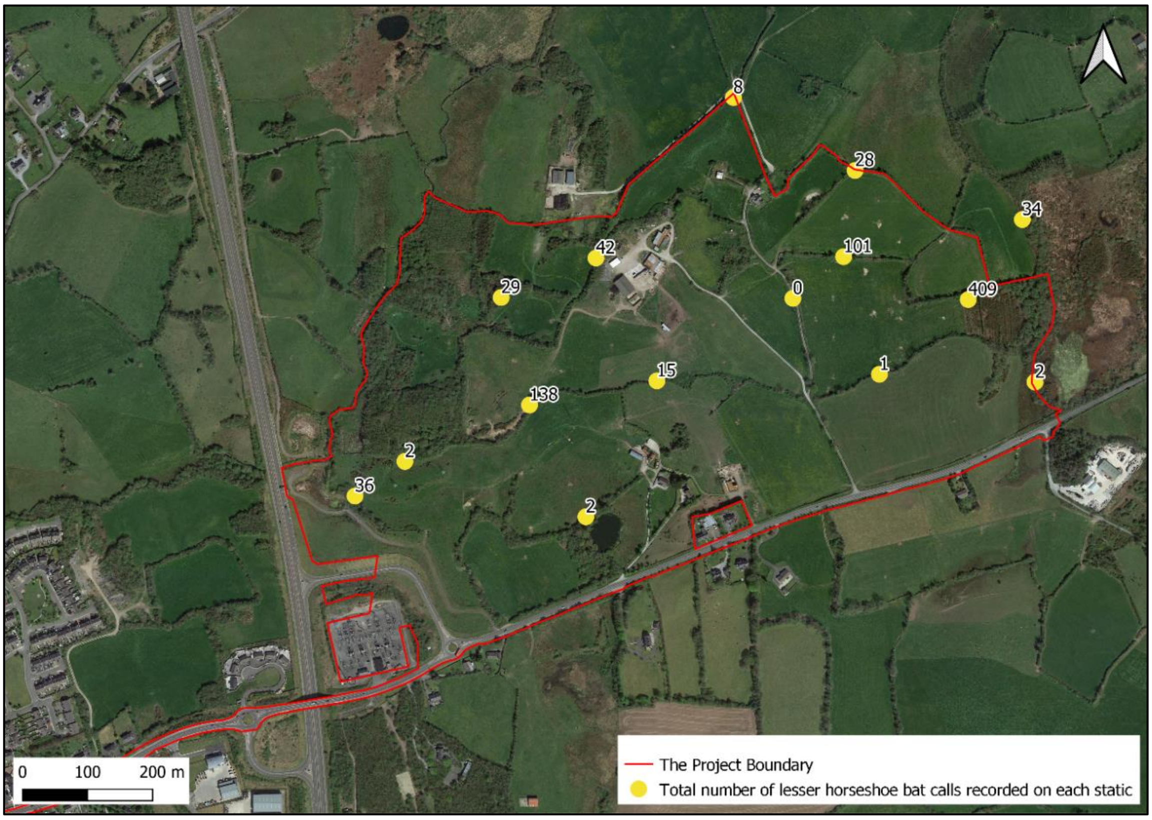

Figure 7.12 *Total number of lesser horseshoe bat calls recorded at each static*

Roost emergence/re-entry activity surveys

Lesser horseshoe bat was not recording during any of the post-emergence/re-entry surveys undertaken at the buildings within the proposed development site, and as such no roosts were recorded of this species within the proposed development boundary. Lesser horseshoe bat are restricted in terms of their choice of roosting site, as they cannot land on walls and crawl in and instead they must fly through an opening large enough to accommodate it's wingspan (Kelleher, 2006)[26]. As a result, lesser horseshoe bats are typically cave-dwelling species, however in Ireland, this species will also use buildings for their summer roosts, and caves for hibernation roosts[27]. Old stone buildings with slate roofs are ideal roosting sites as they usually offer a warm area near the apex of the roof in which to rear young. There are no caves or suitable roost buildings located within or near the proposed development site, with the closest cave in Ballyallia, located *c.* 2.8km north west of the site, and the nearest known roost located *c.* 405m south of the proposed development site[28].

Evaluation

Overall, activity levels of lesser horseshoe bat were considered to be moderate in relation to other bat species activity across the proposed development site. The

[26] Kelleher, C. (2006). *Summer Roost Preferences of Lesser Horseshoe bat Rhinolophus hipposideros in Ireland.* The Irish Naturalists' Journal, Vol. 18, No.6, pp. 229-231.

[27] McAney, K. (2014) *An overview of Rhinolophus hipposideros in Ireland (1994–2014)* Vespertilio 17: 115–125, 2014

[28] University of Bristol Speleological Society – Irish caves locations. Available from http://www.ubss.org.uk

hedgerows and treelines bordered by pasture grassland located within the eastern section of the site, were the most frequented by this species with the highest levels of activity experienced here. Areas located close to the woodland also had a high number of calls per night. The results from surveys carried out in 2018 by Scott Cawley Ltd., were similar to the results of the 2020 surveys[29]. The results from the other areas within the site are very similar to the 2020 survey results, with hedgerows near the woodland having the highest number of calls per night of lesser horseshoe bat during both seasons of surveys.

Unlike other species, lesser horseshoe bats do not have a wide distribution throughout the country with their core area restricted to six western counties (*i.e.* Clare, Cork, Galway, Kerry, Limerick and Mayo) and it has the smallest predicted core area of any other species (Roche *et al.*, 2014).

Lesser horseshoe bat are known to forage a few kilometres from the roost, relying on linear landscape features to commute to and from these roosts, and avoiding flying out in the open (Roche *et al.*, 2014). As evident from the results of the desk study, numerous small lesser horseshoe roosts exist in the vicinity of the subject lands, and it is likely that they use the subject lands for foraging or the linear vegetation features for commuting to and from their roosts. Nearby European site designated for lesser horseshoe bats include Old Domestic Buildings (Keevagh) SAC, located *c.* 4.3km away, Dromore Woods and Loughs SAC, located c. 4.2km north east, and Old Domestic Buildings, Rylane SAC, located c. 5.9km east, it is possible individual bats foraging within the proposed development site are connected with these SAC populations.

Given the small range of the species, the quantity and proximity of confirmed lesser horseshoe bat roosts around the site as well as the species' sensitivity to habitat change and removal of linear vegetation features, and the potential connection of populations of lesser horseshoe bats to a number of European sites designated for this species, the local population of lesser horseshoe bat have been classified as being of international importance.

<u>Soprano Pipistrelle Bat</u>

Transect Surveys

Full details from each transect survey are provided above in Appendix 7.6 and locations of each of the recorded soprano pipistrelle calls are shown on Figure 7.13-7.14. Soprano pipistrelle was the most commonly occurring species recorded during all three transect visits during surveys undertaken in July and August 2020. This was also the case in surveys carried out in 2018. This species was identified across the site with a high number of associated calls. Area of high activity were: along Toureen Laneway, which traverses the site from the R352 in the south to the north; along the hedgerows associated with this laneway; at Toureen Lough and the farm buildings adjacent to this; and, the woodland in the north west. Lower levels of activity associated with this species were identified: along the southern boundary; parallel to the R352; and also along the north eastern boundary of the site. The levels of activity recorded and the corresponding areas, were both very similar to the results of the 2018 surveys, with the highest number of soprano pipistrelle calls within the proposed development boundary recorded at Toureen Lough, Toureen Laneway, and the woodland. Activity

[29] The proposed development boundary has been extended slightly eastwards in 2020, and therefore the eastern most area of the site had not been surveyed previously in 2018.

levels were recorded along well-established hedgerows and treelines, and linear features, which provide suitable commuting and/or foraging routes for bats to the wider environment beyond the proposed development site.

Static Detector Surveys

Soprano pipistrelle calls were identified on 14 of the 15 static detectors deployed in 2020. In 2018 static detector deployments, this species was recorded on all 14 detectors deployed. The level of activity recorded on these statics was generally high, as was the case during transect surveys. The highest number of calls recorded per night and the highest total number of calls recorded, were both at Toureen Lough. Very high levels of activity were also recorded at: the woodland in the north west; Toureen Laneway; the marsh area adjacent to barn buildings (BB 6) in north; and the scrub habitat and hedgerows adjacent in the east. These results were similar to the results of the 2018 surveys, with very similar levels of activity recorded at all static deployment locations (or closest location or detector). Full details of the number of calls per night and number of nights static bat detectors were deployed are presented in Table 7.11, and in Figure 7.13 and 7.14 below.

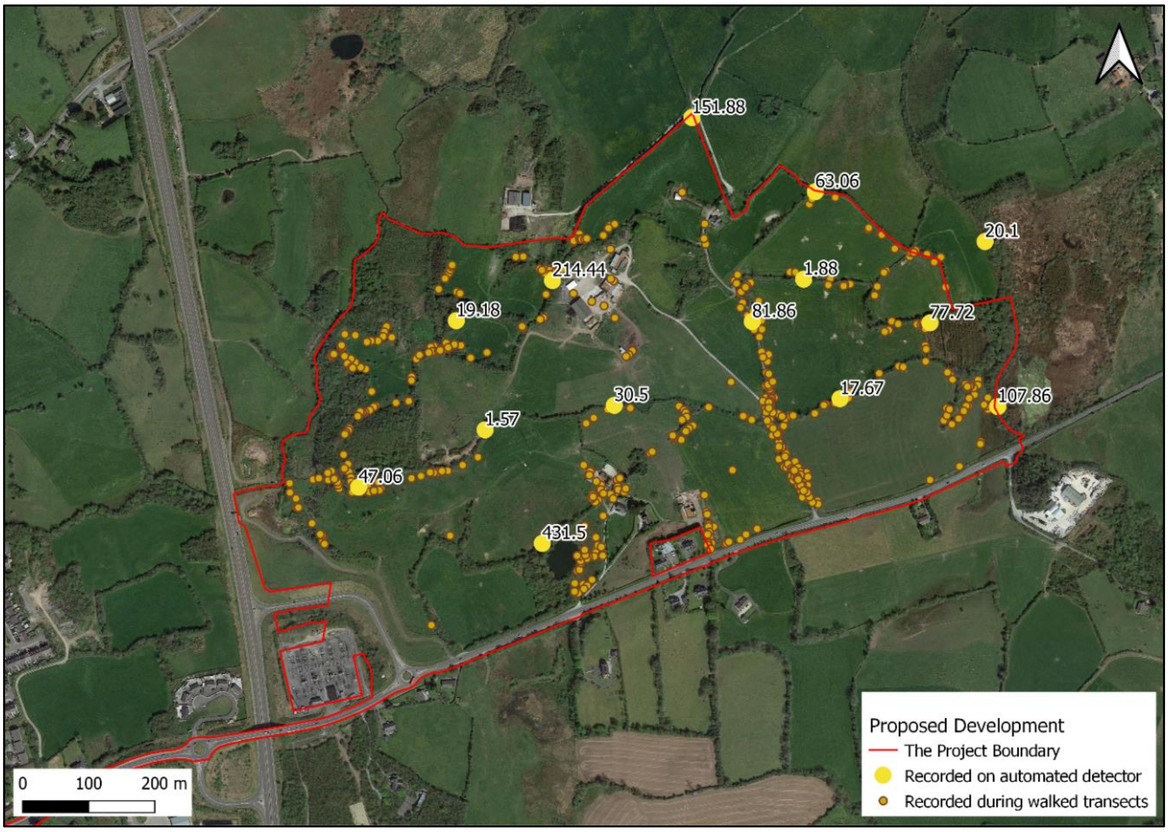

Figure 7.13 *Location of soprano pipistrelle calls recorded during both walked transects and automated static bat detector deployment, along with the average number of soprano pipistrelle calls recorded per night during the static deployment only*

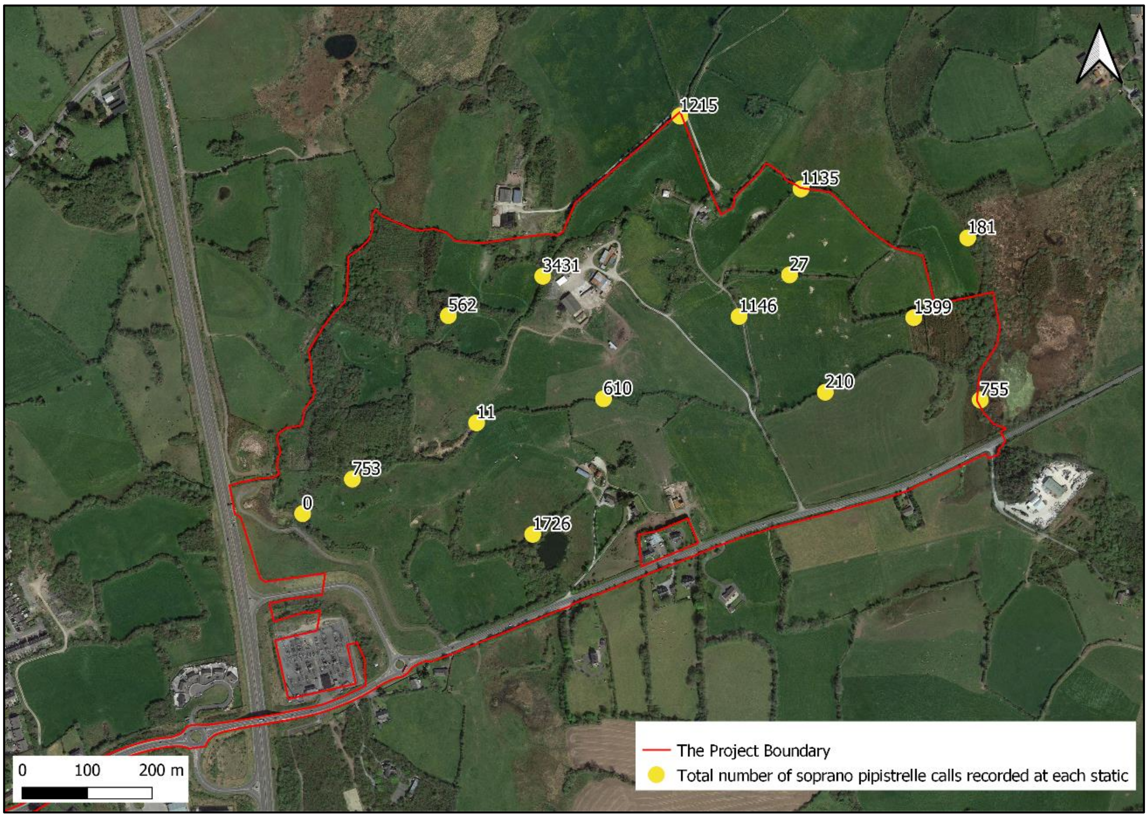

Figure 7.14 *Total number of Soprano pipistrelle calls recorded at each static*

Roost emergence/re-entry activity surveys

Of the 16 buildings on site that were surveyed, 18 soprano pipistrelle roosts were identified. Full details of the surveys and species identified can be found in Appendix 7.5, and buildings can be found in Figure 7.4. The following buildings contained soprano pipistrelle roosts:

- BB 1A – One individual soprano pipistrelle bat was recorded at this roost during the first survey in July at this building.

- BB 2 – Four soprano pipistrelle roosts identified at this building across two surveys. Small roosts of one to two individual bats.

- BB 3 – Five soprano pipistrelle roosts identified at this building across three surveys. 30 individual bats were recorded emerging/re-entering from one location in this building. 11 other individual bats were recorded at another roost location within this same building, the other roosts were smaller with one to three individual bats.

- BB 5A – Four soprano pipistrelle roosts identified at this building across three surveys; all of which comprised small roosts with one to two individual bats.

- BB 8 – Three soprano pipistrelle roosts identified at this building across two surveys. 13 individual bats were recorded emerging from one roost, while two individual bats were recorded emerging/re-entering from two other roosts.

- BB 9 – One soprano pipistrelle roost was identified at this building during one survey, with 8 individual bats recorded emerging from one roost.

Soprano pipistrelle calls were also identified foraging and commuting during the activity surveys at the buildings on site. Moderate to high numbers of calls were noted around all of the farm buildings, with soprano pipistrelle observed foraging within and around BB 1A, 1B, BB 4A -D, 5B, and 6A–C and using the treelines and hedgerows as commuting corridors to these buildings. Activity was also recorded around the treelines and hedgerows of the residential houses and gardens associated with the houses.

Evaluation

Soprano pipistrelle was the most commonly recorded bat species identified within the proposed development site, during all the survey types carried out. This is consistent with the results of the 2018 surveys. Levels of activity were particularly high along well-established linear hedgerows and treelines, and adjacent to waterbodies and farm buildings, where prey availability is likely to be high. Soprano pipistrelle bats are a specialist species, and tend to favour riparian habitats more than other pipistrelle species (Rachwald *et al.*, 2016). The large roosts in BB 3 and BB 8, are potentially maternity colonies. This is deduced from the numbers of bats identified emerging/re-entering from these buildings, and from the obvious increase in numbers around the peak breeding season, and the drop in numbers of individuals, post breeding season (*i.e.* September). Pipistrelle species typically forage near their roost (BCT, 2021), and the results from the transect surveys and emergence re-entry surveys would suggest that bats roosting in these buildings use the nearby Toureen Lough and hedgerows/treelines connected to this for foraging, and commute along the linear features adjacent to other areas of foraging within the site. Toureen Laneway was also an area that exhibited high activity levels of this species. This laneway is lined with mature trees, and as such would provide suitable commuting and/or foraging habitat for pipistrelle species in the area.

Soprano pipistrelle bats are known to have a widespread distribution across the region, and in Ireland (Roche *et al*., 2014). Soprano pipistrelles populations vary in abundance across the country (Aughney *et al*., 2018), with populations trends steadily increasing. Taking this into account, as well as the availability of suitable roosting, commuting and foraging habitat in the immediate surrounding environment, the presence of potential maternity colonies on site, as well as multiple other small roosts, the local soprano pipistrelle population is valued as being of County Importance.

Common Pipistrelle Bat

Transect surveys

Full details from each transect survey are provided above in Appendix 7.6 and locations of each of the recorded common pipistrelle calls are shown on Figure 7.15 – 7.16. Common pipistrelle was recorded during all three transect visits during the surveys in 2020, and on both transect visits carried out in 2018. It was the second most frequent species encountered during all transect surveys undertaken. The areas with the highest numbers of calls from this species were very similar to soprano pipistrelle, and included; Toureen Laneway, woodland in north west, hedgerows in the east, and around the farm buildings in the north of the site (BB 6A, B, C and BB 5B). Toureen Lough had noticeably less number of common pipistrelle calls compared to soprano pipistrelle calls. This was also the case for the surveys carried out in 2018. Areas with lower activity levels for this species included the south western area of the site, the southern boundary along the R352, and the northern boundary. As with soprano pipistrelle, activity was associated with well established hedgerows and mature treelines, and around farm buildings where foraging opportunities of insects are higher.

Static detector surveys

Common pipistrelle was identified on 14 of the 15 static detectors deployed on site in 2020, and on all 14 detectors deployed in 2018. Similar to soprano pipistrelle, and the results from the transects, common pipistrelle was identified throughout the site, with high levels of activity recorded along Toureen Laneway, along the hedgerows and treelines of the woodland in the north west, and around the farm buildings in the north of the site (BB 6A, B, C, D). This species was not identified on Static 9, located in the west of the site, adjacent to the M18 Attenuation pond. Static 1 and 2 located along the hedgerow directly east of Static 9, also had low numbers of calls[30]. Full details of the number of calls per night and number of nights static bat detectors were deployed are presented in Table 7.11, and in Figure 7.15 and 7.16 below.

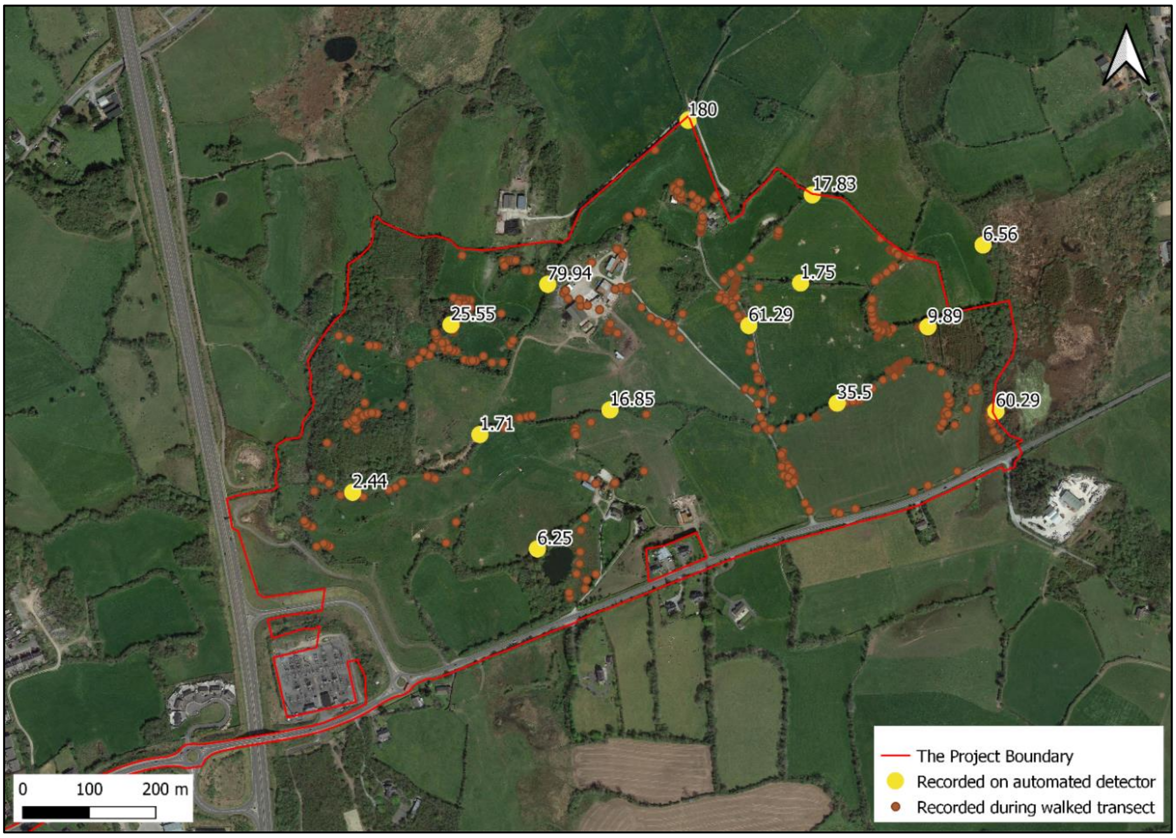

Figure 7.15 *Location of common pipistrelle calls recorded during both walked transects and automated static bat detector deployment, along with the average number of common pipistrelle calls recorded per night during the static deployment only*

[30] However Static 1 only recorded calls for 7 nights, which may have impacted the results, as it was deployed for a shorter amount of time, and would have a lower number of calls than if it had been deployed for longer.

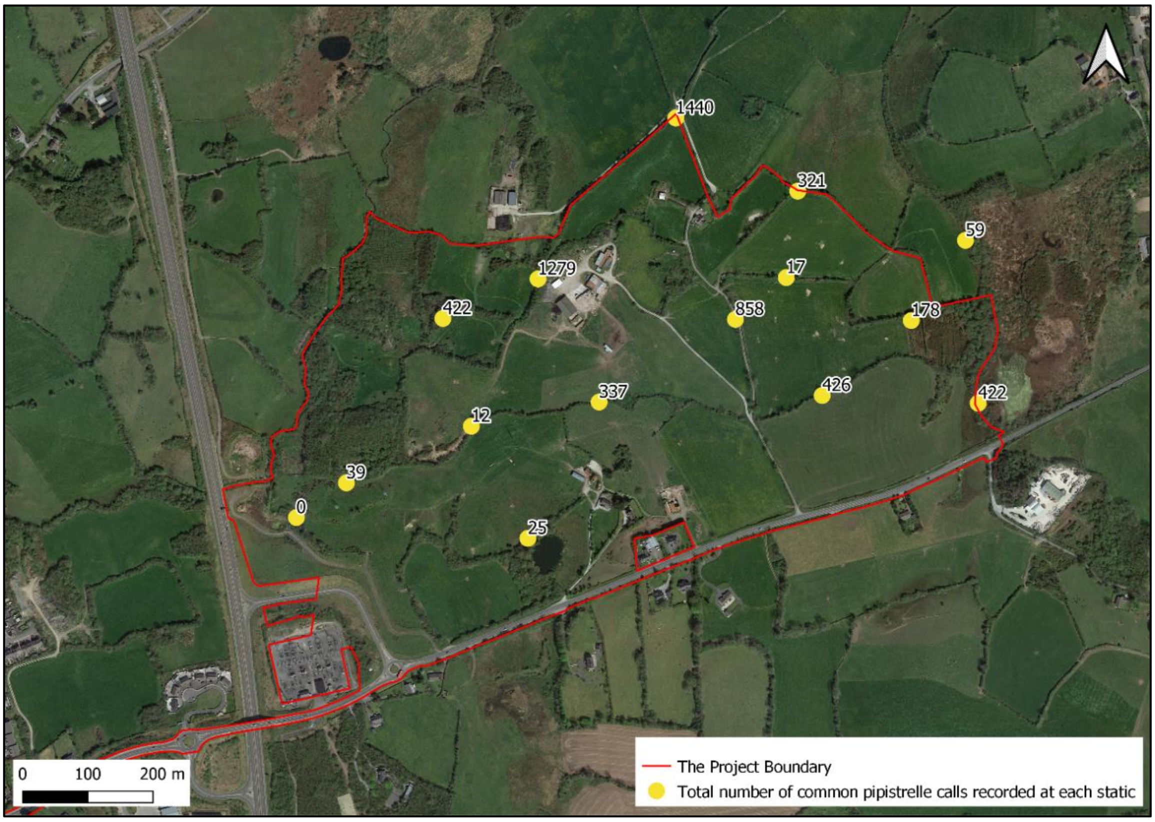

Figure 7.16 *Total number of common pipistrelle calls recorded at each static*

Roost emergence/re-entry activity surveys

One common pipistrelle roost was identified within one of the 16 buildings on site. This roost was identified at BB 5A, with one individual bat emerging during one survey. No other roosts of this species were identified. Similar to soprano pipistrelle, common pipistrelle bats were observed foraging around the barn buildings previously mentioned, and using hedgerows and treelines connected to these buildings.

Evaluation

Common pipistrelle was the second most commonly recorded bat species identified within the proposed development site. This is consistent with the results of the 2018 surveys. The areas that exhibited the highest levels of activity were very similar to the locations where soprano pipistrelle was recorded; however only one roost was identified across the proposed development site. This suggests that the site is an important foraging area for common pipistrelle, who may be roosting in structures and/or trees close to the site. The site may also be used by bats commuting to and from local roost sites. The mature hedgerows and treelines along field boundaries within the site provide linear corridors for commuting bats through the site between foraging areas within the farm buildings in the north (BB 6A, B, C) and in the south (BB 4A, B, C, D) (likely feeding off insects attracted to cow dung), and to the wetland habitats.

Common pipistrelle bats are widespread in Ireland; however, they tend to show a southern bias in their distribution, with greater numbers occurring in the south west and east of the country that in the north (Roche *et al.,* 2014). This species has also shown increasing population trends in recent years. Taking this into account, as well as the availability of suitable roosting, commuting and foraging habitat in the immediate surrounding environment, the local common pipistrelle population within the study area are considered to be of local importance (higher value).

Brown long-eared bat

Transect surveys

Full details from each transect survey are provided above in Appendix 7.6 and locations of each of the recorded brown long-eared bat calls are shown on Figure 7.17 – 7.18. brown long-eared were recorded during two of the three transect visits carried out within the site. Brown long-eared calls were not identified during any of the transect visits carried out in 2018. The number of brown long-eared calls recorded during transects was relatively low in comparison to other bat species. Brown long-eared bats have very quiet, short echolocation calls, forage in cluttered habitats and therefore are less likely to be recorded by handheld bat detectors (Aughney *et al.*, 2011). This species also emerges from roosts later than other species, as their typical prey (Lepidopterans) tend to be available later in the night. However, all-night transect survey, with the addition of static detectors, addresses this limitation.

A number of areas within the site were identified as important commuting corridors for this species. The area with the highest number of calls recorded was Toureen Laneway, with a total of 20 calls recorded during two of the three visits. Five brown long-eared bat calls clustered together were recorded in the area adjacent to the woodshed located in the north of the site (BB 5B), These were likely to be the individual brown long-eared bats roosting within BB 5B. Single brown long-eared calls were also recorded within and along the woodland edge in the north west of the site, and in the south adjacent to the R352 and a small pocket of woodland in an agricultural field.

Static detector surveys

Brown long-eared bats were identified on 13 of the 15 static detectors deployed on site in 2020, and on six of the 14 detectors deployed in 2018. Activity levels were low across the site, with the highest number of calls and highest average number of calls per night recorded along Toureen Laneway. This is consistent with the transect data and static data recorded in 2018. Activity was highest in the northern section of the site, along the northern boundary and adjacent to the farm buildings (BB 6A-C), compared to the southern section of the site. These deployment locations (*i.e.* Static locations 10, 11, 12) are connected to the brown long-eared bat roost in BB 5B by hedgerows and treelines. The two statics located along the hedgerow through the site in the west (*i.e.* location 1 and 2), did not record any brown long-eared bat calls, with the other statics in the south, recording a low number of brown long-eared calls and a low average number of calls per night across the duration of deployment. Full details of the number of calls per night and number of nights static bat detectors were deployed are presented in Table 7.11, and in Figure 7.17 and 7.18 below.

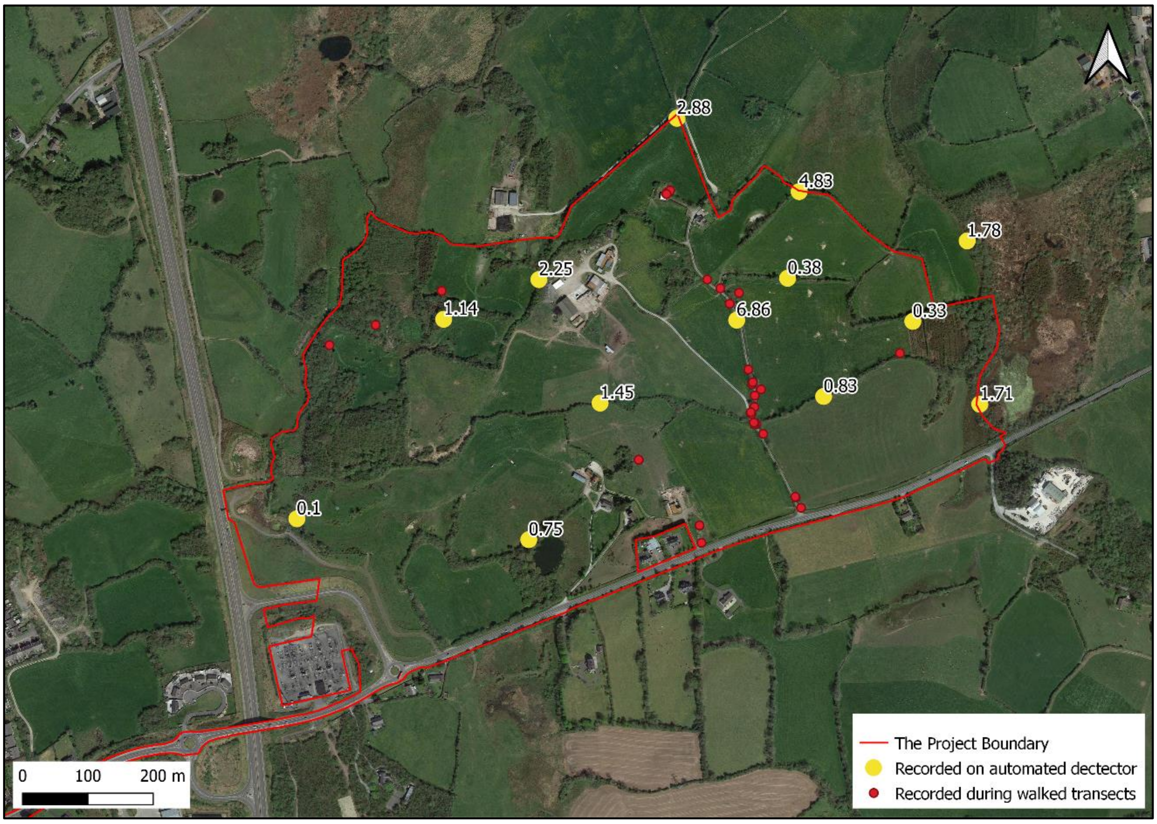

Figure 7.17 *Location of brown long-eared bat calls recorded during both walked transects and automated static bat detector deployment, along with the average number of brown long-eared bat calls recorded per night during the static deployment only*

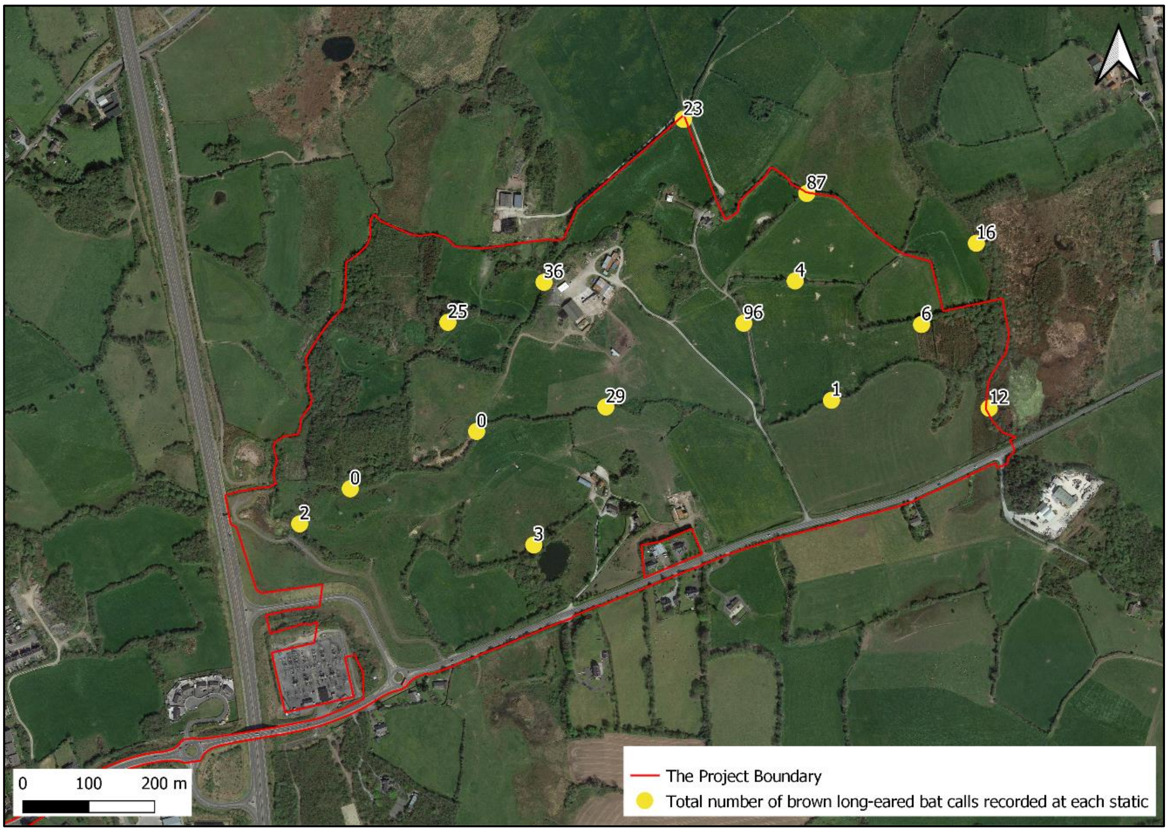

Figure 7.18 *Total number of brown long-eared bat calls recorded at each static*

Roost emergence/re-entry surveys

One brown long-eared bat roost was identified within one of the 16 buildings on site (*i.e.* BB 5B). Two individuals were observed emerging from features in the interior wall inside this farm building, where it was densely covered in ivy. Following emergence, these bats proceeded to fly around barn, possibly warming up before emerging from the building to feed. One of the individuals also landed on a wooden supporting beam, where surveyors could identify the species as brown long-eared and record the brown long-eared calls on the handheld bat detector. Both individuals emerged after *c.* 20 minutes within the building.

Brown long-eared bat calls were also recorded during numerous other emergence/re-entry surveys on site, however no other brown long-eared bat roosts were identified. Activity was recorded near the farm buildings and residential houses, in the south of the site (*i.e.* BB 1A, 1B, 2, 3, 8), with activity noted primarily along hedgerows and treelines adjacent to the buildings. Brown long-eared bat was also identified in the north near BB 5A. These arelikely to be the individual bats commuting to/from foraging sites and their roost in BB 5B.

Evaluation

Whilst brown long-eared bat were not the most frequently identified bat species within the site with other species showing higher levels of activity, they were recorded widely across the site, as demonstrated by the results from the static bat detector surveys. It is possible that brown long-eared bats were under-recorded within the proposed development site, due to their short, quiet echolocation calls which can go undetected by bat detectors[31]. Static bat detectors would be more likely to record the calls as they are deployed all night and brown long-eared typically emerge an hour after sunset, however, the bats would have to be flying relatively close to the detectors to be picked up as the detection of these calls by bat detectors is limited to a distance of approximately 0.7m (Aughney and Roche, 2008[32]). On this basis, a precautionary principle has been applied, and it has been assumed that most hedgerows and treelines within the site are important for foraging and commuting brown long-eared bats, particularly heavily wooded areas such as the woodland area in the north west, the mature treelined Toureen Laneway and the mature hedgerow along the northern boundary. Toureen Laneway is particularly important for this species as it connects the roost building (BB 5B) to the wider landscape via hedgerows and treelines.

As brown long-eared bats are widely distributed across the country and have also shown a stable increasing population trend[31] , due to the presence of a roost within the site, and the widespread distribution of this species across the site, this local population of brown long-eared bat is considered to be of local importance (higher value).

[31] Aughney, T., Langton, S. & Roche, N. (2011) Brown long-eared bat roost monitoring scheme for the Republic of Ireland: synthesis report 2007-2010. Irish Wildlife Manuals, No. 56. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

[32] Aughney, T & Roche, N. (2008) *Brown long eared bat Plecotus auritus Roost Monitoring 2007, Irish Bat Monitoring Programme.* Bat Conservation Ireland www.batconservationireland.org.

Leisler's bat

Transect surveys

Full details from each transect survey are provided above in Appendix 7.6, and locations of each of the recorded Leisler's bat calls are shown on Figure 7.19–7.20. Leisler's bats were the third most commonly identified species during transect surveys of the proposed development, and calls were detected on all three transects carried out in 2020, and both transects in 2018. Areas with the highest levels of activity were along Toureen Laneway, and in the wet grassland habitat adjacent to Toureen Lough. Whilst this species was identified with higher numbers of calls in similar areas in 2018 i.e. Toureen Laneway and Toureen Lough, activities levels in 2018 were a lot lower than activity levels in 2020. Very little activity was recorded in the woodland in the north west, which differs from the all other bat species identified within the lands. This is likely due to the feeding preferences of Leisler's bat, as it is an exclusively aerial-hawking species[33], foraging up to heights of 30m. Although this species was identified from calls along hedgerows and treelines, this likely just reflects the walking route that was undertaken by surveyors, potentially resulting in missed commuting and/or foraging Leisler's bats that were feeding at a height over the fields and pastures. In this essence, whilst treelines and hedgerows are important for this species, they are less likely to be impacted directly from the removal of these features. High buildings or structures could pose collision risk issues for this species as a result.

Static detector surveys

Leisler's bat were detected on 14 out of 15 static detectors deployed in 2020, and 11 out of 14 in 2018. Activity levels were highest in the north of the site, along Toureen Laneway, and along the southern mot hedgerow associated with the laneway. Little to no activity was recorded in the west, particularly the south west, south of the woodland habitat. Static detectors deployed in 2018, had significantly lower numbers of calls picked up on detectors, however activity was highest along Toureen Laneway, and in the north of the site.

[33] Vincent Wildlife Trust, Ireland. Species profile – Leisler's bat. Accessed here: https://www.vincentwildlife.ie/species/leislers-bat

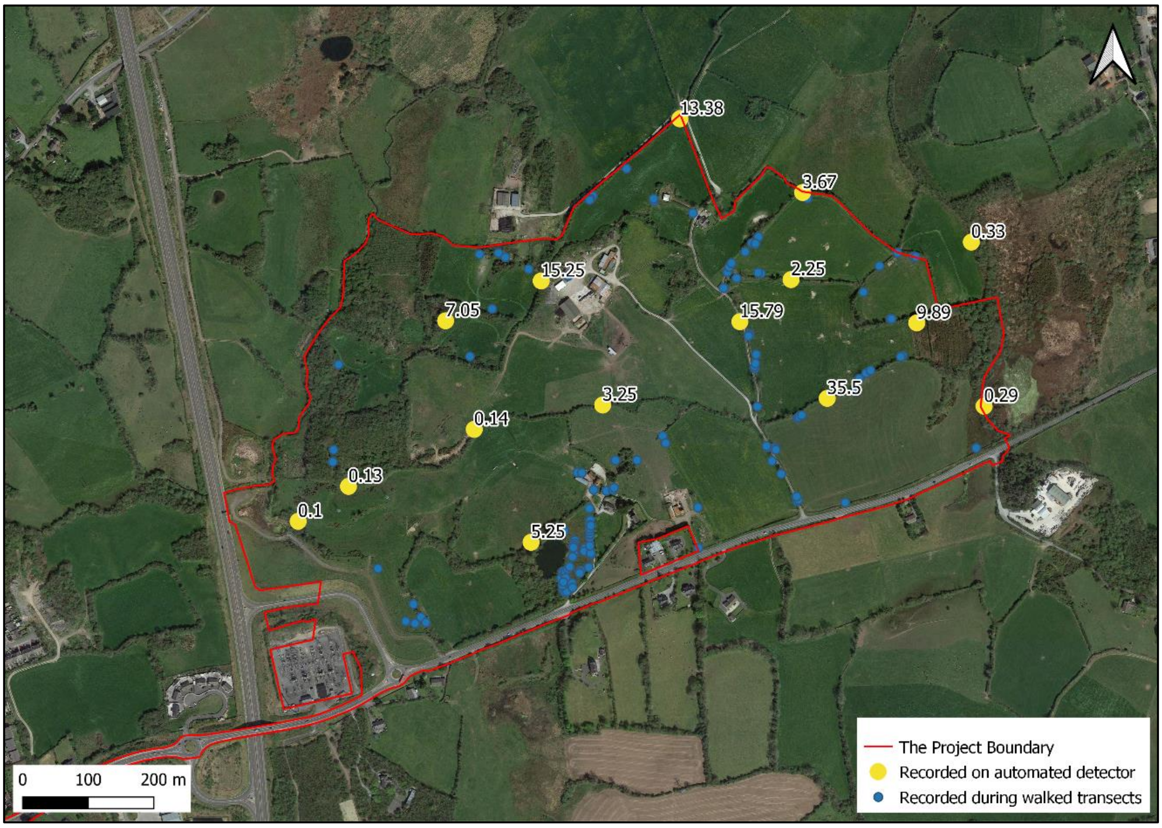

Figure 7.19 *Location of Leisler's bat calls recorded during both walked transects and automated static bat detector deployment, along with the average number of Leisler's bat calls recorded per night during the static deployment only*

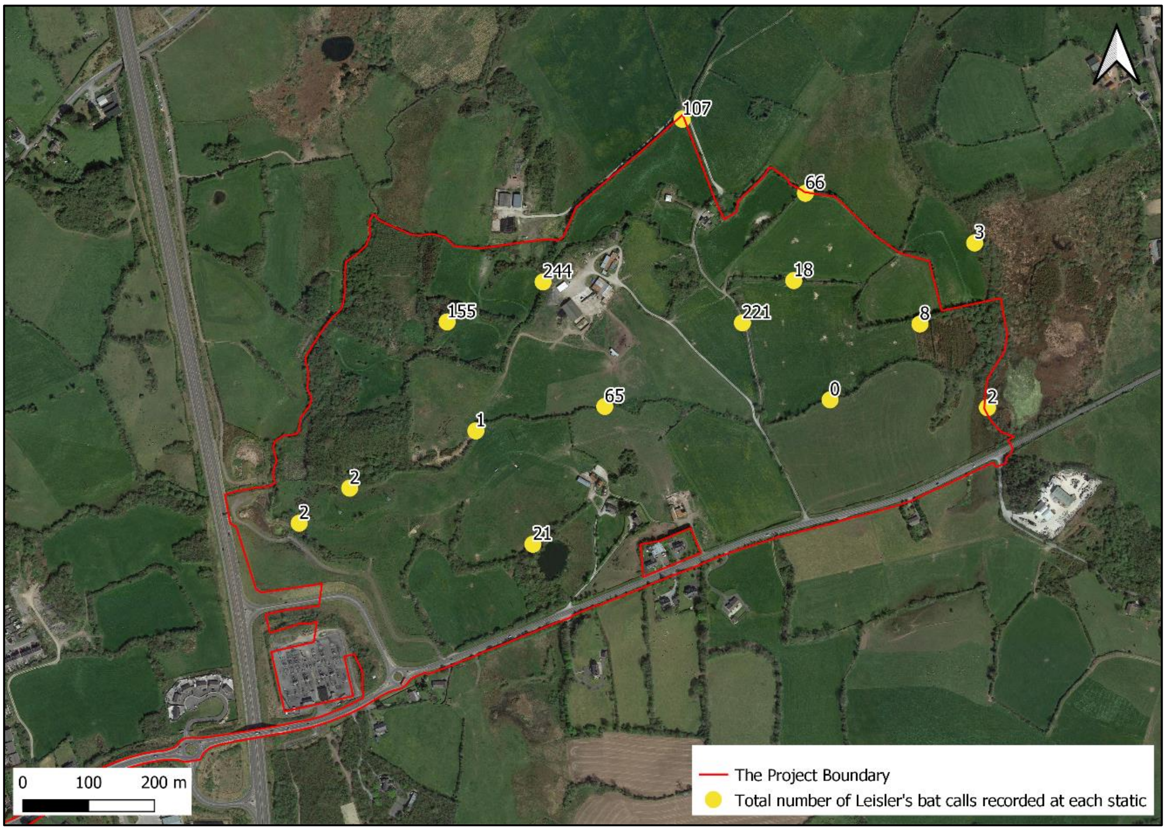

Figure 7.20 *Total number of Leisler's bat calls recorded at each static*

Roost emergence/re-entry surveys

There were no Leisler's bat roosts identified within the proposed development site during activity surveys. However; a Leisler's bat roost with one bat was identified during daytime building inspections during surveys in March 2022. Leisler's are predominantly tree roosting bats but can occasionally roost in buildings as nursery roosts[33]. Roost emergence/re-entry surveys on trees were not carried out.

Evaluation

Leisler's bats were recorded in high numbers across the site, particularly in surveys carried out in 2020. They are known to have a widespread distribution across the region, and in Ireland (Roche *et al.*, 2014), however Leisler's bats tend to show a southern bias in their distributions, with greater numbers occurring in the south west and east of the country than in the north. Populations of this species have shown to be increasing in recent years. Leisler's are high flying bats, and as such, they may have been using areas not covered by detectors (middle of fields etc.), and therefore potentially not identified. However, Leisler's bat calls are typically loud and can be heard from a significant distance away, and would likely have been picked up by static and/or handheld detectors despite this. Given the high suitability of the site for this species, the Leisler's bat roost identified, and the increasing population trends, particularly in the south west of the country, the local population of Leisler's bat is valued as being of local importance (higher value).

<u>Myotis sp.</u>

Transect surveys

Full details from each transect survey are provided above in Appendix 7.6, and locations of each of the recorded *Myotis* sp. calls identified are shown on Figure 7.21–7.22. *Myotis* sp. was identified on all three transect surveys undertaken in 2020, and during one transect survey undertaken in 2018. Higher activity levels were mainly associated with Toureen Laneway, and in areas close to the barns/farm buildings in the north (*i.e.* BB 6C and BB 5B). There was very little activity recorded in the south western and eastern areas of the site. Similarly, very few *Myotis* sp. calls were recorded during transect surveys undertaken in 2018.

Static detector surveys

Myotis sp. were identified on all 15 static detectors in 2020, and all 14 detectors in 2018. Although *Myotis sp.* calls were widespread across the site, activity levels were varied. Detectors on the eastern boundary of the site adjacent to wetland features, and Toureen Laneway, had the highest number of calls and highest average number of calls per night. Daubenton's bat, a *Myotis* sp. bat that typically feeds above water by gleaning insects from the surface[34], was are likely to use the areas of open water located within the eastern section of the site site as feeding habitat. Toureen laneway is lined with mature ash and oak trees, and with high numbers of calls from *Myotis* sp. identified along this corridor, Natterer's bat could potentially be the *Myotis* sp. foraging along here. The woodland in the north west had moderate levels of activity, particularly on the southern edge. The highest levels of *Myotis* sp. recorded in the 2018 surveys were located in the north west of the site, in the woodland habitat.

[34] *Daubenton's bat, Woodland Trust.* Accessed here: https://www.woodlandtrust.org.uk/trees-woods-and-wildlife/animals/mammals/daubentons-bat/

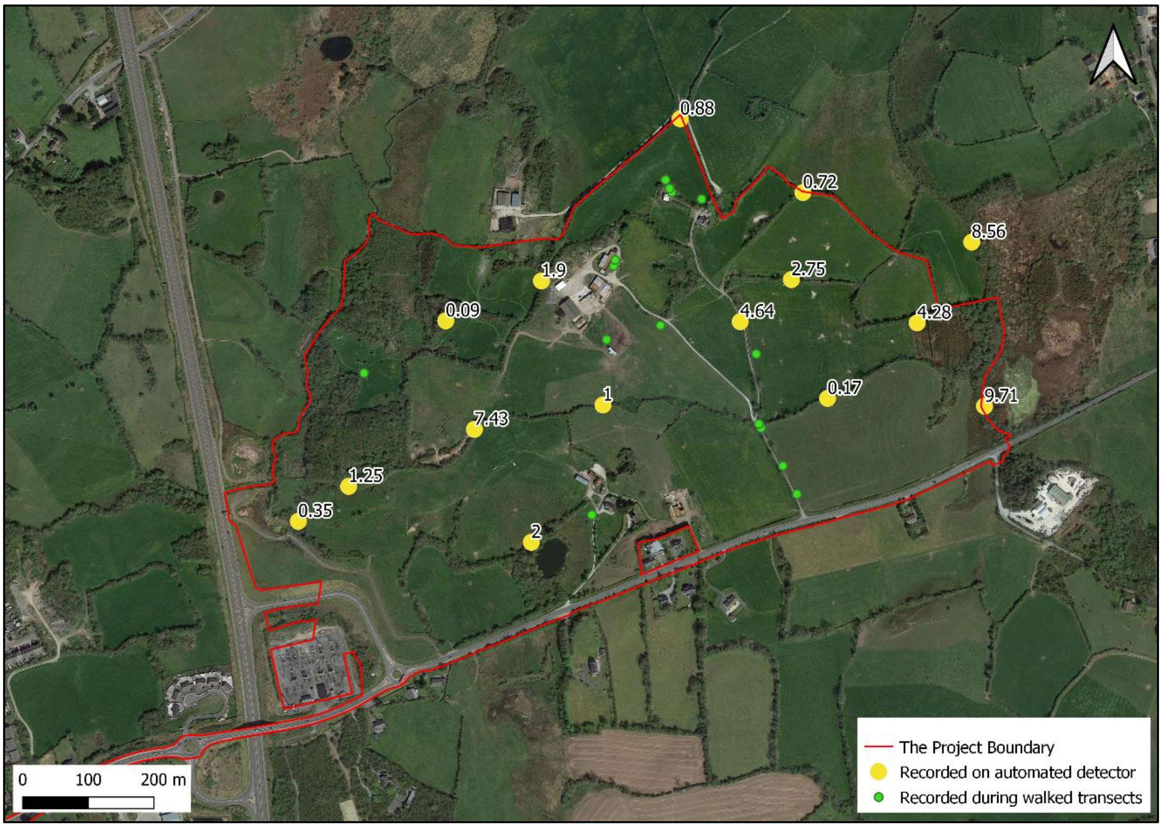

Figure 7.21 *Location of Myotis sp. bat calls recorded during both walked transects and automated static bat detector deployment, along with the average number of Myotis sp. calls recorded per night during the static deployment only*

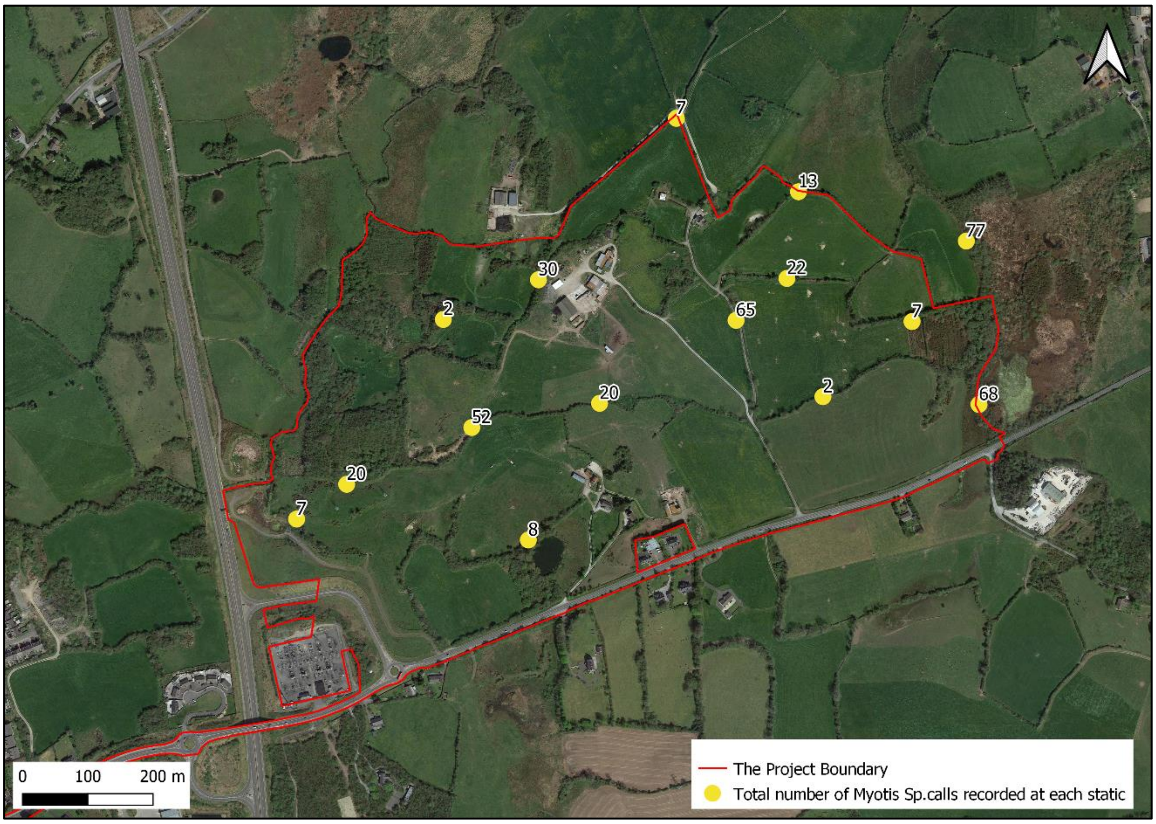

Figure 7.22. *Total number of Myotis species calls recorded at each static*

Roost emergence/re-entry surveys

There were no *Myotis* sp. bat roosts identified within the proposed development. *Myotis* sp. bats can roost in a range of roost types, including buildings and trees.

Evaluation

Whilst widely recorded within the proposed development site, moderate levels of activity were observed from the various survey types carried out. Commuting routes along hedgerows and treelines are important corridors for these species who prefer to feed close to vegetation to avoid predation[35]. *Myotis* bat species, including Daubenton's bat, whiskered bat and Natterer's bat have a relatively wide but dispersed distribution throughout Ireland. Bat species of the genus *Myotis* were associated most commonly with habitats within the west and east of the site, *i.e.* the woodland area, and the wetlands in the east. Outside of the subject lands the next closest area of significant woodland is *c.* 110m south. Similarly, certain species in the genus *Myotis* (*i.e.* Daubenton's bat) perform the majority of its foraging over water. Numerous smaller waterbodies are present outside of the subject lands, such as the larger lakes of Holaan Lough, located *c.* 500m south-east of the subject lands, Girroga Lough located *c.* 2.3km west, and Ballyallia Lake located *c.* 2.6km north-west, and a smaller lough, Ballymacahill Lough, located c. 250m north of the subject lands. Given the widespread distribution of bats of the genus *Myotis* and the availability of similar habitat (woodland and waterbodies) within the immediate surrounding environment, the local population of *Myotis* sp. is considered to be of local importance (higher value).

Tree surveys

The habitat within the lands provides excellent commuting and foraging routes for bats within the area. The treelines and hedgerows within and along the boundaries of the site follow linear routes which are connected to treelines and hedgerows in the surrounding area. The subject lands are unlit by adjacent roads or buildings, and therefore are suitable for foraging bats. A total of 17 trees (*i.e.* 14 Ash *Fraxinus excelsior* and three sycamore *Acer pseudoplatanus)* were identified to have the potential to support roosting bats within the proposed development site (Figure 7.23). 14 of these trees were deemed as having low potential, with two trees deemed as having moderate potential, and one deemed as having high potential, assessed in accordance with Collins *et. al* (2016) bat survey guidelines (Figure 7.23).

Figure 7.23 *Location of trees with potential bat roost features (updates)*

7.3.3.6 Fish

Fish species are protected under the Fisheries Acts and by fishing bye-laws. Atlantic salmon, river lamprey, sea lamprey and brook lamprey are listed on Annex II of the EU Habitats Directive.

[35] Jones, G., Rydell, J. (1994) Foraging strategy and predation risk as factors influencing emergence time in echolocating bats. Philosophical Transactions Of The Royal Society Of London. Series B: Biological Sciences, *346*(1318), 445-455.

The proposed development site lies within the Fergus_SC_040 catchment. The EPA segment of the Spancelhill Stream which is contained within the study area is Spancelhill_010. Spancelhill_010 segment is c. 7.5km and consists of the channel of the Spancelhill Stream from its starting point in O'Briens Big Lough, to where it joins the River Fergus downstream of the proposed development site. The Spancelhill Stream and the River Fergus have not been surveyed by Inland Fisheries Ireland (IFI) for their Ecological Fish Status. There are five Annex II fish species found within the Lower River Shannon SAC, *i.e.* sea lamprey *Petromyzon marinus*, brook lamprey *Lampetra planeri*, river lamprey *Lampetra fluviatilis*, Atlantic salmon *Salmo salar* and twaite shad *Alosa fallax*, the four former species of which are Qualifying Interests of the SAC. The three lamprey species and Atlantic salmon have all been observed to be spawning in the Lower Shannon and its tributaries (NPWS, 2013d). There was one fish species record, sea lamprey, identified within c. 2km returned from the desk study. While fish surveys were not carried out in the waterbodies within the proposed development site, Toureen Lough, and the M18 Attenuation Pond have potential to hold populations of small fish species. Spancelhill Stream is not suitable for salmonid species due to the heavy poaching from cattle using the stream from nearby lands. This poaching has resulted in very silty, soft substrate, and little instream vegetation. Instream vegetation is important for rivers/streams used by salmonid species, as it provides protection from predators[36]. Lamprey species tend to live in soft substrate, where they can hide from predators[37]. As this habitat is present along the Spancelhill Stream that borders the proposed development site, there is potential for lamprey species to be directly impacted from the installation of the drainage pipes, headwall and mattress.

Annex II fish species are classified as being of international importance, while non-Annex II fish species are classified as being of local importance (higher value).

7.3.3.7 Invertebrates

White-Clawed Crayfish Austropotamobius pallipes

White-clawed crayfish are legally protected under the Wildlife Acts and are also listed on Annex II of the Habitats Directive. Ireland remains the only part of the EU with no introduced species of crayfish, as such is of key conservation concern.

The desk study did not return any records for white-clawed crayfish within 2km of the proposed development. The closest record for this species is located in Lough Cullaunyheeda, c. 10.1km south-east of the proposed development and is not hydrologically linked to the site. Although this species is not known to be within the River Fergus Catchment, this species is present in the Shannon Catchment[38], and therefore populations could expand into the River Fergus Catchment, which has a direct hydrological link to the proposed development site via the Spancehill Stream. The local population of white-clawed crayfish is therefore considered to be of local importance (higher value).

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[36] Marsh, JE, Lauridsen, RB, Gregory, SD, et al. Above parr: Lowland river habitat characteristics associated with higher juvenile Atlantic salmon (Salmo salar) and brown trout (S. trutta) densities. Ecol Freshw Fish. 2019; 00: 1– 15.

[37] Lamprey habitats, Lamprey Surveys and consultancy advice UK & Ireland. Found here: https://lampreysurveys.com/lamprey-habitats/

[38] Reynolds, J.D., O'Connor, W., O'Keeffe, C. & Lynn, D. (2010) A technical manual for monitoring white-clawed crayfish Austropotamobius pallipes in Irish lakes. Irish Wildlife Manuals, No 45, National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin.

Freshwater Molluscs (including freshwater pearl mussel Margaritifera margaritifera)

The freshwater pearl mussel population of the Lower River Shannon SAC is present in the Cloon River, which is located in a different river catchment to that of the proposed development, *c.* 20.5km south west of the proposed development (NPWS, 2012a). The desk study returned no records for freshwater mollusc species and will not be considered further.

Marsh Fritillary Euphydras aurina

Marsh fritillary are legally protected under Annex II of the Habitats Directive. Surveys for marsh fritillary were not carried out as part of this assessment. In an Irish context, the conservation status of these species in Ireland is designated as 'Vulnerable' (Regan *et al.* 2010).

The desk study did not return records for marsh fritillary within the footprint of the proposed development. Desk study records in the wider area were largely historical (pre-1980s). The most recent record was from 2011 and located c. 800m north west of the proposed development site in Cappagh More. Although specific butterfly surveys were not carried out within the proposed development, the site was surveyed for various other species multiple times (See Table 7.1), and any evidence of this species would have been identified if present. This species was not identified within the proposed development site during surveys carried out in 2018 and 2020.

Marsh fritillary are restricted to habitats containing a low, open sward with abundant devil's-bit scabious *Succisa pratensis* including sand dunes, calcareous grassland, fens, raised and blanket bogs, upland heaths and grasslands. Calcareous grass is present within the footprint of the proposed development site and outside the footprint of the development. Suitable habitat for marsh fritillary, namely devil's-bit scabious, was not identified within the proposed development, and as such the site is not suitable for this species and is not considered further.

Other invertebrates

The desk study returned records for 26 species listed on Ireland Red List No. 4 (Regan *et al.* 2010), and Ireland Red List No. 6 (Nelson *et al.* 2011), within c. 2km of the proposed development site. There were no Red Listed or rare bee species records identified within c. 2km of the proposed development site. None of these species were identified within the proposed development site during surveys carried out in 2018 or 2020.

14 of the 18 red-listed butterfly species records identified were of Least Concern. The remaining four species included; small heath *Coenonympha pamphilus* (Near Threatened) with the most recent record from 1978, wall butterfly *Lasiommata megera* (Endangered) with the most recent record from 1998, wood white *Leptidea sinapis* (Near threatened) with the most recent record from 2006, and marsh fritillary (as described above). Butterfly are known to favour nectar-rich flowers which provide larval foodplants, preferred species include cock's-foot grass *Dactylis glomerata*, bird's-foot trefoil *Lotus corniculatus*, common nettle *Urtica dioica*, cuckoo flower *Cardamine pratensis*, garden nasturtium *Tropaeleum majus*, common holly *Ilex aquifolium* and common ivy *Hedera helix* (Butterfly Conservation Ireland 2020).

The remaining eight red-listed species identified within c. 2km of the proposed development included six species of damselfly, and two species of dragonfly, all listed as species of Least Concern (Appendix 7.2).

Corresponding habitats within the proposed development are located in dry meadows and grassy verges (GS2), amenity grassland (GA2), dry calcareous and neutral grassland (GS1) habitats, wet grassland (GS4) and the various wetland habitats within the site (Toureen Lough, Lough Ardnamurry, M18 Attenuation pond). Species diversity was low in terms of foodplants in these habitats. Butterfly communities that are known to survive in highly fragmented landscapes are mobile species that can feed off a range of plants (Öckinger *et al.* 2010).

The local invertebrate population is considered to be of local importance (higher value).

7.3.4 Summary of Ecological Evaluation

Table 7.12 below summarises the ecological evaluation of all receptors taking into consideration legal protection, conservation status and local abundance, and identifies the Key Ecological Receptors (KERs). Species, habitats and features not qualifying as KERs are not subjected to impact assessment in line with current best practice of assessing the impacts on what are determined to be important ecological or biodiversity features: CIEEM and TII guidelines (CIEEM, 2018 and National Roads Authority, 2009).

Table 7.12 *Summary of the ecological evaluation*

Ecological Receptor	Ecological Valuation	KER?
Designated Sites		
Lower River Shannon SAC	International	Yes
Ballyallia Lake SAC	International	Yes
Dromore Woods and Loughs SAC	International	Yes
Old Domestic Building (Keevagh) SAC	International	Yes
Old Domestic Buildings, Rylane SAC	International	Yes
Ballyallia Lough SPA	International	Yes
Slieve Aughty Mountains SPA	International	Yes
River Shannon and River Fergus Estuaries SPA	International	Yes
Corofin Wetlands SPA	International	Yes
All other SAC or SPA sites	International	No
Newpark House (Ennis) pNHA	National	Yes
Old Domestic Building (Keevagh) pNHA	National	Yes
Ballyallia Lake pNHA	National	Yes
Lough Cleggan Lake pNHA	National	Yes
Durra Castle pNHA	National	Yes
Dromore Woods and Loughs pNHA	National	Yes
Fergus Estuary and Inner Shannon, North Shore pNHA	National	Yes
All other NHA or pNHA sites	National	No
Habitats		
Wet Willow-Alder-Ash woodland (WN6)	International	Yes

Ecological Receptor	Ecological Valuation	KER?
Designated Sites		
Alluvial woodland [*91E0]		
Reed and large sedge swamp (FS1) *Cladium* Fen [*7210]	International	Yes
Dry calcareous and neutral grassland (GS1) Calcareous grassland [6210]	National	Yes
Wet grassland (GS4) Molinia meadows [6410]	National	Yes
Rich fen and flush (PF1) Alkaline fen [7230]	National	Yes
Oak-Ash-Hazel woodland (WN2)	County	Yes
Mesotrophic lake (FL4)	Local importance (higher value)	Yes
Depositing/lowland rivers (FW2)	Local importance (higher value)	Yes
Other artificial lakes and ponds (FL8)	Local importance (higher value)	Yes
Rich fen and flush (PF1)	Local importance (higher value)	Yes
Reed and large sedge swamps (FS1)	Local importance (higher value)	Yes
Marsh (GM1)	Local importance (higher value)	Yes
Dry calcareous and neutral grassland (GS1)	Local importance (higher value)	Yes
Wet grassland (GS4)	Local importance (higher value)	Yes
Hedgerows (WL1)	Local importance (higher value)	Yes
Treelines (WL2)	Local importance (higher value)	Yes
Oak-Ash-Hazel Woodland (WN2)	Local importance (higher value)	Yes
Immature Woodland (WS2)	Local importance (higher value)	Yes
All other habitats	Local importance (lower value)	No
Fauna Species		
Lesser horseshoe bat	International importance	Yes
Soprano pipistrelle	County importance	Yes
All other bat species	Local importance (higher value)	Yes
SCI Wintering birds	International importance	Yes
All other wintering birds	Local importance (higher value)	Yes
Otter	International importance	Yes
Grey wagtail	County importance	Yes
Other breeding birds	Local importance (higher value)	Yes
Pine marten	Local importance (higher value)	Yes
Other mammal species	Local importance (higher value)	Yes
Badger	Local importance (higher value)	Yes
Reptiles	Local importance (higher value)	Yes
Amphibians	Local importance (higher value)	Yes

Ecological Receptor	Ecological Valuation	KER?
Designated Sites		
Annex I Fish species	International importance	Yes
Other fish species	Local importance (higher value)	Yes
Freshwater molluscs	Local importance (lower value)	No
White-clawed crayfish	Local importance (higher value)	Yes
Marsh fritillary	N/A	No
Other invertebrates	Local importance (higher value)	Yes

7.4 CHARACTERISTICS OF THE DEVELOPMENT

The proposed development is to demolish a number of existing dwelling houses and farm outbuildings and to develop six data storage facilities, an energy centre, an Above Ground Installation (AGI) building, a vertical farm, a substation compound and associated ancillary development on a c. 60ha greenfield site (currently used for agriculture and hosting power transmission infrastructure) in the townlands of Tooreen and Cahernalough, Ennis, Co. Clare. The development is fully described in Chapter 2 Description of the Proposed Development. This section outlines the characteristics of the development in relation to biodiversity.

Figure 7.24 presents the site layout for the proposed masterplan. The footprint of the proposed development occupies c. 17.3ha of the c. 60ha development site; the site layout reserves c. 10 ha of lands as ecological buffer zones. The indicated buffer zones on Figure 7.24 were delineated following assessment undertaken as part of the area assessment within the Clare County Development Plan 2017 – 2023 (Variation No. 1).

To facilitate the footprint of the development, there will be a total loss of 2.7km of hedgerows, and 30 trees. There will also be approximately 1,525m^2 of scrub being removed. In order to ensure the site continues to remain suitable for local wildlife species, there will be replacement planting of 4.86km of new native hedgerows, 57 new native trees and 58,567m^2 of native woodland planting. The proposed planting plan will be carried out in phases, with the first phase carried out pre-construction before any removal of vegetation takes place. In order to reduce the amount of soil being removed from the lands, berms will be utilised in a number of places within the proposed development. These areas will be planted with woodland species, and will further screen the development. The proposals for the site have been prepared taking account of the of the All-Ireland Pollinator Plan with the majority of the species proposed in the various habitats recommended in the Plan. Further details on the landscaping proposals and phasing of the development can be found in Chapter 10 *Landscape And Visual Impact Assessment* of the EIAR[39], The Landscape and Biodiversity Management Plan[40], and the Landscape Design Strategy[41] that will be submitted as part of this application.

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[39] Chapter 10 *Landscape and Visual Impact Assessment.* Nicolas de Jong Associates (July 2021)

[40] *Landscape and Biodiversity Management Plan, Art Data Centres – Ennis Campus*. Nicholas de Jong Associates (July 2021)

[41] *Landscape Design Strategy, Art Data Centres – Ennis Campus.* Nicholas de Jong Associates (July 2021)

Figure 7.24. *Proposed development boundary. Red hatched areas show the buffer zones included in the proposed development*

Foul water

There is an existing 225mm diameter foul drain that forms part of an existing foul drainage network that services the existing Knockanean area southwest of the proposed development along the existing Tulla Road/R352. This existing foul drain discharged to the existing Pumping Station of Gort Na mBlath located approximately 550m further west from the proposed development. It is proposed to convey and discharge all domestic foul flows generated from the proposed development into the existing Gort Na mBlath Pumping Station. A temporary trench excavation along the Tulla road will be undertaken to facilitate pipe laying for connection with existing public wastewater sewer and mains water supply.

There is no trade effluent proposed for this development. Foul sewage will be collected from site (data storage facility, offices and energy centre washroom facilities and canteen) and discharged through a new pumping station which will be constructed as part of this proposed development, to the foul drainage network which runs along the Tulla Road and ultimately discharges to Ennis North (Clonroadmore) Wastewater Treatment Plant (WWTP) Reg D0048. Ennis North WWTP has no capacity issues and consultation with Clare County Council has confirmed that sufficient wastewater capacity is available and a pre-connection enquiry PCE application form has been submitted to Irish Water (IW).

Surface water

The proposed surface water drainage design for the development comprises various drainage components including positive stormwater networks, attenuation systems and several Sustainable Drainage System (SuDS) elements. Stormwater will be attenuated on site for the 1:1000 yr flood event. An over flow subsurface pipeline will discharge at current discharge rates (greenfield) to the Spancelhill Stream (also known as Ballymacahill River).

The roofs, yards and internal access roads proposed throughout and within the footprint of the proposed development will be drained through a sealed drainage system that will ultimately be collected by gullies and conveyed through a series of proposed storm water pipes prior to discharging into a proposed open attenuation basin. There will be no direct discharge from hardstand area to swallow holes or existing pond features within the site boundary. Further details are provided in Chapter 7 of the EIAR and within the CSEA engineering reports and drawings[42] prepared for planning.

7.5 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

As per the relevant guidelines, significant effects have only been assessed for KERs, as listed in Table 7.12. An impact is considered to be ecologically significant if it is predicted to affect the integrity or conservation status of a KER at a specified geographical scale. All impacts are described in the absence of mitigation.

7.5.1 Construction Phase

7.5.1.1 Designated Sites

This section describes and assesses the potential for the proposed development to result in likely significant effects on European sites that lie within the ZoI of the proposed development. In the context of European sites this is focussed on the habitats and species for which the sites are selected (*i.e.* Qualifying Interest (QIs) for SACs and Special Conservation Interest species (SCIs) for SPAs) and the conservation objectives supporting their conservation status in each site. In the case of NHAs and pNHAs the assessment considers whether the integrity of any such site would be affected by the proposed development with reference to the ecological features for which the site is designated, or is proposed.

European sites

In the context of assessing whether the proposed development would be likely to result in an impact on the integrity of any European sites, the tests and assessment presented in the Natura Impact Statement (NIS) fulfil this role. The NIS considers whether the proposed development will affect the conservation objectives supporting the favourable conservation condition of any European sites' QIs/SCIs and as a result presents an assessment of whether the integrity of any European sites would be affected – *i.e.* if the proposed development would adversely affect the integrity of a European site, this would constitute a likely significant effect in the context of the EIA Directive.

The nature and scale of the proposed development, the identified potential impacts and their relationship to European sites were considered in order to determine which European sites were located within the ZoI of the proposed development, in view of

[42] *Engineering Planning Report, Art Data Centre – Ennis Campus.* Clifton Scannell Emerson Associates (CSEA), July 2021

best scientific knowledge and in view of conservation objectives, and therefore potentially at risk of the proposed development affecting their conservation objectives. The potential impacts associated with the proposed development are discussed below in relation to those European sites within its ZoI (see also Section 5 and Section 6 of the NIS[43]).

The Zone of Influence (ZoI) is a distance within which the proposed development could potentially affect the conservation condition of QI habitats or QI/SCI species of a European site.

The mechanism to define the ZoI is summarised as follows:

- Consider the nature, size and location of the proposed development;
- Consider the sensitivities of the ecological receptors;
- Identify impact sources and pathways; and
- Determine the ZoI based on the extent of the impact.

Considering the ZoI, in the absence of mitigation measures, the proposed development was assessed as having the potential to adversely affect the integrity of the following eight European sites (refer to Section 5 and Section 6 of the NIS[33]):

- Lower River Shannon SAC
- Dromore Woods and Loughs SAC
- Old Domestic Building (Keevagh) SAC
- Old Domestic Buildings, Rylane SAC
- River Shannon and River Fergus Estuaries SPA
- Ballyallia Lough SPA
- Slieve Aughty Mountains SPA
- Corofin Wetlands SPA

The locations of these European sites relative to the proposed development, and the predicted ZoI, are shown on Figure 7.5.

The following potential impacts on European sites have been identified based on the existing ecological environment and the extent and characteristics of the proposed development (see information provided below for detailed description of these potential impacts and relevant European site):

- Habitat loss and fragmentation;
- Habitat degradation/effects on QI/Sci species as a result of hydrological impacts;
- Habitat degradation as a result of hydrogeological impacts;
- Habitat degradation as a result of air quality impacts;
- Habitat degradation as a result of introducing/spreading non-native invasive species;
- Disturbance and displacement impacts; and
- Direct injury/mortality

As the proposed development does not traverse any European sites, there is no potential for habitat fragmentation of any European site to occur.

[43] *Natura Impact Statement, Art Data Centre – Ennis Campus.* Scott Cawley, June 2022

A potential source-pathway-receptor link exists between the proposed development site and the following European sites : Lower River Shannon SAC and River Fergus and River Shannon Estuaries SPA. This link is via the Spancelhill Stream, which flows along the north western boundary of the proposed development site, flowing downstream before joining the River Fergus and finally discharging into the Fergus Estuary. QI and SCI species/habitats of these European sites located downstream of the proposed development site are therefore at risk of habitat degradation, which may occur in the event of a pollution event affecting surface water quality. The Dromore Woods and Loughs SAC is located c. 4.5km north west of the proposed development site, and is upstream of the proposed development site. A portion of the River Fergus flows through this European site. The River Fergus then flows c. 9.3km downstream, via Ballyallia Lough SAC, and combines with the outfall of the River Fergus that connects with the Spancelhill Stream, upstream of this. There is therefore a hydrological link between the proposed development site and these aforementioned European sites.

Otters are QI species of the Lower River Shannon SAC and Dromore Woods and Loughs SAC, and therefore at risk from the proposed development should an accidental pollution event affect surface water quality. QI habitats within this European site are not at risk due to this European site being located upstream of the proposed development site.

There are a number of European sites in the vicinity of the proposed development that are designated for lesser horseshoe bat (Appendix 7.1). This species has been identified commuting and foraging within the proposed development site. The normal core foraging range for lesser horseshoe bat is within 2-3km of roosts, which sometimes extends up to 4km (Bontadina, 2002 and Biggane, 2003). This distance can reduce down to a few hundred metres in the birthing season whilst larger scale movements of up to c. 15km are not unreasonable when bats move between winter and summer roosts. The Core Sustenance Zone (CSZ) for this species is described as the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the resilience and conservation status of the colony using the roost. A review carried out by BCT of radio-tracked individuals, has defined the CSZ as within 2.5km of their roosts[44]. From research carried out in Galway on radio-tracked lesser horseshoe bats, this species has been shown to travel as far as c. 5.15km from roosts for foraging (Rush and Billington, 2014). In consideration of this, it is possible that individual lesser horseshoe bats recorded within the proposed development site may be connected to the populations of the following European sites located within 6km of the proposed development site: Old Domestic Building (Keevagh) SAC, Dromore Woods and Loughs SAC, and Old Domestic Buildings, Rylane SA. European sites outside of 6km from the proposed development will not be impacted by the proposed development as a result.

Ballyallia Lough SPA and Corofin Wetlands SPA are not hydrologically or otherwise connected to the proposed development site. However, a number of SCI species of these European sites were recorded within the proposed development site during the wintering bird surveys, and therefore the conservation objectives of these European sites could be indirectly impacted on a result of the proposed development site.

[44] NPWS (2018) *Conservation objectives supporting document – lesser horseshoe bat (Rhinolophus hipposideros) Version 1*. Conservation Objectives Supporting Document Series. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Dublin, Ireland.

As the NIS concluded, the potential impacts associated with the proposed development have the potential to affect the receiving environment and, as a result, the conservation objectives supporting the QIs/SCIs of eight European sites: Dromore Woods and Loughs SAC, Lower River Shannon SAC, Old Domestic Building (Keevagh) SAC, Old Domestic Buildings, Rylane SAC, Ballyallia Lough SPA, River Shannon and River Fergus Estuaries SPA, Slieve Aughty Mountains SPA and Corofin Wetlands SPA.

Lower River Shannon SAC

As described in Section 7.1 of the NIS, the proposed development has the potential to affect the qualifying interests and conservation objectives, and therefore the integrity, of the Lower River Shannon SAC because of the following:

<u>Habitat degradation/effects on QI species as a result of hydrological impacts</u>

The release of contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water features during construction, has the potential to affect water quality in the receiving aquatic environment. Such a pollution event may include: the release of sediment into receiving waters and the subsequent increase in mobilised suspended solids; and the accidental spillage and/or leaks of containments (e.g. fuel, oils, lubricants, paints, bituminous coatings, preservatives, weed killer, lime and concrete) into receiving waters. The associated effects of a reduction of surface water quality could potentially extend for a considerable distance downstream of the location of the accidental pollution event or the discharge. The proposed development is hydrologically connected to the Spancelhill Stream and the River Fergus both of which discharge into the Fergus Estuary. Therefore, (albeit unlikely due to the distance between the main construction activities and watercourses) there is potential for the proposed development to result in effects which could have implications for the conservation objectives of Lower River Shannon SAC as a result of hydrological impacts.

<u>Habitat loss and fragmentation</u>

Otter are a QI species for Lower River Shannon SAC, which is downstream of the proposed development. Research carried out by Ó Néill et al. (2008) on ranging behaviours of otter on river systems in Ireland found that female otter ranges averaged *c.* 7.5km while male otter home ranges varied between *c.* 7-19km. Evidence of otter was identified within the proposed development site along Spancelhill Stream. As there is a hydrological connection between the proposed development and the European site (located *c.* 2.1km downstream), it is considered that the proposed development site is within the potential home range of otter associated with the Lower River Shannon SAC and, therefore, otter present within Spancellhill Stream at this location may be connected with this SAC population. Construction works within the Spancelhill Stream will include the installation of a grated culvert with associated headwall and mattress, with a total loss of $2m^3$ of bankside habitat. This habitat loss is considered to be temporary (2-3 weeks), and will be reinstated following completion of this. The total area of this installation will be $2m^3$. Therefore, the predicted habitat loss impact will not have any long-term effects on the QI otter population in terms of distribution/range, extent of available habitat, couch/holt sites, and barriers to connectivity. Therefore the impact on otter populations connected to the Lower River Shannon SAC as a result of direct habitat loss/fragmentation, is not considered to be significant.

The installation of this culvert, headwall and mattress, may require instream works. As the section of the Spancelhill Stream where works will be required has suitable habitat for lamprey species, there is potential for the proposed development to directly impact these QI species, i.e. brook lamprey, river lamprey, and sea lamprey.

Indirect habitat loss as a consequence of severe habitat degradation arising from a reduction in water quality and/or change to the hydrological regime, could also affect the conservation status of the Lower River Shannon QI species, including: otter, sea lamprey, river lamprey, brook lamprey, and Atlantic salmon from the Lower River Shannon SAC.

<u>Disturbance and/or displacement</u>

A temporary and/or permanent increase in noise, vibration and/or human activity levels during the construction and/or operation of the proposed development could result in the disturbance to and/or displacement of QI otter populations present in the vicinity of the proposed development. Such disturbance effects would not be expected to extend beyond a distance of *c.* 150m[45] for the majority of the proposed development, as noise levels associated with general construction activities would attenuate to close to background levels at that distance and beyond. Noisy works associated with the proposed development could include piling works between c. 150-200m away from watercourses known to support otter. These potential impacts could occur to such a degree that the conservation objectives of the Lower River Shannon SAC are undermined. As the works are planned during the day, levels of noise would not be expected to be dissimilar to background traffic noise, to which the mostly nocturnal otter would be habituated to from the M18 Motorway directly west of the site. If works were required at night time, however, an increase in noise levels in close proximity to watercourses used by otter could result in disturbance impacting otter movements. Furthermore, temporary works that will be occurring adjacent to Spancelhill Stream for the construction of services pipes for drainage and fibre optics, and the installation of a headwall and mattress with culvert, could also result in disturbance. It is predicted that the disturbance could affect the local population over the short term, but that the local otter population could utilise other unaffected suitable habitat along the watercourse during this temporary period. This is not uncommon among otter who can maintain a number of resting sites within their territory[46].

The temporary works required in the bank of Spancelhill Stream, may also result in a disturbance and/or displacement of lamprey species in the watercourse, that are from the Lower River Shannon SAC. Lamprey species may utilise the soft, silty substrate within this section of the Stream for burrowing into, and therefore any instream works required may temporarily impact the conservation objectives of this QI species.

Therefore, there is potential for the proposed development to result in significant effects (albeit temporary) which could have implications for the conservation objectives of Lower River Shannon SAC as a result of disturbance/displacement impacts,

<u>Habitat degradation as a result of introducing/spreading non-native invasive species</u>

[45] This is consistent with Transport Infrastructure Ireland (TII) guidance (Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes and Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes) documents. This is a precautionary distance, and likely to be moderated by the screening effect provided by surrounding vegetation and buildings, with the actual ZoI of construction related disturbance likely to be much less in reality.

[46] Species Profiles: Otter. Vincent Wildlife Trust (VWT). Accessed here: https://www.vincentwildlife.ie/species/otter

No non-native invasive plant species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations, 2011 were present within, or in close proximity to, the proposed development. During construction and/or routine maintenance/management work, non-native species could potentially be introduced to terrestrial habitats located within downstream European sites via surface water features. The introduction and/or spread of these invasive species to downstream European sites could potentially result in the degradation of existing habitats present, in particular coastal habitats not permanently or regularly inundated by seawater. These species may outcompete other native species present, negatively impacting the species composition, diversity and abundance and the physical structural integrity of the habitat. This in turn could undermine the conservation objectives of these European sites. The proposed development is hydrologically connected to the Spancelhill Stream, River Fergus, both of which flow into the Fergus Estuary. Therefore, there is potential for the proposed development to result in significant effects which could have implications for the conservation objectives of the Lower River Shannon SAC as a result of invasive species spread.

Affecting the integrity of the Lower River Shannon SAC would result in a significant effect at the international geographic scale.

Dromore Woods and Loughs SAC

As described in Section 7.2 of the NIS, the proposed development has the potential to affect the qualifying interests and conservation objectives, and therefore the integrity, of Dromore Woods and Loughs SAC because of the following:

<u>Habitat loss and fragmentation</u>

Otter are a QI species for Dromore Woods and Loughs SAC, which is upstream of the proposed development. Research carried out by Ó Néill et al. (2008) on ranging behaviours of otter on river systems in Ireland found that female otter ranges averaged c. 7.5km while male otter home ranges varied between c. 7-19km. Evidence of otter was identified within the proposed development site along Spancelhill Stream. As there is a hydrological connection between the proposed development and the European site (located c.12km downstream), it is considered that the proposed development site is within the potential home range of male otters associated with the Dromore Woods and Loughs SAC and, therefore, otter present within Spancellhill Stream at this location may be connected with this SAC population. Construction works within the Spancelhill Stream will include the installation of a grated culvert with associated headwall and mattress, with a total loss of 2m^3 of bankside habitat. This habitat loss is considered to be temporary (2-3 weeks), and will be reinstated following completion of this. The total area of this installation will be 2m^3. Therefore, the predicted habitat loss impact will not have any long-term effects on the QI otter population in terms of distribution/range, extent of available habitat, couch/holt sites, and barriers to connectivity. Therefore the impact on otter populations connected to the Dromore Woods and Loughs SAC as a result of direct habitat loss/fragmentation, is not considered to be significant.

However, indirect habitat loss as a consequence of severe habitat degradation arising from a reduction in water quality and/or change to the hydrological regime, could affect the conservation status of this QI species from Dromore Woods and Loughs SAC.

Lesser horseshoe bat is a QI species for Dromore Woods and Loughs SAC which is located *c.* 4.5km north west of the proposed development site. This species has been recorded using the proposed development site for foraging and/or commuting during surveys carried out in 2018 and 2020. No roosts were identified within the site.

However, records from BCI (as discussed in Section 7.3.3.5), identified nine lesser horseshoe roosts within 2km of the proposed development site, with the closest being *c*. 430m south. Research carried out on this species has suggested that the majority of feeding activity takes place within c. 2-3km of roosts during the year with occasional movements in excess of *c.* 4km (Bontadina, 2002 and Biggane, 2003). This distance can reduce down to a few hundred metres in the birthing season whilst larger scale movements of up to 15km are not unreasonable when bats move between winter and summer roosts. The Core Sustenance Zone (CSZ) for this species is described as the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the resilience and conservation status of the colony using the roost. A review carried out by BCT of radio-tracked individuals, has defined the CSZ as within 2.5km of their roosts. From research carried out in Galway on radio-tracked lesser horseshoe bats, this species has been shown to travel as far as c. 5.15km from roosts for foraging (Rush and Billington, 2014). In consideration of this, a precautionary approach has been adopted and it has been assumed for the purposes of this assessment that the lesser horseshoe bats recorded within the proposed development site may be connected with the lesser horseshoe bat populations of Dromore Woods and Loughs SAC. Although there will be a loss of suitable habitats within the site for this species including 2.7km of hedgerows and 30 trees, the design layout of the proposed development has been designed to minimise the amount of suitable foraging and/or commuting habitat removal through an iterative process. However, as there will be a loss of lesser horseshoe bat foraging and/or commuting habitat to facilitate the development, therefore there is potential for the conservation status of this species to be compromised by the development in the absence of mitigation.

As Dromore Woods and Loughs SAC is located upstream of the proposed development site, there is no impact pathway for effects on designated QI habitats at risk of habitat loss and fragmentation.

<u>Habitat degradation/effects on QI/SCI species as a result of hydrological impacts</u>

As the Dromore Woods and Loughs SAC is located upstream of the proposed development, there is no potential for a pollution event of any magnitude to affect any QI habitats or associated plant species for which this European site is designated. However, as the proposed development is hydrologically connected to the River Fergus and there is potential for impacts to occur on otter populations (a mobile species) associated with Dromore Woods and Loughs SAC. The release of contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water features during construction, or operation, has the potential to affect water quality in the receiving aquatic environment. Such a pollution event may include: the release of sediment into receiving waters and the subsequent increase in mobilised suspended solids; and, the accidental spillage and/or leaks of containments (*e.g.* fuel, oils, lubricants, paints, bituminous coatings, preservatives, weed killer, lime and concrete) into receiving waters. The associated effects of a reduction of surface water quality which could in turn negatively affect the otter population through direct contact with pollutants or a decline in fish prey. These potential impacts could occur to such a degree that the conservation objectives of Dromore Woods and Loughs SAC QI species are undermined.

Therefore, (albeit very unlikely due to the distance between the main construction activities and watercourses) there is potential for the Proposed development to result in effects which could have implications for the conservation objectives of Dromore Woods and Loughs SAC as a result of hydrological impacts.

Disturbance and displacement impacts

A temporary and/or permanent increase in noise, vibration and/or human activity levels during the construction and/or operation of the proposed development could result in the disturbance to and/or displacement of the otter population present in the vicinity of the proposed development. Disturbance and/or displacement effects on otter populations connected to Dromore Woods and Loughs SAC are as described above in Section 7.5.1.1 under the Lower River Shannon SAC heading., and are considered to be a temporary potential impact on this QI species.

Lesser horseshoe bat, a QI species for Dromore Woods and Loughs SAC, have been identified using the site as foraging and/or commuting grounds predominately located along hedgerows and treelines within the site, and along the woodland area in the north west of the proposed development. There are no lesser horseshoe bat roosts within the proposed development site. The closest roost identified to the site is approximately c. 430m south, in Kilfelim. It is considered likely that Dromore Woods and Loughs SAC is within the normal core foraging range and the normal commuting range of this species. Research carried out on this species has suggested that the majority of feeding activity takes place within *c.* 2-3km of roosts during the year with occasional movements in excess of c. 4km (Bontadina, 2002 and Biggane, 2003). This distance can reduce down to a few hundred metres in the birthing season, with research carried out in Galway on radio-tracked lesser horseshoe bats, this species has been shown to travel as far as c. 5.15km from roosts for foraging (Rush and Billington, 2014). Larger scale movements of up to c. 15km are not unreasonable when bats move between winter and summer roosts. The Core Sustenance Zone (CSZ) for this species is described as the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the resilience and conservation status of the colony using the roost. A review carried out by BCT of radio-tracked individuals, has defined the CSZ as within 2.5km of their roosts. There will be removal of treelines and hedgerows within the footprint of the development, and additional lighting proposed. In the absence of mitigation, removal of suitable foraging and commuting habitat within the proposed development site, and an increase in light levels may potentially indirectly impact on lesser horseshoe bat species that utilise the site for roosting, foraging and/or commuting by making it unsuitable.

Therefore, there is potential for the proposed development to result in effects which could have implications for the conservation objectives of Dromore Woods and Loughs SAC as a result of disturbance/displacement impacts.

Affecting the integrity of the Dromore Woods and Loughs SAC would result in a likely significant effect at the international geographic scale.

Old Domestic Building (Keevagh) SAC & Old Domestic Buildings, Rylane SAC

As described in Section 7.3 of the NIS, the proposed development has the potential to affect the qualifying interests and conservation objectives, and therefore the integrity, of the Old Domestic Building (Keevagh) SAC, and Old Domestic Buildings, Rylane SAC because of the following:

Habitat loss and fragmentation

Lesser horseshoe bat is a QI species for Old Domestic Building (Keevagh) SAC which is located c. 4.3km south east of the proposed development site, and Old Domestic

Buildings, Rylane SAC, located c. 5.9km north east. This species has been recorded using the proposed development site for foraging and/or commuting during surveys carried out in 2018 and 2020. Habitat loss and fragmentation impacts on lesser horseshoe bat populations from Old Domestic Building (Keevagh) SAC and Old Domestic Buildings, Rylane SAC, are as described above in Section 7.5.1.1. under the Dromore Woods and Lough SAC heading. As there will be a loss of lesser horseshoe bat foraging and/or commuting habitat to facilitate the development, therefore there is potential for the conservation status of this species to be compromised by the development in the absence of mitigation.

<u>Disturbance and displacement</u>

A temporary and/or permanent increase in noise, vibration and/or human activity levels during the construction and/or operation of the proposed development could result in the disturbance to and/or displacement of QI populations present in the vicinity of the proposed development. Lesser horseshoe bat, a QI species for Old Domestic Building (Keevagh) SAC, and Old Domestic Buildings, Rylane SAC, have been identified using the site as foraging and/or commuting grounds, predominately located along hedgerows and treelines within the site, and along the woodland area in the north west of the proposed development. Results from the surveys carried out within the proposed development site can be found above in Section 7.3.3.5. There will be removal of treelines and hedgerows within the footprint of the development, and additional lighting proposed. In the absence of mitigation, removal of suitable foraging and commuting habitat within the proposed development site, and an increase in exiting light levels may potentially indirectly impact on lesser horseshoe bat species that utilise the site for roosting, foraging and/or commuting by making it unsuitable.

Therefore, there is potential for the proposed development to result in significant effects in the absence of mitigation which could have implications for the conservation objectives of Old Domestic Building (Keevagh) SAC, and Old Domestic Buildings, Rylane SAC as a result of disturbance/displacement impacts.

Affecting the integrity of the Old Domestic Building (Keevagh) SAC and Old Domestic Buildings, Rylane SAC would result in a likely significant effect at the international geographic scale.

Ballyallia Lough SPA, River Shannon and River Fergus Estuaries SPA, Slieve Aughty Mountains SPA and Corofin Wetlands SPA

As described in Section 7.3 of the NIS, the proposed development has the potential to affect the qualifying interests and conservation objectives, and therefore the integrity, of Ballyallia Lough SPA, River Shannon and River Fergus Estuaries SPA, Slieve Aughty Mountains SPA and Corofin Wetlands SPA because of the following:

<u>Habitat degradation/effects on QI/SCI species as a result of hydrological impacts</u>

The release of contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water features during construction, or operation, has the potential to affect water quality in the receiving aquatic environment. Such a pollution event may include: the release of sediment into receiving waters and the subsequent increase in mobilised suspended solids; and, the accidental spillage and/or leaks of containments (*e.g.* fuel, oils, lubricants, paints, bituminous coatings, preservatives, weed killer, lime and concrete) into receiving waters. The associated effects of a reduction of surface water quality could potentially extend for a considerable distance downstream of the location of the accidental pollution event or the discharge. The proposed development is hydrologically connected to the River Fergus, which discharges into the Fergus Estuary and thereafter the River Shannon and River Fergus Estuaries SPA. Whilst Ballyallia Lough SPA and Corofin Wetlands SPA are upstream of proposed development, some of the SCI species overlap with the River Shannon and River Fergus Estuaries SPA *i.e.* teal, wigeon, whooper swan, black-tailed godwit and wetland and waterbirds. Therefore it cannot be excluded that SCI species from Ballyallia Lough and Corofin Wetlands SPA also feed in the River Shannon and River Fergus Estuaries SPA.

Therefore, (albeit unlikely due to the distance between the main construction activities and watercourses) this reduction in water quality (either alone or in combination with other pressures on water quality) could result in the degradation of sensitive habitats present within River Shannon and River Fergus Estuaries SPA, which in turn would negatively affect the SCI bird species that rely upon these habitats as foraging and/or roosting habitat. It could also negatively affect the quantity and quality of prey available to SCI bird species. These potential impacts could occur to such a degree that they result in significant effects which could have implications for the conservation objectives of Ballyallia Lough SPA, River Shannon and River Fergus Estuaries SPA, and Corofin Wetlands SPA.

<u>Disturbance and displacement</u>

A temporary and/or permanent increase in noise, vibration and/or human activity levels during the construction and/or operation of the proposed development could result in the disturbance to and/or displacement of SCI bird species present within the footprint and/or the vicinity of the proposed development. Such disturbance effects would not be expected to extend beyond a distance of *c.* 300m, as noise levels associated with general construction activities would attenuate to close to background levels at that distance and beyond. Construction activities such as piling could extend beyond a distance of c. 300m however, this will be occurring within the west of the footprint of the design, at Data Centre 6 and Data Centre 5.

There were five SCI species identified within the proposed development site during wintering bird surveys carried out on the site, these included: coot, mallard, gadwall, teal and lesser black-backed gull (see Section 5.1.3.3). Suitable habitat for these species was identified in the wetland habitats within the proposed development site, including; Toureen Lough, the M18 Attenuation Pond, the wetland in the east of the site (outwith the redline boundary), and the temporary pond features in the north west of the site. Toureen Lough, and the wetland feature in the north west, are within 300m of the footprint of the proposed development, and therefore are likely to be impacted by construction activities and SCI bird species may potentially be disturbed from these suitable habitats. The majority of the wetland habitat will be screened visually from the development by the existing planting and additional planting proposed (*i.e.* Toureen Lough and wetlands in the east, and attenuation pond in the west). During construction there will be an increase in noise and vibration within the site (Chapter 9 Noise and Vibration, AWN 2021), however this is predicted to be a Moderate and Short-Term Impact at worst during initial ground works, reducing to Not Significant following this. The small temporary pond features in the north (floods in winter months only) will be directly adjacent to the proposed development construction. Whilst this alteration of suitable habitat will result in a temporary disturbance (*i.e.* over one winter period), due to the small numbers identified on this feature (<10 individuals), the size of the feature, and the suitable habitat in the surrounding lands (*i.e.* Ballymacahill Lough c. 250m north, Cahernalough Lough c. 550m north east, Holaan Lough c. 880m south east, O'Briens Big Lough c.3km north east) the disturbance and displacement impacts are not likely to result in effects which could have implications for the conservation objectives of Ballyallia Lough SPA, River Shannon and River Fergus Estuaries SPA, and Corofin Wetlands SPA. There are no predicted impacts on SCI bird species during the operational phase of the proposed development, as noise levels are predicted to be Not Significant at the areas of suitable habitat within the site, and due to the establishment of additional and retained planting that will further screen wetland areas from any disturbance associated with the development.

The Slieve Aughty Mountains SPA is designated for breeding populations of hen harrier and merlin. There is no suitable breeding or foraging habitat within or near the proposed development for merlin, however suitable wintering roosting habitat for hen harrier was identified in the east of the site slightly outside the red line boundary, where a wetland/swamp habitat was located. Winter surveys carried out here did not identify any hen harrier using the site within or surrounding the lands. However, as suitable winter foraging/roosting habitat was identified, it cannot be ruled out that hen harrier may be impacted by the proposed development as a result of disturbance/displacement impacts. The suitable habitat extends outside the proposed development site in the east, and other areas of suitable wintering roosting/foraging habitat exist in close proximity to the proposed development in lowland wetland habitats, and within the Fergus Estuary downstream of the site.

Habitat loss and fragmentation

Records of hen harrier, an Annex I bird species were returned from the vicinity of the proposed development. Hen harriers have been found to travel up to 9km from nests (Arroyo et al., 2014), and the nearest European site designated for this species is Slieve Aughty Mountains SPA, c. 4.5km from the proposed development. This species is known to breed and forage in the summer on heather moorland and young forestry plantations where they nest on the ground. They will then spend winter in more coastal and lowland areas throughout Ireland. Therefore, there is potential that hen harriers associated with the Slieve Aughty Mountains SPA may hunt and roost during winter in the vicinity of the proposed development. However, dedicated hen harrier vantage point surveys were carried out within the proposed development and no individuals were identified within or in the adjoining lands. Given that the proposed development will sit into the landscape and the nearest building to suitable habitat to be constructed will be over 250m away, there is no potential for the proposed development and predicted habitat loss impact to have any long-term effects on the QI populations in terms of population trends, distribution/range, extent of available habitat or loss of territory on SCI populations of hen harrier associated with the Slieve Aughty Mountains SPA.

Direct injury/Mortality

The development has been designed so that the buildings will be set into the existing landscape and will be 40m maximum in height, will be screened by various landscaping features including tree and hedgerow planting carried out during the first phases of the development which will have matured by the time the buildings will be established. The development is also not on a known flight path for SCI and wintering bird species, with gull species typical flying height range up to 250m above sea level while foraging and travelling[47]. Given the small numbers of SCI species identified using the proposed development, most of which were located in the west or north west of the site, it is

[47] Thaxter, C., Ross-Smith, V., & Cook, A. (2015). How high do birds fly? A review of current datasets and an appraisal of current methodologies for collecting flight height data: Literature review. British Trust for Ornithology Research Report No. 666.

predicted that there is no potential for the proposed development to increase the collision risk to mobile SCI species which are present in the area, during the construction and operational phases.

The proposed development does not require any tall structures to be constructed (maximum height at 40m), and whilst hen harrier do tend to fly at lower altitudes[48], they were not identified within the site, and the only suitable foraging and roosting habitat is located outwith the redline boundary and the footprint of the site. As such there is no potential, for the proposed development to present a collision risk to hunting and/or breeding hen harrier, during the construction and operational phases. Therefore, there is no potential for the proposed development to result in mortality of SCI bird species associated with European sites

Affecting the integrity of the Ballyallia Lough SPA, River Shannon and River Fergus Estuaries SPA, Slieve Aughty Mountains SPA and Corofin Wetlands SPA would result in a likely significant effect at the international geographic scale.

Nationally designated sites

In the case of NHAs and pNHAs the assessment considers whether the integrity[49] of any such site would be affected by the proposed development with reference to the ecological features for which the site is designated or is proposed.

As the proposed development does not traverse any national site, there is no potential for habitat fragmentation of any national site to occur.

The boundaries of the Fergus Estuary and Inner Shannon, North Shore pNHA overlaps with the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA. In the absence of site synopses for this pNHAs, it has been assumed that these sites are designated for the same reasons as the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA. Similarly, the boundaries of Old Domestic Building (Keevagh) pNHA, Ballyallia Lake pNHA, and Dromore Woods and Loughs pNHA overlap with Old Domestic Building (Keevagh) SAC, Ballyallia Lake SAC, and Dromore Woods and Lough SAC. Therefore, the potential impacts during construction on these national sites would be as previously described above in Section 7.5.1.1, under their respective headings. These potential impacts could affect habitat and species within the pNHAs, and therefore, the integrity of the pNHAs which could potentially result in a significant negative effect at the national geographic scale.

Newpark House (Ennis) pNHA

There is no site synopsis available for this national site, however detail from Newpark House Hotel website[50], describes the site as containing “Irish Oak, beech and some magnificent specimens of lime and poplar.” This national site is not hydrologically connected or otherwise to the proposed development site, and as such the integrity of the pNHA is unlikely to be impacted from the proposed development site at any geographic scale.

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[48] Madders, M. and Whitfield, D. P. (2006). Upland raptors and the assessment of wind farm impacts. *Ibis*, *148*, 43-56.

[49] Refer to Section 7.2.5 for definition and impact assessment methodology

[50] Newpark House Hotel. Available at: https://www.newparkhouse.com

Lough Cleggan Lake pNHA

This national site is located *c.* 4.9km west of the proposed development site and is designated for its diverse range of habitats and plant species. It is also of local importance for wintering waterfowl, including breeding populations of tufted duck and coot. These populations of tufted duck and coot may be connected to the individual coot birds that were recorded using the lands within the proposed development site.

The potential impacts of the proposed development on this pNHA are as outlined above for the SPAs: an accidental pollution event during construction that may affect surface water in the local environment and in turn result in the degradation of habitats that may support these bird species; and, the potential for disturbance and displacement of these bird species from an increase in noise and vibration associated with the construction phase of the development.

These potential impacts could affect species within the pNHA, and therefore, the integrity of the pNHA which could potentially result in a significant negative effect at the national geographic scale.

Durra Castle pNHA

This national site is located *c.* 3.4km north east of the proposed development and is designated for nursery/breeding population of lesser horseshoe bat. This pNHA is within the normal foraging range of lesser horseshoe bats as previously described, and therefore, there is potential for individuals using the proposed development as foraging and/or commuting grounds, to be connected to this pNHA population, and therefore there is potential for this national site to be impacted as a result of the proposed development.

The potential impacts of the proposed development on this pNHA are outlined above in Section 7.5.1.1 for the SACs designated for lesser horseshoe bats, *i.e.* disturbance and displacement impacts from an increase in light levels and from the removal of suitable foraging and/or commuting grounds, and the loss of suitable habitat within the normal foraging range of this species.

These potential impacts could affect species within the pNHA, and therefore, the integrity of the pNHA which could potentially result in a significant negative effect at a national geographic scale.

7.5.1.2 Habitats

Habitat Loss

Construction of the proposed development will result in the loss of habitat area; totalling *c.* 17.7ha. With the exception of the Annex I habitat calcareous grassland [6210] located in the west of site, none of the habitats directly lost by the proposed development are considered to be any greater than of a local biodiversity importance (higher value). The majority of the habitats within the proposed development footprint (*c.*16.4ha) are of local biodiversity importance (lower value) and predominantly comprised:

- Buildings, artificial surfaces and bare ground (c. 1ha to be lost)
- Improved agricultural grassland (c. 11.4ha to be lost),
- Poor quality dry calcareous and neutral grassland (c. 1.0ha to be lost)

- A mosaic of recolonising bare ground, dry meadows and grassy verges, spoil and bare ground, and scrub (c. 2.5ha to be lost)

As these habitats are of a local biodiversity importance (lower value), their loss or modification will not result in a likely significant effect on biodiversity. These habitats will be permanently lost from the subject lands and will largely be replaced by buildings and artificial surfaces including the data centre hall buildings, vertical farm building, substation, energy centre, and associated roads and pathways.

The habitat types that are considered to be of a high local biodiversity value, are the following:

- Hedgerows (WL1), with the total linear length of this habitat being lost is *c.* 2.7km. The loss of this habitat is considered to be significant at a local scale only, due to the common nature of this habitat in the local environs.
- Marsh (GM1) habitat, with a total loss of c. 5m^2 due to the surface water drainage pipe layout in the north west of the site. This loss is considered not to be significant at any geographic scale due to the small amount of this habitat being lost, and availability of this habitat in other areas of the site, and outside the proposed development site in the wider environs;
- Wet grassland (GS4) habitat, with a total loss of c. 1.4ha in the south west of the site. This loss is considered to be significant at a local scale only due to the availability of this habitat in other parts of the site, and outside the proposed development site in the wider environs; and
- Lowland/Depositing Rivers (FW2), with a total loss of 2m^2 in the eastern most bank for implementation of the attenuation drainage outfall pipe and fibre optic cable.

The areas of oak-ash-hazel woodland and immature woodland in the north west, Toureen Lough, the alluvial woodland (*91E0), *Molinea* meadows (6410) and alkaline fen (7230) surrounding Toureen Lough and in the north west, and calcareous grassland (6210) adjacent to the attenuation pond by the M18 Motorway, will be protected under the ‘Ecological Buffer Space’ as designated by *Clare County Development Plan Variation No. 1*. These areas will be retained, protected from development and will not be directly impacted from the development. Other areas of local importance (higher value) or more that will not be impacted directly from development as they are beyond the footprint are the Alluvial woodland (*91E0), *Cladium* fen (*7210), oak-ash-hazel woodland, immature woodland and reed and large sedge swamp habitat in the east of the site.

The areas of calcareous grassland that will be directly affected by construction works due to the location of the attenuation pond, correspond to the Annex I habitat calcareous grassland [6210] listed under the Habitats Directive. This area of *c.* 0.79ha of the Annex I habitat will be directly impacted by construction works, with the overall habitat within the proposed development totalling c. 0.89ha. In the absence of mitigation, the loss of Annex I habitat calcareous grassland [6210] within the proposed development site will lead to a temporary impact at a national level, due to its location within the favourable reference range, current range, and current distribution of calcareous grassland [6210][51].

[51] NPWS (2019). The Status of EU Protected Habitats and Species in Ireland. Volume 2: Habitat Assessments. Unpublished NPWS report. Edited by: Deirdre Lynn and Fionnuala O’Neill

Introducing or spreading non-native invasive plant species

No non-native invasive plant species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations, 2011 were present within, or in close proximity to, the proposed development. However, during construction and/or routine maintenance/management work, non-native species could potentially be introduced to terrestrial habitats located within downstream habitats via surface water features. Giant hogweed is typically found in damp places such as riverbanks and spreads via seed dispersal (NBDC, 2013a), while Himalayan balsam and Japanese knotweed are both found in a wider variety of habitats including river banks, roadsides, and urban areas such as waste ground and railways; the former species spreading by seed dispersal, the latter vegetatively (NBDC, 2013b; NBDC, 2013c). Giant hogweed, Himalayan Balsam and Japanese knotweed are all classified as high impact invasive species.

The introduction and/or spread of these invasive species to downstream European sites and sensitive habitats could potentially result in the degradation of existing habitats present, in particular coastal habitats not permanently or regularly inundated by seawater. These species may outcompete other native species present, negatively impacting the species composition, diversity and abundance and the physical structural integrity of the habitat. This in turn could result in a significant effect, at geographic scales ranging from local to international.

Habitat degradation from dust generated during construction

The proposed development has the potential to generate dust during construction works which could affect vegetation in habitat areas within and adjacent to the proposed development boundary. This has the potential to affect highly sensitive and ecologically-important habitat areas (*e.g.* designated area for nature conservation or areas of Annex I habitat) both within and in the surrounding environment and result in a likely significant negative effect, at geographic scales ranging from local to international.

An Accidental Pollution Event during Construction Affecting Surface Water Quality in the Receiving Environment

During construction contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water feature has the potential to have a significant negative impact on water quality and consequently affect aquatic and wetland habitats in the receiving environment. The effects of frequent and/or prolonged pollution events in a river system have the potential to be extensive and far-reaching and could potentially have significant long-term effects. In a worst-case scenario, estuarine and coastal habitats downstream of the proposed development site could also be affected.

However, it is considered unlikely that a pollution event of such a magnitude would occur during construction or be any more than temporary in nature. Particularly considering the environmental protection controls incorporated into the design of the proposed development, the fact that the development footprint is located away from any wetland areas (*i.e.* minimum c. 50m away), and that any works that are near water features will be undertaken in accordance with IFI/NRA guidelines. Nevertheless, a precautionary approach is being taken in assuming a level of risk (albeit low due to the distance between surface water features and the main construction activities) of water quality impacts. Consequently, detailed mitigation measures are required to further minimise the risk of the proposed development having any perceptible effect on water quality during construction.

During construction suspended solids, silt and other harmful materials generated as a result of proposed works could be released into the local drainage infrastructure and travel downstream, including, potentially, into watercourses such as the Spancelhill Stream, River Fergus and wider Fergus Estuary. Cement based products used in the construction phase of the proposed development (*e.g.* concrete and/or bentonite which are highly corrosive and alkaline materials), if released into any watercourse may cause surface water degradation and damage to aquatic fauna. This has the potential to result in significant negative effects on water quality and consequently affect aquatic and wetland habitats in the receiving environment. In a worst-case scenario, the potential to be negatively impacted from other a wide range of pollutants contained within surface water runoff remains. Habitat degradation as a consequence of construction effects on surface water quality has the potential to affect the conservation status of downstream estuarine and coastal habitats in the Fergus Estuary European sites, such as the Lower River Shannon SAC, and therefore, has the potential to result in a significant negative impact at an international scale. The Spancelhill Stream is hydrologically connected to downstream habitats including those which are QI Annex I habitats or SCI supporting wetland habitat which may also be at risk of habitat degradation as a consequence of construction effects on surface water quality.

Habitat Degradation – Groundwater

Any effects on the existing hydrogeological baseline supporting wetland habitats, has the potential to negatively affect habitat extent and distribution, and vegetation structure and composition. The potential effects upon the existing hydrogeological regime are not necessarily limited to habitats within the proposed development boundary but can be far-reaching, with significant negative long-term effects. This is discussed in more detail in Chapter 5 *Land, Soils, Geology & Hydrogeology* of the EIAR.

7.5.1.3 Bats

Roost loss in buildings

Lesser horseshoe bat

There are no lesser horseshoe bat roosts located within the proposed development, with the closest known roost of this species located *c.* 430m south of the proposed development site. There were no suitable roosting sites (*i.e.* old stone buildings or caves) within the proposed development site. Therefore, there is no potential for likely significant effects on the conservation status of lesser horseshoe bats to occur at any geographic scale as a result of this potential direct impact of roost loss (See Section 5.1.3.2 of the NIS, Scott Cawley, 2021).

Soprano pipistrelle bat

There are 17 confirmed soprano pipistrelle roosts within buildings located within the proposed development site. All but one of these are located in residential buildings, with one roost in a cattle shed (BB 1A). 13 of these roosts were small roosts of one to two individuals. BB 3 had one roost of 30 bats, and another roost of 9 bats, BB 8 had a roost of 13 bats, and BB 9 had a roost of seven to eight bats. Overall, this site is considered to be an important site for roosting soprano pipistrelles.

Accidentally destroying a bat roost, in particular if the affected roost was a significant maternity or hibernation roost, would have the potential to have long-term effects on the local bat population of the species concerned. The layout of the proposed development site has been designed so as to avoid any impacts on bat roosts (with the exception of one bat roost, as described below) within the proposed development site. The buildings (BB 1A, BB 2, BB 3, BB 5A, BB 8 and BB 9) will be retained as they are currently, with a 30m dark buffer zone also in place to ensure roosting bats are not disturbed by construction activities, and continue to use the roost buildings. Therefore, there is no potential for likely significant effects on the conservation status of soprano pipistrelle bats to occur at any geographic scale as a result of this potential direct impact of building loss.

Common pipistrelle and brown long-eared bat

One common pipistrelle and one brown long-eared building roost were identified within the proposed development site, both small roosts of two individuals (*i.e.* BB 5A and BB 5B, respectively). These roosts are small, and significant at a local scale only; therefore the loss of these roosts would result in a likely significant effect at a local scale only.

However, as mentioned above, all confirmed bat roosts (with the exception of BB 6C as discussed below) within buildings in the proposed development site will be retained and protected from development, and consequently will not be impacted by the development. Therefore, there is no potential for likely significant effects on the conservation status of common pipistrelle and brown long-eared bat to occur at any geographic scale as a result of this potential direct impact of building loss.

Myotis sp.

There were no *Myotis* sp. building roosts identified within the proposed development site. The buildings within the site are suitable for roosting *Myotis* sp. As there are no buildings with confirmed *Myotis* sp. bat roosts species within the proposed development site there is no potential for likely significant effects on the conservation status of these bat species to occur at any geographic scale as a result of this potential direct impact of building loss.

Buildings that did not have confirmed roosts (*i.e.* BB 1B, BB 4A – D, BB 6A-B, and BB 7) were all negligible - low potential farm buildings, with the exception of BB 7, which was considered to be of moderate potential for roosting bats. These buildings will be removed as part of the development. Although roosts were not identified in any of these buildings, due to the high activity levels and numbers of roosting bats across the site, a precautionary principle will be applied, and subsequent mitigation measures implemented to ensure there are no risks of injury/mortality to local bat species as a result of the proposed development.

Leisler's bat

One Leisler's bat roost with a single Leisler's bat was identified within BB 6C. This roost was only identified during surveys in 2022, highlighting the transient and mobile bat species are. This roost is small, and significant at a local scale only; therefore, the loss of this roost would result in a likely significant effect at a local scale only.

This roost comes under the footprint of the proposed development, and as mentioned previously, bats are protected by law in Ireland, and it is considered to be appropriate to undertake all reasonable measures to avoid mortality of bats during proposed works. In the absence of any mitigation, the potential effects of roost loss on Leisler's bat would be significant, although in light of the small number of bats roosting in the building, the scale of impact would be at the local level only. Potential impacts of loss of this roost would not have an impact on the conservation status for this species as they are widespread in the area, and across Ireland, and are a species listed as 'Least Concern'.

Tree roost loss

There were no confirmed bat tree roosts within the proposed development site. However, there were 17 trees identified as having bat roost potential features. These included; one high potential tree, two moderate potential trees, and 14 low potential trees. Therefore there is potential for local bat species to be impacted by the removal of potential tree roosts within the site. Lesser horseshoe bats do not typically use trees for roosting in due to their specific roosting preferences and are therefore excluded from impacts related to tree roost removal[52]. Soprano and common pipistrelle bat, Leisler's bat, brown long-eared bat, and all species of *Myotis* bat use trees for roosting[53].

The proposed development will not directly, or indirectly, affect any known bat roosts. Trees on site with the potential to support roosting bat, could be occupied at the time of site clearance; and there is therefore the potential that bats on site could be injured or killed. All the bats recorded using the site that roost in trees are common species in Ireland that are classified as being of "least concern" in the *Ireland Red List No. 3: Terrestrial Mammals* (Marnell *et al.*, 2019). The low and moderate potential trees within the proposed development site that have some potential for roosting bats, are not considered to be of significant in size and are unlikely to hold enough space for them to be maternity or hibernation roosts. One high potential tree located within the site could support larger roost sizes due to the size of PRFs identified. The potential effects on bat populations arising from loss of a number of potential small roost sites, and one potentially larger roost side, is considered to be significant, at a local (high) geographic scale only.

Bats, and their breeding and resting places, are strictly protected under the Birds and Habitats Regulations, and under the Wildlife Acts, and it is an offence under that legislation to intentionally kill or injure bats or to interfere with or destroy their breeding or resting places. Therefore, mitigation measures are included to ensure that any tree removal works do not result in the permanent loss of tree roosting sites or result in bats being accidentally killed or injured during construction.

Habitat Loss as a result of fragmentation of foraging/commuting habitat and commuting routes

Bats rely on suitable semi-natural habitats which support the insect prey upon which they feed. The proposed development will result in the loss of such habitats used for feeding by all bat species recorded in the study area.

Suitable habitat for foraging and commuting bats within the footprint of the proposed development includes hedgerows, treelines, scrub, open grassland and farm buildings (foraging on prey within cattle sheds). The area of the habitats which will be lost as a result of the proposed development is significant at a local scale only, considering the quantity of suitable habitat, which will not be impacted, in the local vicinity. The total loss of bat commuting and/or foraging habitat is *c.* 1.38km. Habitat loss for other bat

[52] *Lesser horseshoe bat Rhinolophus hipposideros,* Bat Conservation Trust (2010).

[53] Bat Roosts, Bat Conservation Ireland. Access here: https://www.batconservationireland.org/irish-bats/bat-roosts

species using the subject lands for foraging and/commuting*, i.e.* soprano and common pipistrelle, Leisler's bat, Daubenton's bat, *Myotis* sp., and brown long-eared bat, is likely to result in a significant effect, at a local (high) geographic scale, due to highly suitable habitat in the surrounding environs, stable populations of these species, and as they are species of 'least concern'. Impacts on lesser horseshoe bats are discussed in Section 6 of the NIS (Scott Cawley, 2021), and above in Section 7.5.1.1 under the heading for Old Domestic Building (Keevagh) SAC and Old Domestic Buildings, Rylane SAC.

Installation of temporary working and site compound lighting which may cause indirect disturbance of flight patterns

One construction compound is proposed at the location of the proposed Data Centre 1 adjacent to Toureen Laneway in the south of the site. Potential impacts of lighting during construction will be slight and short-term as construction works will generally be confined to daylight hours (07:30-17:30). Where works are required during hours of darkness, portable lighting will be used, which will be pointed downwards at a 45-degree angle and away from any sensitive receptors (hedgerows, treelines, confirmed bat roosts, Toureen Lough, and Spancelhill Stream). Artificial lighting within suitable habitat may result in avoidance behaviour by bats, and could prevent bats from accessing foraging areas or roosts and/or result in bats taking more circuitous routes to get to foraging areas and hence potentially depleting energy reserves and abandonment of nearby roosts. Security lighting will not involve high intensity lighting (*e.g.* floodlighting), therefore the impact of increased artificial lighting at the proposed construction compound on bat species excluding lesser horseshoe bat is considered to be significant at the local level only. The impact of increased lighting during construction on lesser horseshoe bat, is considered to be significant at an international level, which is discussed in Section 6 of the NIS (Scott Cawley, 2021), and above in Section 7.5.1.1 under the heading for Old Domestic Building (Keevagh) SAC and Old Domestic Buildings, Rylane SAC.

Construction works will typically be undertaken during normal daylight working hours, and therefore the requirement for lighting to accommodate construction works during night-time, in areas where existing light levels are low, will be limited and restricted to winter time when sunrise/sunset is later/earlier. Temporary lighting effects associated with the construction of the proposed development on local bat species, is considered to be significant at the local geographic scale only.

7.5.1.4 Otter

Although it cannot be predicted if otter will establish new holt or couch sites within the ZoI of the proposed development before construction works commence, it is a possibility, and this scenario has been taken into account in the mitigation strategy. As the otter populations that utilise the proposed development are considered to be part of European site populations downstream and hydrologically connected to the site (i.e. Lower River Shannon SAC and Dromore Woods and Loughs SAC), any potential impacts predicted on this species are discussed in Section 7.5.1.1 above, and in Section 6 of the NIS produced as part of this planning application (Scott Cawley, 2021).

7.5.1.5 Badger

A total of three confirmed badger setts were recorded across the proposed development site. None of which are located within the footprint of the proposed development and none located within the ZoI of the general construction activities (*i.e.* within 50m) based upon the impact distance bands described in the TII guidance

(National Roads Authority, 2006a). All setts are located beyond the 150m of the proposed Project and therefore beyond the ZoI of any potential pile driving or blasting works and any other construction activities.

Although it cannot be predicted if badger will establish new setts within the ZoI of the proposed Project before construction works commence, it is a possibility and this scenario has been taken into account in the mitigation strategy (refer to Section 7.6.1.6).

Loss of foraging habitat and breeding/rest sites.

The proposed development will not result in the permanent loss of any badger sett identified during the surveys and therefore there is no potential for impacts arising from the loss of breeding sites to occur at any geographic scale.

Construction will result in the permanent loss of *c.* 16.7ha of suitable foraging/commuting habitat for badgers (*i.e.* hedgerows, grassland, scrub, and spoil). However, given the lack of evidence of badger using these areas within the site, the availability of suitable badger habitat in the immediate surrounding environment, the proposed development is unlikely to affect the conservation status of the local badger population and will not result in a likely significant negative effect, at any geographic scale.

Disturbance/displacement

Along with any potential displacement effects associated with habitat loss, increased human presence and/or noise and vibration associated with construction works, the proposed development has the potential to displace badgers from foraging habitat located beyond the footprint of the proposed development.

As construction works will typically be undertaken during normal daylight working hours and badgers are nocturnal in habit, the displacement of badgers from the retained areas of suitable foraging habitat (*i.e.* areas located beyond the footprint of the proposed development) is extremely unlikely to affect the local badger population and therefore will not result in a likely significant negative effect, at any geographic scale. In addition, the construction phase of the development is predicted to produce noise levels that are slight-moderate, and short-term in nature, with the construction noise levels predicted to be the same or below the baseline noise levels, at max. 63dB (A) or below, prior to mitigation. Following initial ground works, construction noise impacts will reduce to not significant at any geographic level. Badgers residing within the wider study area are likely to be habituated to certain level of disturbance within the suburban environment and therefore are likely to be less sensitive to very localised, temporary increases in disturbance.

Disturbance and displacement effects on badger may also arise as a result of increased artificial lighting during construction. Nocturnal mammals, such as badger, are likely to be disturbed by the introduction of artificial light into established breeding and foraging areas (Rich & Longcore, 2005). The majority of the proposed development is currently free from artificial lighting. The proposal may result in the introduction of portable lighting to previously unlit areas, and for the proposed construction compound security lighting for the duration of construction. However, works will normally only be undertaken during daylight hours (07:30-17:30), and any security lighting will be pointed down at a 45-degree angle and away from sensitive receptors. Although the particular location of the proposed compound is not considered to be of any significance for local badger, i.e. in the south of the site where Data Hall 1 will be located, light spill into adjacent suitable areas could render these areas unsuitable for foraging badger. This is unlikely to result in a negative effect on badgers, as it will be temporary in nature and very localised, and there is ample suitable habitat for foraging and breeding badger in the surrounding areas.

7.5.1.6 Other mammals (including pine marten and Irish hare)

Pine marten and Irish hare were the only other mammals identified within the proposed development site during mammal surveys carried out in 2020. The desk study results also included records of red squirrel, pygmy shrew, hedgehog and Irish stoat within 2km of the proposed development site.

Habitat Loss

The construction of the proposed development will result in the temporary loss of suitable habitat for small mammals located within in the proposed development site. Pine marten were identified within the woodland in the north east of the site, and Irish hare were identified in close proximity to the woodland in the north east. This woodland area is suitable as foraging and/or breeding habitat for all of the aforementioned species, with the exception of Irish hare, which is most typically found in lowland pasture habitat[54]. The habitat that will be temporarily lost as a result of the proposed development is only suitable for commuting and foraging of these species, as the woodland habitat in the north west will be retained. Given the relatively low numbers of individuals of each species that are likely to be affected (*i.e.* pine marten, red squirrel, hedgehog, pygmy shrew and Irish hare), the protection of the woodland in the north east from any development for pine marten, red squirrel, pygmy shrew and hedgehog, and the abundance of alternative suitable habitat available locally, the effects of habitat loss associated with construction works are unlikely to affect the long-term viability of the respective local populations of these species. Therefore, habitat loss is unlikely to affect the species' conservation status or result in a significant negative effect, at any geographic scale.

Mortality Risk

Site clearance works have the potential to result in the mortality of small mammal species. The potential for this impact to occur would be expected to be greater during the breeding season when juveniles would be present in nests, or in the case of hedgehog impacts may be greater during their hibernation period. Furthermore, the potential for direct mortality to small mammals would be greater in the more vegetated areas, as opposed to areas dominated by artificial ground/ grassland habitat, as the former areas would offer more in terms of breeding/ resting habitat for small mammal species. Given the relatively low numbers of individuals of each species that are likely to be affected, and that these species are highly mobile, site clearance is unlikely to result in a level of mortality that would affect the species' conservation status, and result in a significant negative effect, even at a local geographic scale. Nevertheless, there is a risk of small mammals (*e.g.* pygmy shrew and hedgehog) falling into excavations or pits during construction. To ensure no mammals are harmed during the construction of the proposed development site, mitigation is provided for this risk.

[54] Reid, N., Dingerkus, K., Montgomery, W.I., Marnell, F., Jeffrey, R., Lynn, D., Kingston, N. & McDonald, R.A. (2007) Status of hares in Ireland. *Irish Wildlife Manuals*, **30**. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government.

Disturbance/displacement

Along with any displacement effects associated with habitat loss, increased human presence and/or noise and vibration associated with construction works, the proposed development has the potential to displace mammals from both breeding/resting places and from foraging habitat. The construction phase of the development is predicted to produce noise levels that are slight-moderate, and short-term in nature. Following initial ground works, construction noise impacts will reduce to not significant. The construction phase of the development is predicted to produce noise levels that are slight-moderate, and short-term in nature, the with construction noise levels predicted to be the same or below the baseline noise levels, at max. 63dB or below prior to mitigation. Following initial ground works, construction noise impacts will reduce to not significant. Mammals (as described in Section 7.3.3.1) residing within the wider area are likely to be habituated to disturbance within the suburban environment from Ennis town, and the M18 Motorway both to the west.

As construction works will typically be undertaken during normal daylight working hours and these small mammal species are nocturnal in habit, the displacement of these small mammal species from retained foraging areas (*i.e.* areas located beyond the footprint of the proposed development) is extremely unlikely to affect the local small mammal populations and therefore will not result in a likely significant negative effect, at any geographic scale.

7.5.1.7 Breeding Birds

Habitat Loss and Loss of Breeding/Resting Sites

The proposed development will result in the loss of breeding bird nesting and foraging habitat within the footprint of the proposed development. The areas of habitat loss within the proposed development boundary are provided in Section 7.5.1.2 and tabulated in Table 7.12 for all KER habitat types. These areas comprise a total linear length of *c.* 1.38km of hedgerows and treelines. In addition, there are areas of scrub, wet grassland, agricultural grassland (*c.* 12.3ha in total area) within the footprint of the proposed development, which are not KERs in their own right due to their limited botanical value, however, may provide nesting and/or foraging habitat for birds. These areas will be removed during construction of the proposed development resulting in an additional loss of breeding bird nesting and/or foraging habitat. There will also be removal of the farm sheds within the proposed development site, and whilst no breeding birds were identified in the buildings for removal (aside from BB 5B was identified as having barn swallow nests, however it will be retained), they have the potential to support breeding bird populations such as barn swallows and house martins.

The primary consequence of habitat loss will be increased competition for resources (*e.g.* nesting habitat and/or prey/food source) both between and amongst breeding bird species. The magnitude of this effect will be largely defined by many unquantifiable factors such future land use changes and whether the local habitat resource has currently reached its carrying capacity or not in terms of breeding bird species. For species with larger home ranges during the breeding season (*i.e.* buzzard) habitat loss at the scale of the proposed development is not likely to have any perceptible effects on breeding success or population dynamics.

The habitat areas that will be lost as a result of the proposed development form a relatively small part of larger expanses of similar habitat types and mosaics in the wider locality. The proposed development is connected to agricultural lands of the same land uses within the proposed site. The hedgerows and treelines that demarcate these boundaries would be important breeding sites for local bird species, including red-listed grey wagtail. The woodland in the north west, and scrub/woodland in the east will be retained and protected as part of the development. None of the habitat areas to be lost are unique to the locality and, either individually or collectively, are not likely to support a significant proportion, or the only population, of any given breeding bird species locally. Although a temporary decline in overall breeding bird abundance could potentially occur at a local level (*i.e.* the footprint of the proposed development), this is unlikely to affect the local range of the breeding bird species present nor is it likely to affect the ability of these breeding bird populations to maintain their local populations in the long-term.

Mortality Risk

If site clearance works were to be undertaken during the bird breeding season (*i.e.* March to August, inclusive) it is likely that nest sites holding eggs or chicks would be destroyed and birds killed.

Mortality of birds at the scale of the proposed development, over what is likely to be a single breeding bird season in terms of completing site clearance works, will probably have a short-term effect on local breeding bird population abundance.

However, in the longer-term this would be unlikely to affect the ranges of the breeding bird species recorded in the study area nor would it be likely to affect the long-term viability of the local populations. Mortality of birds during site clearance works could result in a short-term significant effect on local breeding bird populations at a local scale only, due to the amount of hedgerows being lost within the footprint of the development (i.e. *c*. 2.7km).

Disturbance/displacement

The noise, vibration, increased human presence and the visual deterrent of construction traffic, associated with site clearance and construction will temporarily disturb breeding bird species and is likely to displace breeding birds from habitat areas adjacent to the footprint of the proposed development. Construction activities will largely involve excavations of the land, construction of buildings, construction of pathways and new road layouts, with piling also proposed at two locations in the west of the site also proposed. The magnitude of the impact will be dependent on the type of construction works and their duration; general construction activities will have a less pronounced affect than blasting, in terms of its ZoI, but will be on-going from a period of between 9-12 months (as well as a 6-month advanced work period) and multiple breeding seasons. The construction phase of the proposed development will be completed on a phased basis, over a period of 6 years.

Although it is not possible to definitively quantify the magnitude of this potential impact (or the potential effect zone) in a worst case scenario it could potentially extend for several hundred metres from the proposed development. As such, the construction works have the potential to affect the conservation status of affected breeding bird species and will result in a likely short-term significant negative effect, at a local geographic scale.

7.5.1.8 Wintering birds

This section of the impact assessment deals with wintering bird species, *i.e.* those bird species which are listed on either the BoCCI Red or Amber lists for their wintering populations or are Annex I species. The assessment carried out in the NIS for the proposed development considered the potential for the proposed development to affect the bird species listed as SCIs of European sites for their wintering populations. That assessment concluded that proposed development would not affect their wintering bird colonies or have any long-term effects on the local wintering populations following implementation of mitigation measures. Therefore, for these species, the proposed development will not affect the conservation status of the SCI wintering bird populations and will not result in a significant adverse effect on the integrity of the European sites (See Section 7.5.1.1 above and Section 6 of the NIS (Scott Cawley, 2021).

Habitat Loss and/or disturbance/displacement

The development will not involve the removal or alteration of any of the permanent waterbodies within the proposed development site as they are within the ecological protection areas as set out by Clare County Council in the Variation No. 1. The footprint of the development will encroach on a temporary ‘pond’ wetland feature in the north west of the site, where tufted duck and coot were identified during one of the wintering bird surveys. Other areas within the site that come under the footprint of the proposed development, were not deemed suitable and were confirmed to be not used by any wintering bird species during surveys undertaken on the site.

Moreover, a temporary and/or permanent increase in noise, vibration and/or human activity levels during the construction and/or operation of the proposed development could result in the disturbance to and/or displacement of wintering bird species present within the footprint and/or the vicinity of the proposed development.

Current understanding of construction related noise disturbance to wintering waterbirds is based on the research presented in Cutts *et al.* (2009) and Wright *et al.* (2010). In terms of construction noise, levels below 50dB would not be expected to result in any response from foraging or roosting birds. Noise levels between 50dB and 70dB would provoke a moderate effect/level of response from birds, *i.e.* birds becoming alert and some behavioural changes (*e.g.* reduced feeding activity), but birds would be expected to habituate to noise levels within this range. Noise levels above 70dB would likely result in birds moving out of the affected zone, or leaving the site altogether. At *c.* 300m, typical noise levels associated with construction activity (BS 5228) are generally below 60dB or, in most cases, are approaching the 50dB threshold. As such, disturbance effects for general construction activities across the majority of the proposed development would not be expected to extend beyond a distance of *c.* 300m, as noise levels associated with general construction activities would attenuate to close to background levels at that distance and beyond.

The construction phase of the development is predicted to produce noise levels that are slight, and short-term in nature. Following initial ground works, construction noise impacts will reduce to not significant. The construction noise levels predicted to be the same or below the baseline noise levels, at max. 63dB or below.

As the majority of works will be carried out during normal working daylight hours (07:30-17:30), the potential for construction to disturb wintering birds at night, will not arise under normal circumstances. Impacts associated with increased levels of disturbance will likely result in the temporary displacement of these wintering bird species to other suitable available lands in the locality. These impacts will be associated with general construction activities (*e.g.* visual impact of construction workers and machinery and the associated vibration and more constant/continuous noise levels) and impulse noise disturbance from infrequent noise sources with a high noise level, such as piling.

Following the completion of construction, disturbance levels will likely return to baseline conditions and as a result these lands will become available again as foraging and/or roosting habitat for these wintering bird species.

While a good proportion of wintering birds identified in the desk review are typically found in coastal, estuarine and intertidal habitats including the Fergus and Shannon Estuary, and therefore will not be impacted directly during construction, there are large areas of suitable foraging and/or roosting habitat available for these wintering bird species both adjacent to, and in the wider locality of the proposed development (*i.e.* beyond the 300m study area, from *c.* 300m from these existing sites located within the footprint of the proposed development). Therefore the effect of habitat loss on wintering bird species is considered to result in a potential short-term significant effect, at a local geographic scale only.

Habitat Degradation – Surface Water Quality

During construction, contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water feature has the potential to have a significant negative impact on water quality and consequently an impact on wintering birds; either directly (*e.g.* bird species coming into direct contact with pollutants) or indirectly (*e.g.* acute or sub-lethal toxicity from pollutants affecting their food supply or supporting habitats). The effects of frequent and/or prolonged pollution events in a waterbody have the potential to be extensive and far-reaching and could potentially have significant long-term effects.

However, it is considered unlikely that a pollution event of such a magnitude would occur during construction or be any more than temporary in nature. Nevertheless, a precautionary approach is being taken in assuming a level of risk (albeit low due to the distance between surface water features and the main construction activities) of water quality impacts and detailed mitigation measures are required to further minimise the risk of the proposed development having any perceptible effect on water quality during construction.

During construction suspended solids, silt and other harmful materials generated as a result of proposed works could be released into the local drainage infrastructure and travel downstream via Toureen Lough, Spancelhill Stream, including, potentially, into watercourses such as the River Fergus, Fergus Estuary and wider Shannon Estuary. Cement-based products used in the construction phase of the proposed development (*e.g.* concrete and/or bentonite which are highly corrosive and alkaline materials), if released into any watercourse may cause surface water degradation and damage to aquatic fauna. This has the potential to result in significant negative effects on water quality and could consequently affect aquatic and wetland habitats in the receiving environment. In a worst-case scenario, estuarine/ coastal foraging habitats downstream could also be affected.

Habitat degradation as a result of effects on surface water quality during construction has the potential to affect the species' conservation status and result in a likely significant negative effect, at a local geographic scale. Mitigation measures have been designed to protect water quality during construction (See Chapter 6 Hydrology and Section 7.6 of the CEMP).

Direct injury/mortality

The potential for injury/mortality to SCI bird species from the proposed development is discussed in Section 6.7 of the NIS (Scott Cawley Ltd., 2021), and in Section 7.5.1.1

above under the Ballyallia Lough SPA, River Shannon and River Fergus Estuaries SPA, Corofin Wetlands SPA, and the Slieve Aughty Mountains SPA heading. The impacts described within these sections are also relevant and apply to other wintering bird species (*i.e.* not SCI species).

7.5.1.9 Amphibians

There are records of common frog and smooth newt within *c.* 2km of the proposed development site, and suitable habitat is present for these species within the permanent wetland features and, therefore, it cannot be ruled out that these species occur in the vicinity of the proposed development.

Disturbance & Mortality Risk

Site clearance works have the potential to result in disturbance to, and the direct mortality of amphibians. Given the protection zones of the wetland features within the site, and the distance between the footprint of the site and the availability of other wetland areas outwith the proposed development in the wider area (i.e. Ballymacahill Lough, c. 250 north of the subject lands), the number of individuals that would potentially be at risk is considered to be very low and impacts on such individuals would be unlikely to affect the local populations in the long-term. However, common frog is protected under the Wildlife Acts and it is an offence to hunt, take or kill them, or wilfully to interfere with or destroy their breeding places. Mitigation measures have been provided to ensure adherence to the Wildlife Acts.

Habitat Severance/Barrier Effect

The temporary to short-term physical disruption of the existing landscape during site clearance and construction will not fragment habitat used by amphibians, and the footprint of the development does not overlap with suitable amphibian habitats. Therefore, habitat severance during construction and any associated barrier effect are not likely to affect the species' conservation status and are not predicted to result in a likely significant negative effect to amphibians, at any geographic scale.

Habitat Degradation – Surface Water Quality

During construction, contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water feature have the potential to have a significant negative impact on water quality and, consequently, an impact on amphibian species' either directly (*e.g.* species coming into direct contact with pollutants) or indirectly (*e.g.* acute or sub-lethal toxicity from pollutants affecting their food supply or supporting habitats). The effects of frequent and/or prolonged pollution events in a waterbody have the potential to be extensive and far-reaching and could potentially have significant long-term effects.

However, it is considered unlikely that a pollution event of such magnitude would occur during construction or be any more than temporary in nature. Nevertheless, a precautionary approach is being taken in assuming a level of risk (albeit low due to the distance between surface water features and the main construction activities) of water quality impacts and detailed mitigation measures are required to further minimise the risk of the proposed development having any perceptible effect on water quality during construction.

Habitat degradation as a result of effects on surface water quality during construction has the potential to affect the species' conservation status and result in a likely significant negative effect, at a local geographic scale. Mitigation measures have been designed to protect water quality during construction (see Chapter 6 *Hydrology*, and Section 7.6 of the CEMP).

7.5.1.10 Reptiles

No reptiles were identified within the proposed development during surveys carried out in 2018 and 2020. The NBDC did not return any records of common lizard within the proposed development site, however suitable habitat was identified along the stone walls, and exposed rock habitats within the site. Therefore, it cannot be ruled out that these species do not occur in the wider area.

Disturbance & Mortality Risk

Site clearance works have the potential to result in disturbance to, and the direct mortality of, common lizard. Given the availability of potentially suitable habitat for common lizard in the wider study area and the relatively low number of individuals that would potentially be at risk , it is considered that such impacts are unlikely to affect the local common lizard populations in the long-term. However, given the potential for lizard to be present in a variety of habitats, disturbance and mortality impact could result in a short-term significant negative effect on common lizard, at a local scale.

Habitat Severance/Barrier Effect

The temporary physical disruption of the existing landscape during site clearance and construction will fragment habitat used by common lizard. As a temporary, short-term impact, this is unlikely to present a significant barrier to the movement of the species such that it would affect the local common lizard population in the long-term. Therefore, habitat severance during construction and any associated barrier effect are not likely to affect the species' conservation status and are not predicted to result in a likely short-term significant negative effect to the common lizard, at any geographic scale.

7.5.1.11 Fish

This section only describes fish species in the local waterbodies within the site and that surface water drains to from the site (i.e. Toureen Lough, Spancelhill Stream, M18 Attenuation pond, River Fergus). Impacts on QI species within downstream European sites are described above in Section 7.5.1.1 and in Section 6 of the NIS (Scott Cawley, 2021).

Habitat Degradation – Surface Water Quality

During construction, contaminated or heavily silted surface water runoff, pump discharges and/or an accidental spillage or pollution event into any surface water feature has the potential to have a significant negative impact on water quality and consequently on aquatic habitats and fish species, and potentially also in the marine environment downstream. This could be either directly (e.g. acute or sub-lethal toxicity from pollutants or siltation events damaging spawning habitat downstream) or indirectly (e.g. affecting their food supply or supporting habitats).

The effects of frequent and/or prolonged pollution events in a river system have the potential to be extensive and far-reaching and could potentially have significant long-term effects. It is considered unlikely that a pollution event of such magnitude would occur during construction or if such an event did occur, it would be temporary in nature. Nevertheless, a precautionary approach is being taken in assuming a level of risk (albeit low due to the distance between surface water features and the main construction activities) of water quality impacts and detailed mitigation measures are required to further minimise the risk of the proposed development having any perceptible effect on water quality during construction.

Habitat degradation as a result of effects on surface water quality during construction has the potential to affect the conservation status of affected fish species and result in a likely significant negative effect, at a local geographic scale given the fact that the other fish species in question are common in Irish waters and not of conservation concern.

Habitat Loss

There will be a loss of 2m^2 of habitat along the banks of the Spancelhill Stream in the south west of the proposed development site, in order to install the grated culvert with headwall and mattress for the surface water drainage pipe. During construction of this, this could result in a loss of habitat if instream works are required to facilitate this. This will be a temporary loss (i.e. 2-3 weeks of construction), which will result in a potential short-term impact on local fish populations, significant at a local geographic scale.

7.5.1.12 Invertebrates

White-clawed crayfish

During construction, contaminated or heavily silted surface water runoff, pump discharges and/or an accidental spillage or pollution event into any surface water feature has the potential to have a significant negative impact on water quality and consequently on aquatic habitats and white-clawed crayfish, and potentially also on the marine environment downstream. This could be either directly (e.g. acute or sub-lethal toxicity from pollutants or siltation events damaging habitat downstream) or indirectly (e.g. affecting their food supply or supporting habitats).

The effects of frequent and/or prolonged pollution events in a river system have the potential to be extensive and far-reaching and could potentially have significant long-term effects. It is considered unlikely that a pollution event of such magnitude would occur during construction or if such an event did occur, it would be temporary in nature. Nevertheless, a precautionary approach is being taken in assuming a level of risk (albeit low due to the distance between surface water features and the main construction activities) of water quality impacts and detailed mitigation measures are required to further minimise the risk of the proposed development having any perceptible effect on water quality during construction.

Habitat degradation as a result of effects on surface water quality during construction has the potential to affect the conservation status of affected white-clawed crayfish species and result in a likely significant negative effect, at a local geographic scale given the fact that this species is not known to occur in the receiving local environment, and there are no records of this species within 2km of the proposed development.

7.5.1.13 Other invertebrates

The majority of suitable habitat for other invertebrate species (as described in Section 7.3.3.7), including butterfly, damselfly and dragonfly species, will not be directly impacted by the development as they are outwith the footprint of the proposed development. These areas include the waterbodies and wetland areas of the site (Toureen Lough, M18 Attenuation pond, and Lough Ardnamurry). There will also be the removal and translocation of 0.79 ha of calcareous grassland to a field to the south east of its current location, at the south western end of DC6. It will therefore continue to be suitable for this species once translocated. Until this habitat is successfully translocated, the translocation of suitable habitat will result in a temporary significant effect, at a local geographic scale. The removal of other suitable habitat, including wet grassland, and dry meadows and grassy verges habitat, will not result in a likely significant effect, due to the size of the areas that will be removed, availability of these habitats in other areas of the proposed development and outside the site in the wider environs.

7.5.2 Operational Phase

7.5.2.1 European sites

Lower River Shannon SAC

As described in Section 7.1 of the NIS, the proposed development has the potential to affect the qualifying interests and conservation objectives, and therefore the integrity, of the Lower River Shannon SAC because of:

- An accidental pollution event during operation affecting water quality in the Spancelhill Stream and the River Fergus, which drains to the Lower River Shannon SAC, subsequently affecting QI/SCI species as a result of habitat degradation.

During operation, water runoff from the proposed development will discharge following attenuation and passing through an oil interceptor to the Spancelhill Stream. SUDs, including filter drains and bioswales, and oversized pipes fitted with petrol interceptors, are proposed in suitable locations within the proposed development. These systems will allow surface water runoff from the roads, footpaths and cycle lanes to be discharged to ground via treatment systems to reduce the rate of infiltration (e.g. filter drains). The inclusion of these SUDs systems will reduce the volume of surface water runoff discharging to the existing drainage network. The functioning and effectiveness of both elements of the road drainage network are discussed in more detail in Chapter 6, Hydrology. The existing subterranean flow within the karst will not be altered by the development. Measures will be incorporated in the design to ensure this flow regime continues as current and these are outlined in Chapter 5 Hydrogeology.

Affecting the integrity of the Lower River Shannon SAC would result in a likely significant effect at the international geographic scale. However, due to the design measures that will be in place during operation, an accidental pollution event affecting water quality and the QI species within, will not result in a significant effect at any geographic scale.

Dromore Woods and Loughs SAC

As described in Section 7.2 of the NIS, the proposed development has the potential to affect the qualifying interests and conservation objectives, and therefore the integrity, of Dromore Woods and Loughs SAC because of:

<u>Habitat degradation/effects on QI species as a result of hydrological impacts</u>

During operation, water runoff from the proposed development will discharge following attenuation and passing through an oil interceptor to the Spancelhill Stream. SUDs, including filter drains and bioswales, and oversized pipes fitted with petrol interceptors, are proposed in suitable locations within the proposed development. These systems will allow surface water runoff from the roads, footpaths and cycle lanes to be discharged to ground via treatment systems to reduce the rate of infiltration (e.g. filter drains). The inclusion of these SUDs systems will reduce the volume of surface water runoff discharging to the existing drainage network. The functioning and effectiveness of both elements of the road drainage network are discussed in more detail in Chapter 6, Hydrology. The existing subterranean flow within the karst will not be altered by the development. Measures will be incorporated in the design to ensure this flow regime continues as current and these are outlined in Chapter 5 Hydrogeology.

<u>Disturbance and/or displacement</u>

During operation, the strategies in place are to limit the duration of the lighting at night and also limit lux levels wherever possible. However there is potential for light spill from the proposed development on suitable areas of foraging and/or commuting habitats used by lesser horseshoe bats. There will also be the addition of lighting along new pathways on the Tulla Road, which will be turned on during the hours of darkness for safety reasons. A light spill modelling drawing has been used to indicate where any areas of light spill may be within and beyond the proposed development, prior to mitigation[56]. Impacts on lesser horseshoe bats during the operational phase of the development could result in a significant impact at the international scale.

Affecting the integrity of the Dromore Woods and Loughs SAC from disturbance and/or displacement of QI species would result in a likely significant effect at the international geographic scale.

Old Domestic Building (Keevagh) SAC & Old Domestic Buildings, Rylane SAC

As described in Section 7.3 of the NIS, the proposed development has the potential to affect the qualifying interests and conservation objectives, and therefore the integrity, of the Old Domestic Building (Keevagh) SAC, and Old Domestic Buildings, Rylane SAC because of:

- Artificial lighting during construction may disturb and/or displace the QI species, lesser horseshoe bats, from the proposed development site. The potential impacts for this European site are as described above under the heading for Dromore Woods and Loughs SAC.

Affecting the integrity of the Old Domestic Building (Keevagh) SAC and Old Domestic Buildings, Rylane SAC would result in a likely significant effect at the international geographic scale.

Ballyallia Lough SPA, River Shannon and River Fergus Estuaries SPA, and Corofin Wetlands SPA

As described in Section 7.3 of the NIS, the proposed development has the potential to affect the qualifying interests and conservation objectives, and therefore the integrity, of Ballyallia Lough SPA, River Shannon and River Fergus Estuaries SPA, and Corofin Wetlands SPA because of:

- An accidental pollution event during operation affecting water quality in the Spancelhill Stream and the River Fergus, which are hydrologically connected to the proposed development site, and subsequently affecting SCI species as a result of habitat degradation.

During operation, water runoff from the proposed development will discharge following attenuation and passing through an oil interceptor to the Spancelhill Stream. SUDs, including filter drains and bioswales, and oversized pipes fitted with petrol interceptors, are proposed in suitable locations within the proposed development. These systems will allow surface water runoff from the roads, footpaths and cycle lanes to be discharged to ground via treatment systems to reduce the rate of infiltration (e.g. filter drains). The inclusion of these SUDs systems will reduce the volume of surface water runoff discharging to the existing drainage network. The functioning and effectiveness of both elements of the road drainage network are discussed in more detail in Chapter 6, Hydrology. The existing subterranean flow within the karst will not be altered by the development. Measures will be incorporated in the design to ensure this flow regime continues as current and these are outlined in Chapter 5 Hydrogeology.

Affecting the integrity of the Ballyallia Lough SPA, River Shannon and River Fergus Estuaries SPA, and Corofin Wetlands SPA would result in a likely significant effect at the international geographic scale. However, due to the design measures that will be in place during operation, an accidental pollution event affecting water quality and the QI species within, will not result in a significant effect at any geographic scale.

7.5.2.2 National sites

As previously described in Section 7.5.1.1 above for European sites, the boundaries of a number of National sites overlap with a number of European sites. Therefore, the potential impacts on these National sites during operation would be as previously described above in Section 7.5.1.1 and in the NIS (Scott Cawley, 2021), under their respective headings. These potential impacts could affect habitat and species within the pNHAs, and therefore, the integrity of the pNHAs which could potentially result in a significant negative effect at the national geographic scale.

Newpark House (Ennis) pNHA

The proposed development is not connected to this pNHA, hydrologically or otherwise, and, consequently, the proposed development is unlikely to result in a significant effect at any geographic scale that would affect the integrity of this pNHA .

Lough Cleggan Lake pNHA

The proposed development is upstream of this National site, and therefore, the protected species here are not at risk of habitat degradation as a result of a change in the hydrological regime. Therefore, the risk of downstream effects on this site as a result of hydrological effects does not arise.

A number of bird species also use this pNHA for foraging and breeding. The proposed development site could be an ex-situ site for these bird species and potentially disturb or displace any birds that may be using the proposed development. The impact of this during operation is minimal however, due to the distance between suitable foraging habitat and the proposed development, (i.e. *c.* minimum 50m away) and as the noise produced from the development will be similar to background noise levels.

These potential impacts could however affect species within the pNHA, and therefore, the integrity of the pNHA which could potentially result in a significant negative effect at the national geographic scale.

Durra Castle pNHA

Operational impacts on protected species within Durra Castle pNHA, i.e. lesser horseshoe bat is considered to be the installation of artificial lighting around the development. These potential impacts could affect habitat and species within the pNHA, and therefore, the integrity of the pNHA, which could potentially result in a significant negative effect at a national geographic scale.

7.5.2.3 Habitats

Habitat Degradation- Surface Water Quality

During operation, there will be a total net increase of 17.3 hectares in the impermeable area discharging to the Fergus Estuary. There will be drainage outfalls to the Spancelhill Stream via an attenuation pond. Surface water runoff from the proposed development could contain harmful compounds such as hydrocarbons, heavy metals and particulate matter, which would be derived from the internal combustion engines of vehicles coming in and out of the site. These harmful compounds could affect the water quality of the waterbodies within the ZoI of the proposed development, as well as affecting aquatic flora and fauna located therein.

Where there is an increase in impermeable surface area, the drainage design principles ensure that there will be no net increase in the surface water flow discharged to these receptors (see Section 6 for more detail on drainage design).

Sections of the proposed development that do not have an increase in impermeable surface area will continue to discharge, directly to the receiving surface water network. Watercourses located within the ZoI of the proposed development include Toureen Lough, wetland/pond feature in the north, Spancelhill Stream, and River Fergus, along with waterbodies and wetlands associated with the Fergus Estuary.

During operation, water runoff from the proposed development will discharge following attenuation and passing through an oil interceptor to the Spancelhill Stream. SUDs, including filter drains and bioswales, and oversized pipes fitted with petrol interceptors, are proposed in suitable locations within the proposed development. These systems will allow surface water runoff from the roads, footpaths and cycle lanes to be discharged to ground via treatment systems to reduce the rate of infiltration (*e.g.* filter drains). The inclusion of these SUDs systems will reduce the volume of surface water runoff discharging to the existing drainage network. The functioning and effectiveness of both elements of the road drainage network are discussed in more detail in Chapter 6, Hydrology. The existing subterranean flow within the karst will not be altered by the development. Measures will be incorporated in the design to ensure this flow regime continues as current and these are outlined in Chapter 5 Hydrogeology.

Habitat degradation, as a consequence of operational effects on surface water quality will therefore not result in a significant effect at any geographic scale.

Habitat Degradation – Air Quality

Air quality modelling of NO_x concentration and deposition rates were calculated at receptor points within the proposed development site, including ecological receptors (refer to Chapter 8 *Air Quality & Climate* for details). The Air Quality Standards Regulations (AQS) 2011 (S.I. No. 180 of 2011) have a limit value of 30µg/m3 for the protection of vegetation. The potential impact of habitat degradation as a result of air quality impacts during the operational phase of the proposed development by means of a breach of the ambient air quality standards as a result of air emissions from the data centre back-up diesel generators and the energy centre engines. The back-up diesel generators modelled for the purpose of the air quality assessment will only be used in the event of a power failure at the site and for testing purposes. During normal operations at the facility, the electricity will be supplied by the energy centre on site, which is powered by natural gas.

There are habitats within the proposed development site that are sensitive to changes in air quality including; alkaline fen [7230], *Cladium* fen [*7230], *Molinia* meadows [6410], and calcareous grassland [6210], as described in Section 7.3.2.1 above. Although these habitats are within 5km of both a motorway and the urban townland of Ennis, and as such the NO_x does not exist, the modelling has nonetheless been carried out to demonstrate the change these habitats are predicted to experience due to the proposed development. Emissions from the facility lead to an ambient NO_X concentration (excluding background) which ranges from 43.6 - 56.4 mg/m^3 at the worst-case location within the site over the five years of meteorological data modelled. In addition, modelling results based on conservative assumptions indicate that the proposed development combined with background concentrations lead to an ambient NO_X concentration which ranges from 62.6 - 75.4 mg/m^3 at the worst-case location within the site over the five years of meteorological data modelled

In terms of deposition, the maximum Nitrogen (N) deposition flux for the worst-case year is 10.86 kg/ha/yr. This can be compared to the range of critical loads for the various onsite habitats outlined in the UNECE 2010 Report "Empirical Critical Loads And Dose-Response Relationships". Rich fen critical loads range from 15-30 kg/ha/yr, poor fen critical loads range from 10-15 kg/ha/yr, Molinia meadows ranged from 15-25 kg/ha/yr whilst calcareous grassland ranged from 15-25 kg/ha/yr (UNECE, 2010). Therefore, the maximum critical load of N is below the upper ranges of all habitats onsite and also below most of the lower ranges of the onsite habitats also.

However, as the critical load is above the lower limit for poor fens such as the *Cladium* fen in the east of the site and the alkaline fen beside Toureen Lough, a more detailed analysis has been undertaken at the actual location of these sensitive habitat sites. In terms of deposition, the maximum Nitrogen (N) deposition flux for the worst-case year is 6.33 kg/ha/yr within the onsite poor fens habitat. This can be compared to the range of critical loads for the poor fen habitat outlined in the UNECE 2010 Report "Empirical Critical Loads And Dose-Response Relationship" of 10-15 kg/ha/yr. Thus the maximum critical load of N is below the lower range of the critical load for poor fen habitats.

For the aforementioned reasons, the operational phase impact of the proposed development on designated sites is considered to be not significant at any geographic level.

7.5.2.4 Bats

Indirect Disturbance of Flight Patterns Due to Operational Lighting

High levels of bat activity were recorded across the site. Additional permanent lighting features within areas of suitable habitat may result in avoidance behaviour by bats. Such displacement (which could be a matter of metres) could prevent bats from accessing foraging areas or roosts and / or result in bats taking more circuitous routes to get to foraging areas and hence potentially depleting energy reserves and abandonment of nearby roosts. Given the rural setting of the proposed development site, and the lack of artificial light within the site and in surrounding lands, the effects of displacement as a result of increased lighting along the access roads, and adjacent to buildings, is considered to be significant at a local geographic scale only, for soprano and common pipistrelle bat, brown long-eared bat, *Myotis* sp. (all species) bat, and Leisler's bat. Lesser horseshoe bat, the most light sensitive species using the lands for foraging and/or commuting, is a QI species for nearby European sites, and impacts are described above in Section 7.5.2.1, and in Section 6 of the NIS (Scott Cawley, 2021). A light spill model study has been prepared to identify the requirements to mitigate any potential light spill, and demonstrate the results of these measures, to ensure there are no effects on local bat species. Mitigation measures for the impacts on bat species can be found in Section 7.6.1.1, Section 7.6.1.4 and Section Section 7.6.2.1 below.

7.5.2.5 Otter

As the otter populations that utilise the proposed development are considered to be part of European site populations downstream and hydrologically connected to the site (i.e. Lower River Shannon SAC and Dromore Woods and Loughs SAC), any potential impacts predicted on this species are discussed in Section 7.5.2.1 above, and in Section 6 of the NIS produced as part of this planning application (Scott Cawley, 2021).

7.5.2.6 Badger

Habitat Severance/ Barrier Effect

Barriers such as road infrastructure within the proposed development site may affect the foraging behaviour of badgers and the commuting corridors they utilise, *e.g.* it may impact on the movement of this species between breeding, foraging and hibernation sites and as a result local populations can become isolated, resulting in long-term effects on genetic diversity and gene flow, at a local geographic scale.

As the proposed development will involve the development of roads and services, buildings, parking areas and pathways, there is potential for the proposed development to act as a barrier to badger movement across the landscape. However, badgers are likely to adjust quickly as their movement to other areas within or beyond the proposed development site will not be restricted; therefore, this potential impact is not considered to be significant at any geographic scale.

Disturbance and displacement impacts from light spill

Nocturnal mammals, such as badger, are likely to be disturbed by the introduction of artificial light into established breeding and foraging areas (Rich & Longcore, 2005). The proposed development is mostly unlit and rural in nature.

The development is largely a 'dark development' and light spill on areas outside of the footprint and on important features for wildlife will be less than 0.1Lux. The badger setts and main badger foraging habitat (*i.e.* the woodland in the north west) will be a sufficient distance away from the development and therefore will not be impacted by any level of light spill arising from the proposed development.

Therefore, lighting associated within the proposed development is not predicted to disturb or displace badgers from habitat areas located beyond the footprint of the proposed development, will not affect the species conservation status in that regard and will not result in a likely significant negative effect, at any geographic scale.

7.5.2.7 Other Mammals (including pine marten and Irish hare)

Habitat Severance/ Barrier Effect

Barriers such as road infrastructure within the proposed development site may affect the foraging behaviour of small mammals such as pine marten and Irish hare and the commuting corridors they uilitise, *e.g.* it may impact on the movement of these species between breeding, foraging and hibernation sites and as a result local populations can become isolated, resulting in long-term effects on genetic diversity and gene flow, at a local geographic scale.

As the proposed development will involve the development of roads and services, buildings, parking areas and pathways, there is potential for the proposed development to act as a barrier to mammal movement across the landscape. However, mammals are likely to adjust quickly as their movement to other areas within or beyond the proposed development site will not be restricted; therefore, this impact is not considered to be significant at any geographic scale.

Mortality Risk

The proposed development will increase the level of traffic moving in and out of the site, which has the potential to result in the mortality of small mammal species. The potential for this impact to occur would be expected to be greater during the breeding season when juveniles would be present in nests, or in the case of hedgehog impacts may be greater during their hibernation period. Furthermore, the potential for direct mortality to small mammals would be greater in more vegetated areas, as opposed to artificial ground/ grassland habitat, as these areas would offer more in terms of breeding/ resting habitat for small mammal species. The planting that will be in place during operation, will screen the development, and encourage movement of mammals around the site. Traffic movements will largely be during the day for workers going to and from the site, and as most of the aforementioned species (*i.e.* pine marten, hedgehog and pygmy shrew) are nocturnal species, the risk is reduced. Given the relatively low numbers of individuals of each species that are likely to be affected, and that these species are highly mobile, an increase in traffic movements around the proposed development is unlikely to result in a level of mortality that would affect the species' conservation status, and result in a significant negative effect, even at a local geographic scale.

Disturbance and displacement impacts from light spill

Nocturnal mammals, such as pine marten, hedgehog and pygmy shrew, are likely to be disturbed by the introduction of artificial light into established breeding and foraging areas (Rich & Longcore, 2005). The proposed development is mostly unlit and rural in nature.

The development is largely a 'dark development' and light spill on areas outside of the footprint and on important features for wildlife will be less than 0.1Lux. The main foraging and breeding habitat (*i.e.* the woodland in the north west), will be a sufficient distance away from the development and therefore will not be impacted by light spill.

Therefore, lighting associated within the proposed development is not predicted to disturb or displace mammal species from habitat areas located beyond the footprint of the proposed development, will not affect the species conservation status in that regard and will not result in a likely significant negative effect, at any geographic scale.

7.5.2.8 Breeding birds

Disturbance/ Displacement

Increases in noise levels, associated with the increased frequency of traffic, as well as increased human presence, owing to the provision of the proposed cycle tracks and pathways, and may also have a negative effect on bird abundance and occurrence in the locality. Operation noise impacts are predicted to be negative, not significant-moderate, and long-term. With day to day noise levels predicted at max. 35 dB, and emergency noise at max. 50 dB. Increased noise levels, as well as causing disturbance to birds in the locality, may also affect the breeding success of local bird populations as bird calls could become drowned out by traffic noise.

The displacement of breeding birds from the proposed development boundary is likely to result in an increase in competition for resources (*e.g.* nesting habitat or prey/food sources) both between and amongst breeding bird species, which in turn would have negative impacts on local breeding bird populations in the long-term.

Although the proposed development is predicted to have a long-term effect on local breeding bird populations, even at a local level this is not predicted to affect the ability of local breeding bird species to persist within their current ranges or to maintain their populations long-term. Therefore, the proposed development is not likely to affect the conservation status of breeding bird species and will not result in a likely significant negative effect, at any geographic scale.

7.5.2.9 Wintering birds

This section of the impact assessment deals with wintering bird species, *i.e.* those bird species which are listed on either the BoCCI Red or Amber lists for their wintering populations or are Annex I species. The assessment carried out in the NIS for the proposed development considered the potential for the proposed development to affect the bird species listed as SCIs of European sites for their wintering populations. That assessment concluded that proposed development would not affect their wintering bird colonies or have any long-term effects on the local wintering populations following implementation of mitigation measures. Therefore, for these species, the proposed development will not affect the conservation status of the SCI wintering bird populations and will not result in a significant adverse effect on the integrity of the European sites (See Section 6 of the NIS (Scott Cawley, 2021).

Disturbance/ Displacement

During operation, the proposed development has the potential to disturb and displace wintering bird species from habitats near the proposed development footprint due to an increase in noise, human activity and visual disturbance associated with increased human presence and increased traffic flow. Although the operational disturbance/displacement effect cannot be quantified it would be expected to be much less than the 300m ZoI associated with construction works. Noise generated during operation is anticipated to be long-term, imperceptible, and negative (Chapter 9 Noise and Vibration, AWN 2021). Most species of wintering birds are likely to habituate to the increased traffic flows and human presence. There will be no human presence outside of the footprint of the development, due to the buildings being fenced off from the surrounding areas. Any operational noise increases are not likely to alter the existing baseline effect on wintering birds using the habitats locally.

Although there is still likely to be some level of displacement effect, a perceptible effect would be expected to be limited to habitats immediately adjacent to the proposed development, owing to the duration for screening landscape planting to become fully re-established. As any operational noise increases are not likely to alter the existing baseline noise effect on wintering birds in the locality, effects of noise disturbance can also be excluded.

Any displacement of birds from habitat areas during the operation of the proposed development could be expected to be temporary, as a significant amount of planting will be carried out prior to the development, and will have established for during operation. However, it is not predicted to affect the conservation status of wintering bird species by virtue of the widespread availability of a number of other suitable forage sites nearby and across the wider Fergus Estuary. Thus, the operational impact should not result in a likely significant negative effect, at any geographic scale.

Habitat Degradation – Surface Water

During operation, surface water runoff from the proposed development will discharge to the receiving surface water drainage network. Surface water runoff from the proposed development could contain harmful compounds such as hydrocarbons, and particulate matter, if mitigation is not in place. These harmful compounds could be transferred to waterbodies that support populations of riparian/ estuarine bird species such as the Toureen Lough, wetland/pond feature in the north, Spancelhill Stream, River Fergus, and the Fergus Estuary. This could affect water quality in these areas and therefore have a negative effect on winter bird species as a result of direct contact with pollutants or a reduction in food supply.

The proposed drainage design incorporates pollution control measures to allow surface water runoff from the carriageways, footpaths and cycle lanes to be discharged through a petrol interceptor and through permeable paving in areas of low traffic. The inclusion of SUDs systems and attenuation will reduce the volume of surface water runoff discharging to the existing drainage network. The functioning and effectiveness of both elements of the site drainage network are discussed in more detail in Chapter 6, *Hydrology.*

Habitat degradation because of effects on surface water during operation therefore, does not have the potential to affect the species' conservation status and will not result in a likely significant negative effect, at any geographic scale.

7.5.2.10 Amphibians

Suitable amphibian habitat such as Toureen Lough, the M18 attenuation pond, and the wetland features in the north and east of the site, was identified within the proposed development. The desk study returned records of common frog within c. 2km of the proposed development and therefore impacts on these species cannot be excluded due to suitable habitat on site.

Habitat Severance/ Barrier Effect

Barriers such as road infrastructure within the proposed development site may affect the foraging behaviour of amphibians and the commuting corridors they utilise, *e.g.* it may impact on the movement of amphibian species between breeding and/or hibernation sites, and as a result local populations can become isolated, resulting in long-term effects on genetic diversity and gene flow, at a local geographic scale.

As the proposed development roads will be screened by the use of BERMs and hedgerows, and the permanent wetland features utilised by amphibians within the site will not be impacted directly by the proposed development, the effect of habitat severance/ barrier effect on amphibian species is not considered to be significant at any geographic scale.

Mortality Risk

The proposed development will not result in any increase in terms of mortality risk to amphibians during operation, as no proposed works will be occurring within or adjacent to any of the permanent wetland features within the site. Therefore, the impact of mortality risk to amphibians, as a result of the proposed development is not considered to be significant at any geographic scale.

Habitat Degradation – Surface Water

During operation, surface water runoff from the proposed development will discharge, largely unrestricted, to the receiving surface water drainage network. Surface water runoff from the proposed development could contain harmful compounds such as hydrocarbons, heavy metals and/or particulate matter.

The release of contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water features during operation, has the potential to affect water quality in the receiving aquatic environment. Such a pollution event may include: the release of sediment into receiving waters and the subsequent increase in mobilised suspended solids; and the accidental spillage and/or leaks of containments (*e.g.* fuel, oils, lubricants, paints, bituminous coatings, preservatives, weed killer, lime and concrete) into receiving waters. The associated effects of a reduction of surface water quality could potentially extend for a considerable distance downstream of the location of the accidental pollution event or the discharge. The proposed development is hydrologically connected to the Spancelhill Stream and the River Fergus both of which discharge into the Fergus Estuary.

The proposed drainage design incorporates pollution control measures to allow surface water runoff from the carriageways, footpaths and cycle lanes to be discharged through a petrol interceptor and through permeable paving in areas of low traffic. The inclusion of SUDs systems and attenuation will reduce the volume of surface water runoff discharging to the existing drainage network. The functioning and effectiveness of both elements of the site drainage network are discussed in more detail in Chapter 6, *Hydrology.*

Habitat degradation because of effects on surface water during operation therefore, does not have the potential to affect the species' conservation status and will not result in a likely significant negative effect, at any geographic scale.

7.5.2.11 Reptiles

Habitat Severance/Barrier Effect

The presence of the proposed development will not create any permanent barrier in the landscape to the movement of common lizard. Therefore, habitat severance and barrier effect is not likely to affect the species conservation status and result in a significant effect at any geographic scale.

Mortality Risk

Common lizard are vulnerable to mortality, however the presence of the proposed development will not pose a permanent mortality risk to the species due to lack of large infrastructure that could result in heavy traffic, limited traffic movements confined to the proposed internal road network, and due to the lack of evidence of this species within and surrounding lands.

Therefore, mortality risk is not predicted to affect the species' conservation status or result in a likely significant negative effect to reptiles, at any geographic scale.

7.5.2.12 Fish

Habitat Degradation – Surface Water

There will be a drainage outfall to the Spancelhill Stream following attenuation. Therefore, there is a risk that discharges from the proposed development drainage network could affect water quality, potentially over the long-term, and consequently impact upon aquatic habitats and fish species. In a worst-case-scenario, this could result in a permanent decline in fish species abundance and distribution.

The proposed drainage design incorporates pollution control measures (i.e. petrol interceptors) followed by attenuation ponds (where drainage will be discharged to the existing surface water/storm sewer), as described in detail in Chapter 6.

Those sections of the proposed development drainage that are to be discharged to ground, pose no risk to surface water quality as they are greenfield as current. It is extremely unlikely that the normal operating water quality of the drainage outfalls discharging to the existing surface water/drainage network, even in the unlikely event of a pollution incident, would have any perceptible long-term effect on water quality in receiving watercourses. The functioning and effectiveness of the site drainage network are discussed in more detail in the hydrology chapter (Chapter 6 Hydrology).

Habitat degradation because of effects on surface water during operation, is not predicted to result in a likely significant negative effect, at any geographic scale.

Habitat Severance/Barrier Effect

There will be no permanent structure in place within the Spancelhill Stream as a result of the proposed development, and therefore habitat severance/barrier effect is not considered to be result in a negative effect on fish species, at any geographic scale.

7.5.2.13 Invertebrates

White-clawed crayfish

There will be drainage outfalls to the Spancelhill Stream by the proposed development. Therefore, there is a risk that discharges from the proposed development drainage network could affect water quality, potentially over the long-term, and consequently impact upon aquatic habitats and white-clawed crayfish populations. In a worst-case-scenario, this could result in a permanent decline in white-clawed crayfish abundance and distribution. This is unlikely however due to the lack of local records in the receiving downstream environment.

The proposed drainage design incorporates pollution control measures (i.e. petrol interceptors) followed by attenuation ponds (where drainage will be discharged to the existing surface water/storm sewer), as described in detail in Chapter 6.

Those sections of the proposed development drainage that are to be discharged to ground, pose no risk to surface water quality as they are greenfield as current. It is extremely unlikely that the normal operating water quality of the drainage outfalls discharging to the existing surface water/drainage network, even in the unlikely event of a pollution incident, would have any perceptible long-term effect on water quality in receiving watercourses. The functioning and effectiveness of the site drainage network are discussed in more detail in the hydrology chapter (Chapter 6 Hydrology).

Habitat degradation because of effects on surface water during operation, is not predicted to result in a likely significant negative effect, at any geographic scale.

7.5.2.14 Other invertebrates

No operational impacts are predicted on this species as areas of suitable habitat are located outside the footprint of the development, and the translocation of suitable calcareous grassland will have been allowed to establish and continue to provide habitat for this species during operation.

7.6 REMEDIAL AND MITIGATION MEASURES

7.6.1 Construction Phase

7.6.1.1 European sites

The mitigation measures that are specifically required to ensure that the proposed development will not adversely affect the integrity of the European sites within the ZoI (*i.e.* Lower River Shannon SAC, Dromore Woods and Loughs SAC, Old Domestic Building (Keevagh) SAC, Old Domestic Buildings, Rylane SAC, River Shannon and River Fergus Estuaries SPA, Ballyallia Lough SPA, and Corofin Wetlands SPA) are presented in the NIS (See Section 7). Following a consideration and assessment of the proposed development on the identified relevant European sites, the following mitigation measures were developed to address potential impacts that were identified:

Measures to Protect Surface Water Quality during Construction

A site-specific Construction Environmental Management Plan (CEMP) is also included with the applicant’s planning documentation submitted to Clare County Council. The Principal Contractor and all construction contractorswill implement the mitigation measures specified in the CEMP.

These measures have been developed in consideration of the following standard best international practice including but not limited to:

- Construction Industry Research and Information Association (CIRIA) (2005) Environmental Good Practice on Site (C692)
- CIRIA, (2001) Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors (C532)
- CIRIA, (2000) Environmental Handbook for Building and Civil Engineering Projects (C512)

- CIRIA, (2007) The SUDS Manual (C697)
- CIRIA C648: Control of water pollution from linear construction projects: Technical guidance
- CIRIA (2006) Control of water pollution from linear construction projects: Site guide (C648)
- IFI (2016) Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters
- UK Pollution Prevention Guidelines (PPG) UK Environment Agency, 2004
- BPGCS005, Oil Storage Guidelines

The construction contractor will be required to implement the following specific mitigation measures as a condition if granted by Clare County Council all of which will be incorporated into the CEMP, for release of hydrocarbons, polluting chemicals, sediment/silt and contaminated waters control:

- Specific measures to prevent the release of sediment over baseline conditions in the downstream receiving water environment, during the construction work. These measures include, but are not limited to, the use of silt fences, silt curtains, settlement lagoons and filter materials.
- Provision of exclusion zones and barriers (e.g. silt fences) between earthworks, stockpiles and temporary surfaces to prevent sediment washing into the existing drainage systems and hence the downstream receiving water environment.
- Provision of temporary construction surface drainage and sediment control measures to be in place before earthworks commence.
- Weather conditions will be taken into account when planning construction activities to minimise risk of run-off from the site.
- Prevailing weather and environmental conditions will be taken into account prior to the pouring of cementitious materials for the works adjacent to any surface water drainage features, or drainage features connected to same. Pumped concrete will be monitored to ensure no accidental discharge. Mixer washings and excess concrete will not be discharged to existing surface water drainage systems. Concrete washout areas will be located remote any surface water drainage features, where feasible, to avoid accidental discharge to watercourses. Washing out of any concrete trucks on site will be avoided.
- Any fuels or chemicals (including hydrocarbons or any polluting chemicals) will be stored in a designated, secure bunded area(s) to prevent any seepage of potential pollutants into the local surface water network. These designated areas will be clearly sign-posted and all personnel on site will be made aware of their locations and associated risks.
- All mobile fuel bowsers shall carry a spill kit and operatives must have spill response training. All fuel containing equipment such as portable generators shall be placed on drip trays. All fuels and chemicals required to be stored on-site will be clearly marked. Care and attention will be taken during refuelling and

maintenance operations. Particular attention will be paid to gradient and ground conditions, which could increase risk of discharge to waters.

- A register of all hazardous substances, which will either be used on site or expected to be present (in the form of soil and/or groundwater contamination) will be established and maintained. This register will be available at all times and shall include as a minimum:
    - Valid Safety Data Sheets;
    - Health & Safety, Environmental controls to be implemented when storing, handling, using and in the event of spillage of materials;
    - Emergency response procedures/precautions for each material; and,
    - The Personal Protective Equipment (PPE) required when using the material.
- Implementation of response measures to potential pollution incidents.
- Robust and appropriate Spill Response Plan and Environmental Emergency Plan will be prepared prior to works commencing and they will be communicated, resourced and implemented for the duration of the works. Emergency procedures/precautions and spillage kits will be available and construction staff will be trained and experienced in emergency procedures in the event of accidental fuel spillages.
- All trucks will have a built-on tarpaulin that will cover excavated material as it is being hauled off-site and wheel wash facilities will be provided at all site egress points.
- If groundwater is encountered during the proposed works and temporary pumping at a very localised location is required:
    - An appropriate dewatering system and groundwater management system specific to the site conditions will be designed and maintained. These will include measures to minimise any surface water inflow into the excavation, where possible, and the prolonged exposure of groundwater to the atmosphere will be avoided.
    - Qualitative and quantitative monitoring will be adopted to ensure that the water is of sufficient quality to discharge. The use of silt traps will be adopted if the monitoring indicates the requirement for same with no silt or contaminated water permitted to discharge to the receiving water environment.
- Water supplies shall be recycled for use in the wheel wash. All waters shall be drained through appropriate filter material prior to discharge from the construction sites.
- The removal of any made ground material, which may be contaminated, from the construction site and transportation to an appropriate licensed facility shall be carried out in accordance with the Waste Management Act, best practice and guidelines for same.
- The site investigation did not encounter any contaminated soil. However, If any potentially contaminated material is encountered, it will need to be segregated

from clean/inert material, tested and classified as either non-hazardous or hazardous in accordance with the EPA publication entitled 'Waste Classification: List of Waste & Determining if Waste is Hazardous or Non-Hazardous' using the HazWasteOnline application (or similar approved classification method). The material will then need to be classified as clean, inert, non-hazardous or hazardous in accordance with the EC Council Decision 2003/33/EC, which establishes the criteria for the acceptance of waste at landfills.

- In the event that Asbestos containing materials (ACMs) are found during demolition works, the removal will only be carried out by a suitably permitted waste contractor, in accordance with S.I. No. 386 of 2006 Safety, Health and Welfare at Work (Exposure to Asbestos) Regulations 2006-2010. All asbestos will be taken to a suitably licensed or permitted facility.

- Implementation of measures to minimise waste and ensure correct handling, storage and disposal of waste (most notably wet concrete, pile arisings and asphalt).

- All the above measures implemented on site will be monitored throughout the duration of construction to ensure that they are working effectively, to implement maintenance measures if required/applicable and to address any potential issues that may arise.

<u>Measure to prevent the spread of invasive species during construction</u>

Pre-Construction Survey

Invasive plant species were not identified within the proposed development site. A pre-construction invasive species survey must be carried out prior to any construction activities (including enabling works) by a suitably qualified specialist to confirm the presence or absence and extent of any invasive species within the proposed development site prior to the development. Data collected as part of this survey will also include the approximate area of any respective colonies (m2) and a detailed description of the infestations (e.g. approximate total number of stems, pattern of growth and information on other vegetation present), if invasive species are identified. This information will inform calculations of volumes of infested soils to be excavated, as part of the measures outlined below.

General Measures to Avoid Spreading Invasive Species during Construction or Soil Movement

The species noted in Section 6.4 are invasive and are particularly effective at colonising disturbed ground (e.g. construction sites). Some species spread by the re-growth of cut fragments or root material, they can readily re-grow in new areas if the existing stands are disturbed e.g. by machinery, people, livestock etc.

The most common ways that these species can be spread is:

- Site and vegetation clearance, mowing, hedge-cutting or other landscaping activities;

- Spread of plant fragments during the movement or transport of soil;

- Spread of plant fragments through the local surface water and drainage network;

- Contamination of vehicles or equipment with plant fragments which are then transported to other areas; and;

- Importation of soil from off-site sources contaminated with invasive species plant material.

It is preferable to eradicate invasive species prior to the onset of construction of any proposed development in close proximity. If control programmes have not been achieved before construction begins then the affected areas must be fenced off prior to and during construction in order to avoid spreading seeds or plant fragments around or off the construction site. Earthworks or machinery movement must be avoided in these areas until the relevant species have been eradicated.

If soil is imported to the site for landscaping, infilling or embankments, the contractor must gain documentation from suppliers that the material is free from invasive species.

Disposal of Material if species identified

If any invasive species plant material is collected (e.g. by hand-pulling or mowing), it is important that its disposal does not lead to a risk of further spread. The movement of plant material of any plants listed on the Third Schedule requires a licence from the National Parks and Wildlife Service (NPWS) under Section 49 of the European Communities (Birds and Natural Habitats) Regulations, 2011 (as amended). Invasive species (particularly roots, flower heads or seeds) must be disposed of at licensed waste facilities or composting sites, appropriately buried, or incinerated having regard to relevant legislation, for example; Section 32 of the Waste Management Act, 1996 to 2008; Section 4 of the Air Pollution Act, 1987; relevant local authority byelaws and any other relevant legislation. All disposals must be carried out in accordance with the relevant Waste Management legislation (as per guidance from NRA, 2008).

It should be noted that some invasive species plant material or soil containing residual herbicides may be classified as either ‘hazardous waste’ or ‘non-hazardous waste’ under the terms of the Waste Management Acts, and both categories may require special disposal procedures or permissions. Advice should be sought from a suitably qualified waste expert regarding the classification of waste and the suitability of different disposal measures.

As noted above, additional specific measures for the management of Japanese knotweed cuttings or contaminated soil can be found in the UK Environment Agency document The Knotweed Code of Practice: Managing Japanese Knotweed on development sites (UK Environment Agency, 2013 (withdrawn 2016)).

Measures to be Followed During the Application of Herbicides

The control options for some species will require the use of herbicides, which can pose a risk to human health, to non-target plants or to wildlife. In order to ensure the safety of herbicide applicators and of other public users of the site, a qualified and experienced contractor, and qualified Herbicide Advisor, must be employed to carry out all work.

It is advised that the appointed contractor refer to the following documents, which provide detailed recommendations for the control of invasive species and noxious weeds:

- TII Publication: The Management of Invasive Alien Plant Species on National Roads – Technical Guidance (TII, 2020)

- Managing invasive non-native plants in or near fresh water (Environment Agency, 2010)

These documents include measures to aid the identification of relevant species, with details for the timing, chemicals, methodology for chemical control, and for measures to avoid environmental damage during the use of herbicides.

<u>Measures to Protect Otter from habitat loss/fragmentation and Disturbance/Displacement impacts</u>

This section presents the mitigation measures that will be implemented during construction to avoid the potential impacts of the proposed development on QI otter populations associated with the Lower River Shannon SAC. All of the mitigation measures will be implemented in full. They are in accordance with best practice, and tried and tested, effective control measures to protect otter.

Pre-Construction Survey

- Prior to construction works commencing, the appointed contractor will engage the services of a suitably qualified ecologist to conduct a pre-construction otter survey of the proposed development. The survey will be undertaken within 10 months in advance of construction and supplemented by a further inspection of the proposed development immediately prior to site clearance to ensure that no new holts have been established in the intervening period. These surveys will be carried out in accordance with Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes (NRA, 2006).

- Where any new active holts/couches are recorded within 150m of the proposed development the appointed ecologist will ensure that adequate mitigation is provided in accordance with Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes (NRA, 2006), and a derogation licence is sought from the NPWS where necessary.

Mitigation measures for new active holts/couches recorded within 150m of the development

Until such time as otters have been successfully evacuated from active holts, the following provisions should apply to all construction works:

- No works should be undertaken within 150m of any holts at which breeding females or cubs are present. Following consultation with NPWS, works closer to such breeding holts may take place - provided appropriate mitigation measures detailed below are in place.

- No wheeled or tracked vehicles (of any kind) should be used within 20m of active, but non-breeding, otter holts. Light work, such as digging by hand or scrub clearance should also not take place within 15m of such holts, except under licence.

- The prohibited working area associated with otter holts should, where appropriate, be fenced with temporary fencing prior to any possibly invasive works. Fencing should be in accordance with Clause 303 of the NRA's

Specification for Roadworks (National Roads Authority). Appropriate awareness of the purpose of the enclosure should be conveyed through notification to site staff and sufficient signage should be placed on each exclusion fence. All contractors or operators on site should be made fully aware of the procedures pertaining to each affected holt.

Ecological Clerk of Works/Retained Ecologist

- Were a new holt to be encountered within 150 metres (up and downstream) of watercourse crossing, NPWS consultation will be sought, and the services of an Ecological Clerk of works or retained Ecologist (both with experience with otter survey/mitigation) would be required.

- The appointed contractor shall employ the services of an Ecological Clerk of Works (EcOW) with experience in otter, to oversee and advise works at watercourse crossings for the proposed development (they may also undertake the preconstruction survey). The EcOW will have the authority to:

    - Review method statements;
    - Oversee works;
    - Provide instruction to the appointed contractor(s); and,
    - Require the temporary cessation of works, where necessary.

- Access to and from the M18 Motorway culvert mammal ledge will be maintained at all times, with no works to be carried out at this location.

- The EcOW will deliver a toolbox talk on biodiversity including otter to the appointed contractor(s). This talk will include instructions on identifying otter and details on the protections afforded to otter under Irish and EU legislation. The EcOW will outline the actions which will be taken by the contractor(s) if otter are noted on or near the Proposed development during construction works.

Measures to Prevent/Reduce Disturbance and Displacement of otters

- Night working within/directly adjacent to watercourses where otter are known to commute will be avoided and will only be permitted with the prior approval of the planning authority.

- Where night-working adjacent to watercourses known to support otter, is required, the advice of a suitably qualified ecologist must be sought and a derogation licence, if necessary, will be sought from NPWS permitting such works.

<u>Measures to prevent disturbance and/or displacement of lamprey species</u>

An Ecological Clerk of Works will supervise the following mitigation strategy at the location of the drainage outfall in the banks of the Spancelhill Stream:

- A silt curtain and spill boom will be put in place across the width of the river immediately downstream of the works location, to capture any sediment which is mobilised during the works and any hydrocarbon escape or spill during construction works;

- The works will be undertaken either by placement of sandbags or cofferdam to ensure working in the dry, or as close to dry conditions as possible. Once in place, water will be pumped out of the sandbagged/cofferdam area.

- Prior to pumping commencing the area will be inspected and hand and net searched by the EcOW to check for any lamprey present. Repeat inspections will be undertaken as water levels are lowered during the course of pumping. A sieve will be placed over the in-take pipe of the pump to prevent any accidental uptake of lamprey that may be present.

- Once the area has been substantially de-watered, if net and manual searches cannot comprehensively exclude the possibility of lamprey remaining, then an excavator located out of the water and on the bankside, will carefully excavate the area small sections at a time and will deposit spoil in excess of 10m from the edge of the river bankside for inspection. The ECoW will manually search these spoil heaps for any lamprey present.

- Any lamprey recovered will be handled with care, temporarily stored in buckets of water and released back to the river at a downstream location within 20 minutes of capture.

- Once the outfill pipe has been fully constructed the ECoW will supervise the removal of the sandbags/cofferdam. The silt curtain and spill boom must remain in place until these have been removed and for a period until silt has settled/been captured.

- There will be no concrete pouring and all materials (i.e. pipe, headwall and mattress) will be pre-cast prior to installation.

- The mitigation measures relating to the protection of surface water quality in receiving watercourses during construction are detailed above in Section 7.1.5 and apply for the works at this location, and will be adhered to at all times.

- The culvert, headwall and mattress have been designed in consultation with IFI and in accordance with the design criteria set out in Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (IFI, 2016).

- IFI's guidelines on bio-security measures (IFI, 2010) must be adhered to during works at Spancelhill Stream.

<u>Measures to Protect Lesser Horseshoe bat from habitat loss/fragmentation impacts</u>

Any vegetation (including trees, hedgerows or scrub adjacent to, or within, the proposed development boundary) which is to be retained shall be afforded adequate protection during the construction phase in accordance with the Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes (National Roads Authority, 2006b), as follows:

- All trees along the proposed development boundary that are to be retained, both within and adjacent to the proposed development boundary (where the root protection area of the tree extends into the proposed development boundary), will be fenced off at the outset of works and for the duration of construction to avoid structural damage to the trunk, branches or root systems of the trees. Temporary fencing will be erected at a sufficient distance from the tree so as to enclose the

Root Protection Area (RPA) of the tree. The RPA will be defined based upon the recommendation of a qualified arborist

- Where fencing is not feasible due to insufficient space, protection for the tree/hedgerow will be afforded by wrapping hessian sacking (or suitable equivalent) around the trunk of the tree and strapping stout buffer timbers around it

- The area within the RPA will not be used for vehicle parking or the storage of materials (including soils, oils and chemicals). The storage of hazardous materials (e.g. hydrocarbons) or concrete washout areas will not be undertaken within 10 m of any retained trees, hedgerows and treelines

- A qualified arborist shall assess the condition of, and advise on any repair works necessary to, any trees which are to be retained or that lie outside of the proposed development boundary but whose RPA is impacted by the works. Any remedial works required will be carried out by a qualified arborist

- A buffer zone of at least 5m will be maintained between construction works and retained hedgerows to ensure that the root protection areas are not damaged.

Surveys carried out confirmed that lesser horseshoe bat use the treelines and hedgerows located within the proposed development site as foraging and commuting habitat. The proposed development will result in a total loss of *c.* 2.7km hedgerows, and 30 trees; therefore replacement planting is required to ensure that there will be no net loss of lesser horseshoe bat foraging and commuting habitat as a result of the proposed development. This will comprise of *c.* 4.86km of hedgerow and 57 new trees within the proposed development site (see the Landscape Design Strategy[41], and Chapter *10 Landscape and Visual Impact Assessment*[39] being submitted as part of this application for location map, planting schedule and specific details of proposed species). Native hedgerow planting will include the following species; Alder *Alnus glutinosa*, hazel *Corylus avellana* , hawthorn *Crataegus monogyna*, holly *Ilex aquifolium*, honeysuckle *Lonicera periclymenum*, crab apple *Malus sylvestris*, wild cherry *Prunus avium* , blackthorn *Prunus spinosa*, dog rose *Rosa canina*, elder *Samucus nigris*, and guelder rose *Viburnum opulus*. Tree planting will include semi-mature species such as: Sessile oak *Quercus petraea*, beech *Fagus sylvatica*, strawberry tree *Arbustus unedo*, Scot’s pine *Pinus sylvestris,* multistem birch *Betula pendula*, rowan *Sorbus acuparia*, double flowering wild cherry *Prunus avium plena*, and crab apple. This will ensure the proposed development complies with Objective 14.11 of the *Clare County Development Plan 2017-2023 (as varied)*, and the requirement that there is no net loss of lesser horseshoe bat habitat within the proposed development. This proposed planting has been designed to ensure that connectivity for foraging and commuting bats is maintained - *i.e.* along the peripheries of the site, and within the site from the woodland in the north west to suitable foraging habitats such as Toureen Lough, and along hedgerows in the north to woodland and wetland habitats in the east. Existing hedgerows along the southern boundary that are less species rich, will be enhanced through additional planting of native species. The proposed planting will occur in phases, with the earliest planting occurring along important foraging and/or commuting routes in the north, south and east of the site, at pre-construction stage and prior to removal of any habitats. This will ensure that suitable foraging and commuting habitat for lesser horseshoe bat is established prior to the removal of such habitat during the construction of the proposed development; therefore maintaining the site’s suitability for lesser horseshoe bat. Cattle grazed fields are known to have higher rates of bat activity than ungrazed grassland (Downs et al.

2010)[55], therefore in addition to the hedgerows and treeline planting, areas of cattle grazed grassland will be maintained as they are currently in the east, north and west of the site with additional hedgerows separating fields, to provide further suitable habitat for lesser horseshoe bat.

Measures to protect lesser horseshoe bats from disturbance/displacement impacts

A light spill model study was undertaken by Hurley Palmer Flatt (June 2021)[56] to determine the effects of artificial light and Artificial Light At Night (ALAN) on bats as a result of the proposed development and identify how to reduce or eliminate ALAN onsite, based on information from both Eurobats Guideline No.8, the Institution of Lighting Professionals (ILP) Guidance Note No.8. and Bat Conservation Ireland *Guidance Notes for: Planners engineers, architects and developers*[57]. Potential impacts of lighting during construction will be slight and short-term as construction works will generally be confined to daylight hours (07:30-17:30). Where works are required during hours of darkness, portable lighting will be used, which will be pointed downwards at a 45-degree angle and away from any sensitive receptors (hedgerows, treelines, confirmed bat roosts, Toureen Lough, and Spancelhill Stream).

7.6.1.2 National sites

The mitigation measures that are specifically required to ensure that the proposed development will not adversely affect the integrity of the national sites within the ZoI, and that overlap with previously described European sites (*i.e.* Fergus Estuary and Inner Shannon, North Shore pNHA, Old Domestic Building (Keevagh) pNHA, Ballyallia Lake pNHA, and Dromore Woods and Loughs pNHA), are presented in the NIS in Section 7 (Scott Cawley, 2021). Therefore, the mitigation measures outlined above in Section 7.6.1.1, and as detailed in the NIS, will prevent the proposed development resulting in a significant negative effect on these pNHA sites at the national geographic scale.

The additional national sites within the ZoI of the proposed development, *i.e.* Newpark House (Ennis pNHA), Lough Cleggan Lake pNHA, and Durra Castle pNHA, and the subsequent mitigation required, are described below.

Lough Cleggan Lake pNHA

The mitigation strategy in relation to potential impacts arising from the proposed development on Lough Cleggan Lake pNHA includes surface water protection measures to prevent surface water quality effects (See Section 7.6.1.1)

Durra Castle pNHA

The mitigation strategy in relation to potential impacts arising from the proposed development on Durra Castle pNHA includes measures to prevent disturbance and displacement impacts of lesser horseshoe bat from suitable foraging and/or commuting

[55] Downs, N., & Sanderson, L. (2010). Do Bats Forage Over Cattle Dung or Over Cattle?. *Acta Chiropterologica*, *12*(2), 349-358.

[56] Site Lighting Analysis Report and Light Spill Modelling Study, Project Art, produced by Hurley Palmer Flatt (June 2021)

[57] *Guidance Note for: Planners, engineers, architects and developers.* Bat Conservation Ireland (2010)

grounds, and from the impacts of habitat loss of suitable habitat within the normal foraging range of this species (See Section 7.6.1.1)

7.6.1.3 Habitats

Habitat Loss and Fragmentation

Where possible, habitats of Local Importance (Higher Value), such as tree line and hedgerow habitat types which lie within the footprint, or close to the footprint of the proposed development, that are not directly impacted by the proposed development will be retained. Habitats of higher value are being retained outside the footprint of the development, but within the red line boundary. All proposed works with adhere to the requirements of The BSI Standards Publication: BS 5837:2012 Trees in Relation to Design, Demolition and Construction. These areas will be protected for the duration of construction works and fenced off at an appropriate distance.

Any vegetation (including trees, hedgerows or scrub adjacent to, or within, the proposed development boundary) which is to be retained shall be afforded adequate protection during the construction phase in accordance with the *Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes* (National Roads Authority, 2006b), as follows:

- All trees and hedgerows within the proposed development boundary that are to be retained, both within and adjacent to the proposed development boundary (where the root protection area of the tree extends into the proposed development boundary), will be fenced off at the outset of works and for the duration of construction to avoid structural damage to the trunk, branches or root systems of the trees and hedgerows. Temporary fencing will be erected at a sufficient distance from the tree or hedgerow so as to enclose the Root Protection Area (RPA). The RPA will be defined based upon the recommendation of a qualified arborist.

- Where fencing is not feasible due to insufficient space, protection for the tree/hedgerow will be afforded by wrapping hessian sacking (or suitable equivalent) around the trunk of the tree and strapping stout buffer timbers around it.

- The area within the RPA will not be used for vehicle parking or the storage of materials (including soils, oils and chemicals). The storage of hazardous materials (*e.g.* hydrocarbons) or concrete washout areas will not be undertaken within 10 m of any retained trees, hedgerows and treelines.

- A qualified arborist shall assess the condition of, and advise on any repair works necessary to, any trees which are to be retained or that lie outside of the proposed development boundary but whose RPA is impacted by the works. Any remedial works required will be carried out by a qualified arborist.

- A buffer zone of at least 5m will be maintained between construction works and retained trees and hedgerows to ensure that the root protection areas are not damaged.

The proposed development will result in a total loss of c. 2.7km hedgerows, and 30 trees. Replacement planting will comprise of c. 4.86km of hedgerow and 57 trees within the proposed development site (see the Landscape Design Strategy Report[41] and Associated drawings for location map, planting schedule and specific details of proposed species). Native hedgerow planting will include the following species*; Alnus glutinosa, Corylus avellana , Crataegus monogyna, Ilex aquifolium, Lonicera periclymenum, Malus sylvestris, Prunus avium , Prunus spinosa, Rosa canina, Samucus nigris, and Viburnum opulus.* Tree planting will include semi-mature species such as: *Quercus petraea, Fagus sylvatica, Arbustus unedo, Pinus sylvestris, Betula pendula, Sorbus acuparia, Prunus avium plena*. There will also be woodland structure planting on the peripheries of the site and of the buildings, which will total c. 58,567m^2 of planting, and 3300 trees per/ha (i.e. an equivalent of approx.. 19 trees). This will ensure the proposed development complies with Objective 14.17 of the Clare County Development Plan 2017-2023 (as varied), and the requirement that any tree that will be felled will be replaced on the basis of a minimum ratio of 10 new native trees per 1 tree felled.

Existing hedgerows along the southern boundary that are less species rich, will be enhanced through additional planting of native species. The proposed planting will occur in phases (See Chapter 10 *Landscape And Visual Impact Assessment* of the EIAR, and the Landscape Design Strategy), with the earliest planting occurring along important foraging and/or commuting routes in the north, south and east of the site, at pre-construction stage and prior to removal of any habitats. This will ensure that suitable foraging and commuting habitat for lesser horseshoe bat is established prior to the removal of such habitat during the construction of the proposed development.

An area of *c.* 0.79ha of Annex I habitat dry calcareous grassland [6210], which occurs within the footprint of the proposed development in the location of the proposed SuDS basin, is to be translocated to the field to the south east, at the south western end of DC6, as shown on Dwg. ADC-L-001, in order to maximise its prospect of successful re-establishment in a new location. The conditions at the new location are suitable for the habitats re-establishment, as the habitat present is currently species poor amenity grassland. A Landscape and Biodiversity Management Plan[40] accompanies this application to advise the developer on the relocation and management of this habitat type within the proposed development.

The proposed methodology for translocation of this area of Annex I grassland habitat will include the following steps:

- Preparation – The area where the habitat is to be relocated will be prepared by stripping the topsoil to a depth of between c. 10-30cm.
- The donor site (*i.e.* location of existing Annex I dry calcareous grassland [6210]) and receptor site (*i.e.* location where habitat will be relocated to)s will be fenced off for the duration of construction works, to minimise any disturbance/ accidental damage to these habitats.
- Translocation - The soils of the grassland which are to be relocated are carefully removed using a suitable excavator, during suitable weather conditions, and laid out on the prepared receptor site.
- Again, the donor (including pre-existing Annex I grassland) and receptor sites will be fenced off for the duration of construction works, to minimise disturbance/ accidental damage to these habitats.
- Its establishment can be aided by following the correct management methods and by sowing the land with Irish wildflower seed mixes, which include positive indicator species for ‘this Annex I grassland. It will be ensured that this seed mix is of Irish origin to avoid planting invasive non-native species that will deteriorate the quality of the existing Annex I grassland.
- Management - Commitment to the Landscape and Biodiversity Management[40] plan will be required to ensure the successful establishment of the Annex I dry calcareous grassland on site. The proposed management will include mowing

the grass once a year, and the removal of the cuttings after the plants have seeded. The area under management will be fenced off, to avoid trampling, until the grassland has established.

- Monitoring - The areas of translocated habitat will be monitored annually for three consecutive years, and in addition five years and 10 years following completion. It may take some time for the newly relocated grassland to establish and success cannot be guaranteed.

The above proposed methodology will be included within the Landscape and Biodiversity Management Plan[40] and will need to be agreed with the local authority prior to construction.

Protection of Vegetation from Dust during Construction

To control dust emissions during construction works mitigation measures shall include: spraying of exposed earthwork activities and site haul roads during dry and/or windy conditions; provision of wheel washes at exit points; control of vehicle speeds and speed restrictions (20 km/h on any un-surfaced site road); covering of haulage vehicles; and, sweeping of hard surface roads. These procedures will be strictly monitored and assessed on a daily basis.

Specific mitigation measures to protect sensitive habitats, i.e. habitats of local importance or higher as outlined in Table 7.12, is included in Section 7.2.2 of the CEMP and in more detail in Chapter 8 *Air Quality & Climate*. A summary of these measures include:

- Good site management through good design, planning and effective control strategies by avoiding dust becoming airborne at source.
- Monitoring of dust levels will be carried out frequently, with quick response plans to adverse weather conditions.
- Site routes will be monitored with speed restrictions in place, and frequent use of bowsers during drier periods.
- During periods of dry and windy weather, watering of materials will be carried out to increase stability of soil. Works will be postponed during conditions with very high winds (gales) .
- Materials will be stored in sheltered areas of the site, with regular watering to ensure stability of the soil.
- Materials being transported off site will be enclosed or covered.
- A power washing facility or wheel cleaning facility will be installed near to the site compound for use by vehicles exiting the site when appropriate.

Habitat Degradation – Surface Water Quality

The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined above in Section 7.6.1.1, Section 7.6 of the CEMP and the construction Surface Water and Pollution Management plan[58].

Habitat Degradation – Groundwater

There will be no dewatering or alteration to the natural groundwater regime. The mitigation measures relating to the protection of water flow and water quality in karst

[58] *Surface Water and Pollution Management Plan, Art Data Centre*. Clifton Scannell Emerson Associates, June 2021.

conduits during construction are outlined in Section 7.6 of the CEMP and the construction Surface Water and Pollution Management Plan. A summary of these measures include:

- No works will be carried out within or within 10m of Toureen Lough, with no oil or subsoil storage in the vicinity of this feature.
- The swallow hole located south of DC56 will be clearly delineated and marked prior to construction and surrounded by a concrete ring with chamber and manhole cover. The swallow hole will be monitored daily to ensure it is free flowing and that there are no changes to the existing flow regime.
- The spring located north of DC6 will be clearly delineated and marked. No proposed works will occur within this feature, and a buffer zone of at least 10m will apply.
- Provision of exclusion zones and barriers (e.g. silt fences) will be used between earthworks, stockpiles and temporary surfaces to prevent sediment washing into the existing drainage systems and hence protecting the integrity of the features within the site.
- The ponds north of DC4 are in close proximity to the proposed development, however no construction activities will occur within these features. The DC4 structure will be 'built up' using engineered infill material.
- In areas where potential karst conduits are interpreted i.e. at proposed structures DC3 and DC6, additional geophysical surveying and a sufficient number of exploratory boreholes will be undertaken to further delineate areas of inferred conduit/ below ground flows. These building foundations will be piled, and the design of the piling methodology including pile depths/ spacing (m) designed to allow bridging of the existing [identified as potential] karst conduits i.e. ensuring no change to the existing groundwater flow regime across the site.

Measures to prevent the spread of invasive species during construction

The mitigation measures described in Section 7.6.1.1 are relevant for this section and apply here.

7.6.1.4 Bats

Measures to Protect Bats during the Removal of Suitable Roosting Sites

All bat species and their roost sites are strictly protected under both European and Irish legislation including:

- Wildlife Act 1976 and Wildlife (Amendment) Act, 2000 (S.I. No. 38 of 2000)
- Council Directive on the Conservation of Natural Habitats and of Wild Flora and Fauna 1992 (Council Directive 92/43/EEC)
- European Communities (Birds and Natural Habitats) Regulations, 2011

It is an offence under Section 23 of the Wildlife Acts 1976-2017 and under Section 51 of the European Communities (Birds and Natural Habitats) Regulations, 2011 to kill a bat or to damage or destroy the breeding or resting place of any bat species. Under the European Communities (Birds and Natural Habitats) Regulations it is not necessary that the action should be deliberate for on offence to occur. This places an onus of due diligence on anyone proposing to carry out works that might result in such damage or destruction. Under Section 54 of S.I. 477 of 2011, a derogation may be granted by the Minister where there is no satisfactory alternative and the derogation is not detrimental to the maintenance of the populations of the species to which the Habitats Directive relates at a favourable conservation status in their natural range. Given that the proposed development will result in the loss of a confirmed bat roost, a derogation licence under Section 54 of S.I. 477 of 2011 will be required[59].

The following mitigation measures are proposed in relation to structures with confirmed bat roosts, or are considered to have the potential to support roosting bats:

- Demolition of structures with confirmed bat roosts (i.e. BB 6C), and of buildings considered to have potential to support roosting bats (i.e. BB 1B, BB 4A-D, BB6A-B and BB 7) will be undertaken in March and April or in September, October and/or early November in daylight hours, during dry mild weather when daytime temperatures are above 10°C. Spring and autumn coincide with periods when bats are active, but are at least risk from disturbance as they are not undergoing hibernation or raising young.
- All structures that were confirmed as having potential for bat roosts will be re-examined immediately prior to demolition to assess whether bats are present at the time of demolition. This will be an all-night survey of these structures undertaken during suitable weather conditions to determine if bats enter the building during the night or early morning. If bats are present, then they will require exclusion from the property over several nights or, if possible, bats present will be physically removed by hand by a licensed bat specialist and placed in a bat box and then released in the evening after capture. The number, type and location of bat boxes to be included can be found in the Landscape and Biodiversity Management Plan[40]. 15 bat boxes are proposed for installation in the proposed development site.
- For structures which have not been confirmed as bat roosts that are due to be demolished but are regarded to have potential for bats, a bat detector survey of the property to be demolished will be carried out. If demolitions are proposed during the period of May to August and a bat roost is confirmed to be present, the proposed demolition will not be permitted. This will be an all-night survey undertaken during suitable weather conditions to determine if bats enter the building during the night or early morning. If bats are present, then they will require exclusion from the property over several nights or if possible, bats present will be physically removed by hand by a licensed bat specialist and placed in a bat box and then released in the evening after capture.
- Once structures containing roosts are deemed to be clear of bats, the bat specialist will be on site to supervise the demolition procedure until the structure is no longer deemed able to support a bat roost. This is because bats may re-enter a partially demolished structure overnight.

Measures to Protect Bats during Vegetation Clearance

The following mitigation measures are proposed in relation to those trees identified as having potential to support roosting bats (Figure 7.23). Bats could occupy suitable roosting features at any time prior to the commencement of works. Therefore, there is an inherent risk that bats could be affected by the proposed felling works. Where possible, trees with PRFs should be retained. Where this is not possible, the following mitigation procedures will be followed:

[59] If a bat roost is identified during pre-construction stage in a structure or tree, a derogation licence will be sought from NPWS.

- Felling of confirmed and potential tree roosts will be undertaken during the periods of April to May or September to October as during this period bats are capable of flight and may avoid the risks from tree felling if proper measures are undertaken, but also are neither breeding nor in hibernation
- Use of detectors alone may not be sufficient to record bat emergence and re-entry in darkness. Therefore, prior to felling of confirmed and potential tree roosts, an emergence survey using infra-red illumination and video camera(s) and bat detectors will be carried out on the night immediately preceding the felling operation to determine if bats are present
- Where it is safe and appropriate to do so for both bats and humans, such trees may be felled using heavy plant to push over the tree. In order to ensure the optimum warning for any roosting bats that may still be present, the tree will be pushed lightly two to three times, with a pause of approximately 30 seconds between each nudge to allow bats to become active. The tree should then be pushed to the ground slowly and should remain in place until it is inspected by a bat specialist
- Trees should only be felled “in section” where the sections can be rigged to avoid sudden movements or jarring of the sections
- Where remedial works (*e.g.* pruning of limbs) is to be undertaken to trees deemed to be suitable for bats, the affected sections of the tree will be checked by a bat specialist (using endoscope under a separate derogation licence held by that individual) for potential roost features before removal. For limbs containing potential roost features high in the tree canopy, this will necessitate the rigging and lowering of the limb to the ground (with the potential roost feature intact) for inspection by the bat specialist before it is cut up or mulched. If bats are found to be present, they will be removed by a bat specialist licenced to handle bats and released in the area in the evening following capture
- If any bat tree roosts are confirmed, and will be removed by the proposed felling works, then a derogation licence will be required from the NPWS and appropriate alternative roosting sites will be provided in the form of bat boxes.

Measure to control and reduce light spill during construction

During construction, the use of security lighting such as that around the construction compound could impact on commuting/foraging territory, however night works will not be undertaken during construction. During winter months when days are shorter, there may be a temporary level of light spill from the construction compound either side of sunrise/sunset. This will be during hibernation period for bats however, and impacts will be minimal. Therefore, mitigation is recommended for the temporary impact of light spill of bat species.

Security lighting at construction compounds or in active works areas in close proximity to bat commuting and/or foraging areas will be designed in conjunction with the EcOW/bat ecologist to minimise light spill. Measures to reduce light spill may include the following:

- the use of sensor/timer triggered lighting;
- LED luminaires will be used where possible due to their sharp cut-off, lower intensity, good colour rendition and dimming capability;
- column heights will be considered to minimise light spill; and,

- accessories such as baffles, hoods or louvres will be used to reduce light spill and direct it only where needed.

Measures to reduce impacts from habitat loss

The proposed development will result in a total loss of *c.* 2.7km hedgerows, and 30 trees; therefore replacement planting is required to ensure that there will be no net loss of lesser horseshoe bat foraging and commuting habitat as a result of the proposed development, and to ensure there will be no impact on local bat species, See Section 7 of the NIS (Scott Cawley, 2021), and Section 7.6.1.1 above. This will comprise of *c.* 4.86km of hedgerow and 57 trees within the proposed development site (see the Chapter 10 *Landscape and Visual Impact Assessment*[39], and the Landscape Design Strategy[41] for location map, planting schedule and specific details of proposed species). Native hedgerow planting will include the following species; *Alnus glutinosa*, *Corylus avellana*, *Crataegus monogyna*, *Ilex aquifolium*, honeysuckle *Lonicera periclymenum*, *Malus sylvestris*, *Prunus avium* , *Prunus spinosa*, *Rosa canina*, *Samucus nigris*, and *Viburnum opulus*. Tree planting will include semi-mature species such as: *Quercus petraea*, *Fagus sylvatica*, *Arbustus unedo*, *Pinus sylvestris, Betula pendula*, *Sorbus acuparia*, *Prunus avium plena*. There will also be woodland structure planting on the peripheries of the site and of the buildings, which will total c. 58,567m^2 of planting, and 3300 trees per/ha. This will ensure the proposed development compiles with Objective 14.11 of the *Clare County Development Plan 2017-2023 (As varied)*, and the requirement that there is no net loss of lesser horseshoe bat habitat within the proposed development.

This proposed planting has been designed to ensure that connectivity for foraging and commuting bats is maintained - *i.e.* along the peripheries of the site, and within the site from the woodland in the north west to suitable foraging habitats such as Toureen Lough, and along hedgerows in the north to woodland and wetland habitats in the east, also ensuring connectivity is maintained to/from roost buildings.

Existing hedgerows along the southern boundary that are less species rich, will be enhanced through additional planting of native species. The proposed planting will occur in phases. with the earliest planting occurring along important foraging and/or commuting routes in the north, south and east of the site, at pre-construction stage and prior to removal of any habitats. This will ensure that suitable foraging and commuting habitat for bat species is established prior to the removal of such habitat during the construction of the proposed development; therefore maintaining the site’s suitability for local bat species. Cattle grazed fields are known to have higher rates of bat activity than ungrazed grassland (Downs et al. 2010)[60]; therefore, in addition to the hedgerows and treeline planting, areas of cattle grazed grassland will be maintained as they are currently in the east, north and west of the site with additional hedgerows separating fields, to provide further suitable habitat for lesser horseshoe bat.

7.6.1.5 Otter

As the otter populations that utilise the proposed development are considered to be part of European site populations downstream and hydrologically connected to the site (i.e. Lower River Shannon SAC and Dromore Woods and Loughs SAC), any mitigation measures required to prevent impacts on this species are discussed in Section 7.6.1.1

[60] Downs, N., & Sanderson, L. (2010). Do Bats Forage Over Cattle Dung or Over Cattle?. *Acta Chiropterologica*, *12*(2), 349-358.

above, and in Section 7 of the NIS produced as part of this planning application (Scott Cawley, 2021).

7.6.1.6 Badger

Disturbance/displacement

The mitigation measures described below follow the recommendations set out in the *Guidelines for the Treatment of Badgers during the Construction of National Road Schemes* (National Roads Authority, 2006). These guidelines set out the best practice approach in considering and mitigating impacts on badgers during construction works.

As the usage of setts by badgers can change over time, a pre-construction check of the activity status of all setts will be carried out within 12 months of any construction work commencing within the ZoI of the setts discussed below.

As badgers could potentially establish new setts in the future within the ZoI of the proposed development, a pre-construction check of all suitable habitat within the proposed development boundary will be required within 12 months of any constructions works commencing. Any new badger setts present will be afforded protection in line with the requirements set out in the TII/NRA guidance document as follows:

- Badger setts will be clearly marked and the extent of bounds prohibited for vehicles clearly marked by fencing and signage
- No heavy machinery shall be used within 30m of badger setts; lighter machinery (generally wheeled vehicles) shall not be used within 20m of a sett entrance; light work, such as digging by hand or scrub clearance shall not take place within 10m of sett entrances
- During the breeding season (*i.e.* December to June inclusive), none of the above works shall be undertaken within 50m of active setts, nor blasting or pile driving within 150m of active setts
- Works can be undertaken within these zones following consultation with, the approval of and, if required, under the supervision of a badger ecologist

As the proposed development will not result in the loss of any badger setts, there is no requirement to construct any artificial setts as part of the mitigation strategy.

7.6.1.7 Other Mammals (including pine marten and Irish hare)

The construction phase of the proposed development is not deemed to affect the local mammal population and will not result in a likely significant negative effect, at any geographic scale. However, mitigation is provided should small mammals (*e.g.* pygmy shrew and hedgehog) become trapped in excavations or pits required for construction activities. During construction, the use of egress ramps in any pits or holes that have been dug on site is required. This will allow for any mammal species that have fallen in, to allow to escape and be unharmed by construction activities.

7.6.1.8 Breeding birds

Measures to Protect Breeding Birds During Construction from mortality/injury

Vegetation (*e.g.* hedgerows, trees, scrub and grassland) will not be removed, between the 1st March and the 31st August, to avoid direct impacts on nesting birds.

Disturbance/displacement

Similar to the requirements provided above in terms of reducing mortality risk, vegetation clearance undertaken in the appropriate time should ensure that direct impact on nesting birds will not occur.

7.6.1.9 Wintering birds

Measures to Reduce impacts to wintering birds due to vegetation loss

In the absence of any other ecological requirement/constraint, the removal of screening vegetation from adjacent or within/adjacent to inland forage/resting sites used by wintering bird species (i.e. pond features in the north west) shall be undertaken outside the statutory breeding bird season (March 1st to August 31st) and before the arrival of wintering birds. Thus, vegetation clearance in areas adjacent to or within/adjoining or near feeding sites should be scheduled for September.

Only that vegetation, which is absolutely necessary shall be removed, with very little suitable habitat being removed/altered, the remainder shall be fenced off from works activity (as necessary) in accordance with accepted landscaping protocols.

Measures to prevent Disturbance and Displacement Impacts

The proposed location of the temporary (suggested 2 years) construction compound is in open grassland in the south of the site. Given the proximity of the compound to known feeding sites *i.e*. Toureen Lough, M18 Motorway attenuation pond, within the proposed development site, the following measures should be put in place to minimise disturbance to wintering bird species at this location.

The compound shall be established outside of the wintering bird season (*i.e.* October to March);

- The compound shall be fully screened on all sides for the duration of the works. The screening shall be put in place before the arrival of wintering birds;
- In respect of the physical screening, particular attention should be paid to the west side and additional noise reducing material installed to minimise potential impact on habitat for wintering bird species;
- The normal hours of operation within the compound shall correspond to daylight working hours (8am – 6pm), when background traffic noise on adjacent road may “mask” construction noise within the compound; and
- Outside of work hours during winter months (i.e. 07:30-17:30) shall only be carried out in areas which do not support or impinge on wintering bird species feeding or movement.

Habitat Degradation- Water Quality

The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined above in Section 7.6.1.1, in Chapter 6, *Hydrology* and detailed in Section 7.6 of the CEMP.

7.6.1.10 Amphibians

Disturbance & Mortality Risk

If works to clear any of the habitat features suitable to support common frog are to begin during the season where frogspawn or tadpoles may be present (February – mid-summer), a pre-construction survey will be undertaken to determine whether breeding common frogs are present.

Any frog spawn, tadpoles, juvenile or adult frogs present will be captured and removed from affected habitat by hand net and translocated to the nearest area of available suitable habitat, beyond the ZoI of the proposed road development.

Any capture and translocation works shall be undertaken immediately in advance of site clearance/construction works commencing and will require a licence from NPWS.

Habitat Degradation- Water Quality

The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined above in Section 7.6.1.1, in Chapter 6, *Hydrology* and detailed in Section 7.6 of the CEMP.

7.6.1.11 Reptiles

Habitat Loss, Disturbance & Mortality Risk during Construction

Given the broad range of habitat types favoured by the common lizard, and that the majority of the proposed development contains mosaics of such habitats, site clearance works at any time of year in suitable habitat are highly likely to encounter the species, cause disturbance and have the potential to kill or injure individuals.

In order to minimise the risk of site clearance and construction works disturbing, or causing the mortality of, common lizard the following schedule of site clearance works will be followed in any areas of suitable habitat that will be removed (*i.e.* scrub, stone walls, exposed rock, dead wood):

- Grass or scrub vegetation will be removed during the winter period, where possible, avoiding potential common lizard hibernacula sites (dry sites which provide frost-free conditions *e.g.* stone walls, underground small mammal burrows, piles of dead wood or rubble).
- Where this is not possible and clearance will be undertaken during the active season (*i.e.* March through to September, inclusive), vegetation will be cut first to approximately 15cm, and then to the ground, under supervision of an ecologist. This will allow the opportunity for lizards to be displaced by the disturbance and leave the affected area.
- Stone walls (or other potential hibernacula sites) will be removed during the active season (*i.e.* March through to September, inclusive) under the supervision of an ecologist, when they are less likely to be in use by torpid lizards.

7.6.1.12 Fish

Habitat Degradation – Surface Water Quality

The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined in above in Section 7.6.1.1, in Chapter 6 *Hydrology* and detailed in Section 7.6 of the CEMP.

Habitat loss

The culvert and headwall and mattress have been designed in consultation with IFI and in accordance with the design criteria set out in *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI, 2016).

To minimise the effects of habitat loss on fish species, all sections of river/stream channel within the proposed development boundary, but not within the footprint of the proposed Project and associated infrastructure, will be protected from site clearance and construction works. Rivers/streams will be fenced off at a minimum distance of 5m from the riverbank and within this zone the natural riparian vegetation will be retained.

7.6.1.13 Invertebrates

White-clawed crayfish

The mitigation measures relating to the protection of water quality and to reduce the impact of habitat loss in receiving watercourses during construction are outlined above in Section 7.6.1.1 and detailed in Section 7.6 of the CEMP.

7.6.2 Operational Phase

7.6.2.1 European sites

The mitigation measures that are specifically required to ensure that the proposed development will not adversely affect the integrity of the European sites within the ZoI (*i.e.* Lower River Shannon SAC, Dromore Woods and Loughs SAC, Old Domestic Building (Keevagh) SAC, Old Domestic Buildings, Rylane SAC, River Shannon and River Fergus Estuaries SPA, Ballyallia Lough SPA, and Corofin Wetlands SPA) are presented in the NIS and below. Following a consideration and assessment of the proposed development on the identified relevant European sites, the following mitigation measures were development to address potential impacts that were identified:

Measures to protect surface water quality during operation and prevent impacts on SCI/QI species

Foul water

A temporary trench excavation along the Tulla road will be undertaken to facilitate pipe laying for connection with the existing public wastewater sewer and mains water supply.

There is no trade effluent proposed for this development. Foul sewage will be collected from site (i.e. from the data storage facility, offices and energy centre washroom facilities and canteen) and discharged through a new pumping station which will be constructed as part of this proposed development, to the foul drainage network which runs along the Tulla Road and ultimately discharges to Ennis North (Clonroadmore) WWTP Reg D0048. Ennis North WWTP has no capacity issues and consultation with Clare County Council has confirmed that sufficient wastewater capacity is available and a pre-connection enquiry PCE application form has been submitted to Irish Water (IW).

Surface water

The proposed surface water drainage service to the development comprises various drainage components including positive stormwater networks, attenuation systems and several Sustainable Drainage System (SuDS) elements. Stormwater will be attenuated on site for the 1:1,000 year flood event. An over flow subsurface pipeline will discharge at current discharge rates (greenfield) to the Spancelhill Stream (Ballymacahill River).

The roofs, yards and internal access roads proposed throughout and within the footprint of the proposed development will be drained through a sealed drainage system that will ultimately be collected by gullies and conveyed through a series of proposed storm water pipes prior to discharging into a proposed open attenuation basin. The proposed stormwater drainage networks will range from 225mm to 1050mm pipe diameter depending on the required flow capacity. It is proposed to drain the site using a network of SuDS swales along the edge of the internal road network where possible. Reinforced grass-crete or similar will also be used along parts of the road network to increase infiltration on less heavily trafficked access roads. These drains and swales will discharge to a surface water retention pond/attenuation pond where the discharge will be controlled using a vortex flow control to limit the maximum discharge for the 0.1% Annual Exceedance Pollution event (1:1000-year return period). The attenuation pond to be constructed to retain a constant volume of water to promote settling and reduce conveyance of suspended solids and other particles to the receiving waters. An attenuation volume of 6864 m^3 is designed as part of the proposed development. Further details are provided in Chapter 7 of the EIAR and within the CSEA engineering report prepared for planning.

<u>Measures to prevent disturbance and displacement of lesser horseshoe bats</u>

During operation, the strategies in place are to limit the duration of the lighting at night and also limit lux levels wherever possible. However, there is potential for light spill from the proposed development on suitable areas of foraging and/or commuting habitats used by lesser horseshoe bats. There will also be the addition of lighting along new pathways on the Tulla Road, which will be turned on during the hours of darkness for safety reasons. A light spill modelling drawing has been used to indicate where any areas of light spill may be within and beyond the proposed development, prior to mitigation[56]. The following mitigation measures will be in place to ensure the habitats on site remain suitable for lesser horseshoe bats:

- Street lighting within the development is required for safety and will not be operational at night unless in an emergency and site evacuation, and will consist of minimal number of light fixtures and installed on short poles with the use of shields to restrict beam angles and avoid light spillage where illuminance is not required;
- Tree and hedgerow planting will be implemented around the buildings and along the access roads to screen the development, planted at pre-construction to ensure sufficient screening is in place to prevent any light spill on areas of sensitivity for bats within the proposed development;
- The use of berms along adjacent to the main entrance of the site will further screen any lighting on Tulla Road, by increasing the height of initial planting carried out;

- Office lighting will be controlled to avoid light spill to the outdoors through the glass windows, using black-out blinds from dusk until dawn;
- External lighting for pedestrian pathways and low-traffic roads will be controlled and dimmed and will only be at higher Lux levels when required, i.e. during emergencies, and with the use of shields to limit the light emitted to above or to the sides;
- LED luminaries will be used to ensure light pollution is kept to a minimum and to avoid uplighting. Where practical, directional luminaries will be utilised to enable precise projection of light;
- External lighting will normally be turned off, and internal building lighting will be controlled by PIR switching;
- The light spill model demonstrates that prior to mitigation light spill from the Tulla Road lighting will be more than 0.1 Lux in areas of bat sensitivity, this does not take into account the planting that will be in place, which will develop over time, reducing any light spill onto adjoining areas used by local bat species to negligible levels (0.1 Lux or lower);
- During night-time hours, lighting will only be provided for circulation areas with no lighting on surrounding areas, including protected important foraging and/or commuting areas for bats; and
- There will be no light trespass over 0.1 Lux on surrounding areas beyond the buildings by the use of shielded luminaries, lighting beam angles, low height street lighting columns, and minimal numbers of luminaries used.

7.6.2.2 National sites

The mitigation measures that are specifically required to ensure that the proposed delopment will not adversely affect the integrity of the National sites within the ZoI, and that overlap with previously described European sites (*i.e.* Fergus Estuary and Inner Shannon, North Shore pNHA, Old Domestic Building (Keevagh) pNHA, Ballyallia Lake pNHA, and Dromore Woods and Loughs pNHA), are presented in the NIS and summarised above in 7.5.1.1. Therefore, the mitigation measures outlined above in Section 7.6.2.1, and as detailed in the NIS, will prevent the proposed development resulting in a significant negative effect on these pNHA sites at the national geographic scale.

Durra Castle pNHA

The mitigation strategy in relation to potential impacts arising from the proposed development on Durra Castle pNHA includes mitigation to prevent disturbance and displacement impacts on lesser horseshoe bats on suitable foraging and/or commuting grounds, within the normal foraging range of this species (See Section 7.6.2.1)

7.6.2.3 Habitats

Measures to Protect Surface Water Quality during Operation

Mitigation measures to protect surface water in the receiving local environment during operation are detailed above in Section 7.6.2.1, in Chapter 6: Hydrology, and in the Construction Environmental Management Plan (CEMP), and include: -

- Continued management, monitoring and maintenance of the waste water pumping system in accordance with Irish Water requirements.

- Runoff from the site will be attenuated within the on-site attenuation tanks, swales, and a hydrobrake will also be employed to control the rate of discharge. In combination, these SuDS measures significantly reduce the volume and rate of surface water discharging from the site.

- The SuDS treatment train will pre-treat the surface water discharging to the Spancelhill Stream, removing pollutants and hydrocarbons from the surface water runoff.
- There will be no direct run-off from hard stand areas to the karst conduit systems or Toureen lough.

These mitigation measures are for the protection of the water quality within Toureen Lough, Spancelhill Stream, River Fergus, and for the protection of European Sites downstream as there are significant effects likely to arise on European sites as a result of water quality impacts associated with the proposed development, as discussed above in Section 7.5.1.

Habitat Degradation- Air Quality

A described in Section 7.5.2.3, the operational phase impact of the proposed development on designated sites is considered to be not significant at any geographic level, and therefore requires no mitigation measures.

7.6.2.4 Bats

Measures to Control and Reduce Light Spill During Operation

A light spill model study of the proposed development site was undertaken by Hurley Palmer Flatt (June 2021) to determine the effects of artificial light and Artificial Light At Night (ALAN) on bats as a result of the proposed development and identify how to reduce or eliminate ALAN onsite, based on information from both Eurobats Guideline No.8, the Institution of Lighting Professionals (ILP) Guidance Note No.8. and Bat Conservation Ireland Guidance Notes for: Planners engineers, architects and developers. The mitigation as described above in Section 7.6.2.1, also applies for all bat species using the proposed development site.

To ensure important bat corridors are maintained throughout the site before, during and after construction, a 30m dark zone buffer will be in place along hedgerows and treelines within the site wherever possible, and along the Clare County Council Ecological buffer zones (Figure 7.24).

7.6.2.5 Otter

As the otter populations that utilise the proposed development are considered to be part of European site populations downstream and hydrologically connected to the site (i.e. Lower River Shannon SAC and Dromore Woods and Loughs SAC), any mitigation measures required to prevent impacts on this species are discussed in Section 7.6.2.1 above, and in Section 7of the NIS produced as part of this planning application (Scott Cawley, 2021).

7.6.2.6 Badgers

The operation of the proposed development is not predicted to result in any significant effects to populations of badger in the vicinity of the proposed development. Therefore, no mitigation is proposed.

7.6.2.7 Other Mammals (including pine marten and Irish hare)

The operation phase of the proposed development is not deemed to affect the local mammal population and will not result in a likely significant negative effect, at any geographic scale. As such, no mitigation is proposed.

7.6.2.8 Breeding Birds

Habitat Loss and Loss of Breeding / Resting Sites

Re-planting of treeline, hedgerow and scrub habitats within/alongside the proposed project boundary as detailed in the landscape drawings will over time provide suitable compensatory habitat for the breeding bird species to expand, and disturbance/displacement impacts occurring during the construction phase should reduce.

To further minimise the effects of breeding habitat loss, a total of 15 nest boxes will be erected by a qualified ecologist. The siting and type of nest boxes will be decided on by an ecologist at locations adjacent to where new trees will be planted or at suitable retained vegetation along the proposed development. More detail on location, and type of bird box can be found in the Landscape and Biodiversity Management Plan[40] submitted as part of this development.

7.6.2.9 Wintering birds

Habitat Degradation- Surface Water

In areas where the proposed development will result in an increase in the impermeable surface area, SuDS measures in the form of bioretention areas, swales, filter drains, rain gardens/ bioswales, tree pits oversized pipes and flow control devices, will be installed. These SuDS systems will reduce both the volume and rate of surface waters discharging into the existing surface water drainage network, as well as improving the environmental quality of any such discharges.

Measures to prevent to Disturbance and Displacement Impacts to Wintering Bird species

As part of the landscape plan and following on from completion of works in particularly sensitive and areas of suitable habitat, namely Toureen Lough, the M18 attenuation pond in the western boundary, and wetlands in the east and north of the site; the re-establishment of vegetation in a timely manner will be critical. It will be done outside of the wintering bird season, and will be done during the early stages of the phasing of the development. This early planting will screen off the development from important features and areas of suitable habitat for wintering birds, and there will not be any significant impact on wintering birds as a result of disturbance and displacement impacts, at any geographic scale.

7.6.2.10 Amphibians

In areas where the proposed development will result in an increase in the impermeable surface area, SuDS measures in the form of bioretention areas, swales, filter drains, rain gardens/ bioswales, tree pits oversized pipes and flow control devices, will be installed. These SuDS systems will reduce both the volume and rate of surface waters discharging into the existing surface water drainage network, as well as improving the environmental quality of any such discharges.

7.6.2.11 Fish

Habitat Degradation – Surface Water

The mitigation measures relating to the protection of water quality in receiving watercourses during operation are detailed above in Section 7.6.2.1 and in Section 7.6 of the CEMP.

Habitat Severance/Barrier Effect

The culvert with headwall and mattress have been designed in consultation with IFI and the design criteria set out in the Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (IFI, 2016). This will maintain fish passage during the operation of the proposed development and therefore, will result in a neutral impact to fish species.

7.7 COMPENSATION

There are a number of compensation measures that will be utilised as part of the proposed development site, that will ensure that habitats and biodiversity found within the site are maintained and enhanced where possible, and additional measures proposed as part of the mitigation strategy provided above in Section 7.6 will be implemented in full and in accordance with best practice guidelines.

Hedgerows are a key habitat within the proposed development site, valued as being of local (higher) importance, and forming a key network of green corridors across the site. The retention of as many of these corridors as possible and the enhancement of the existing green network through new additional corridors has been a key consideration in the design of the landscape around the Data Centres. New woodland belts and hedgerows that provide new and replacement connections across the site are utilised, with 4.86km of new native hedgerow planting proposed, as well as c. 58,567m^2 of woodland planting. Only native species, and species that are already found within the site, will be planted. The retention and enhancement of existing hedgerows, with additional planting of native hedgerows will provide commuting and foraging routes for local bat species across the site, and will maintain access to/from roost sites and particularly active foraging areas of the site (Toureen Lough, woodland in the north west, hedgerows in the east). These hedgerows will also provide commuting corridors, foraging areas and suitable habitat for a range of other mammals, birds, invertebrates, and reptiles.

There will be a loss of dry meadows and grassy verges within the footprint of the proposed development. Whilst this habitat is valued as being of local (lower) importance based on the common species found here and availability of this habitat in the wider environs, compensation for the loss of this habitat is included. Meadow grasslands are proposed around the edges of the Data Centres, with c. 5.5ha proposed. These grasslands will include wildflowers such as *Lotus corniculatus, Medicago lupulina, Hypochaeris radicata, Lythrum salicaria, Silene flos-cuculi, Trifolium pratense, Agrostemma githago, and Succisa pratensis* (full list of species can be found in the Landscape Design Strategy Report[41]). These meadow grasslands will provide opportunities for a range of pollinators and other invertebrates, in addition to provide habitat for foraging birds, bats and other mammals. Feature trees and smaller tree species are also proposed within this habitat, the majority of which are seed or fruit bearing, which will offer foraging habitat for birds and mammal species.

The proposal also includes the implementation of woodland embankments, planted up with a mixture of native woodland trees, of varying ages, and structure. The embankment ground beneath the trees will be left bare to provide a suitable attractive habitat for solitary bees, further contributing to the biodiversity of the site.

A SuDS basin is proposed in the west of the site, with a swale proposed along the new road network to the south of DC3. These two features will be seeded with meadow grassland and will form part of the wider meadow grassland landscape. The base of the SuDS basin will be seeded with a wetland meadow mix that is tolerant of flooding. The SuDS basin will add to the wetland areas around the site further contributing to the biodiversity and wildlife of the area.

A Landscape and Biodiversity Management Plan[40] has been produced as part of this planning application *'to provide landscape, visual and environmental screening and enhancement measures through planting and design' (Clare County Council, 2019).* This plan will provide a practical and comprehensive guide that can be referred to and consulted by the local authority, the developer, and their appointed contractors, and the future operator of the Data Centres.

7.8 CUMULATIVE IMPACTS

This section of the report presents the assessment carried out to examine whether any other plans or projects have the potential to act in combination with the proposed development to to give rise to likely significant effects on biodiversity.

The majority of the immediately surrounding lands are not zoned currently. However the area described as 'Buffer Space' by Clare County Council (2019), is currently designated as an ecological protection area and free from development. The lands to the north of the proposed development site are zoned as *O2 – General*; to the immediate east is the substation, *zoned* as N3.2 – Electricity; and further east towards Ennis is mainly zoned as *R2 - Existing residential.* To the south east, there is a site zoned as *C2.1 - Industrial, enterprise, employment,* and to the west, there is a site also zoned for *O2 – General.* Beyond the residential zoning south east of the site, is a large area of land zones as *G3 - Conservation, amenity or buffer space, corridor/belt, landscape.* The most likely cumulative effect of other future development with the proposed development on the receiving environment is the potential for other pollution sources within the Fergus River sub-catchment, the Shannon Estuary North catchment and the River Shannon Catchment, and any other catchments that also drain to the Shannon Estuary to cumulatively affect water quality in the receiving surface water, estuarine and marine environments (See Chapter 6 *Hydrology*).

There are a number of granted planning permissions, and appealed planning permissions, for residential or other small-scale developments, such as construction of housing developments, sporting facilities, renovation of a school, telecommunications services and residential renovations *etc.* in the vicinity of the proposed development site, as well as larger scale developments in close proximity to the proposed development site, some of which may be in construction at the same time as the proposed development. A list of these projects considered in the cumulative impacts assessment is included in Chapter 3, Appendix 3.1.

Potential cumulative impacts may arise during construction and operation, as a consequence of the proposed development acting in-combination with other plans and projects, on water quality in the downstream surface water environment, disturbance to birds, bats, small mammals and badger, otter as well as loss of potentially important habitats and subsequently habitat loss to bats, birds, small mammals, otters and badger.

There is potential for cumulative impacts to arise with other local developments that would also result in increased noise, vibration, human presence and lighting. However, as any disturbance effects from other such local developments are likely to be or a minor nature, temporary, localised and over a short-duration, they are not likely to cumulatively affect the local badger, small mammal, breeding bird, otter or bat populations in conjunction with the proposed development.

This NIS has examined and analysed the potential impact sources and pathways from the proposed development on European sites, and how these could impact on European sites' qualifying interests/special conservation interests and whether the predicted impacts would adversely affect the integrity of; Lower River Shannon SAC, Dromore Woods and Loughs SAC, Old Domestic Building (Keevagh) SAC, Old Domestic Buildings, Rylane SAC, River Shannon and River Fergus Estuaries SPA, Ballyallia Lough SPA, Slieve Aughty Mountains SPA, and Corofin Wetlands SPA. This is in light of the best scientific knowledge, and with respect to those European sites within the zone of influence of the proposed development. There are no other European sites at risk of effects from the proposed development.

Avoidance, design requirements and mitigation measures are set out within the NIS [and its appendices] and they ensure that any impacts on the conservation objectives of European sites will be avoided during the construction and operation of the proposed development such that there will be no risk of adverse effects on these European sites.

It has been objectively concluded by Scott Cawley Ltd., following an examination, analysis and evaluation of the relevant information, including in particular the nature of the predicted impacts from the proposed development, that the proposed development, either alone or in combination with other plans or projects, will not adversely affect (either directly or indirectly) the integrity of any European site.

There is the potential for other pollution sources within the Spancellhill Stream, the River Fergus, the Shannon Estuary North WFD catchment and any other catchments that also drain to the Fergus Estuary to cumulatively affect water quality in the receiving estuarine and marine environments.

The potential for in combination effects to arise in Fergus Estuary from any existing or proposed land use plans or developments is regulated and controlled by the environmental protective policies and objectives of the *Clare County Development Plan 2017-2023*. Any existing/proposed plan or project that could potentially affect Lower River Shannon SAC, Dromore Woods and Loughs SAC, Old Domestic Building (Keevagh) SAC, Old Domestic Buildings, Rylane SAC, River Shannon and River Fergus Estuaries SPA, and Ballyallia Lough SPA, or any other European site, in combination with the proposed development, must adhere to these overarching environmental protective policies and objectives. These policies and objectives will ensure the protection of the European site within the zone of influence of the proposed development, and include the requirement for any future plans or projects to undergo Screening for Appropriate Assessment and/or Appropriate Assessment to examine and assess their effects on European sites, alone and in combination with other plans and projects.

There are specific objectives and policies in the *Clare County Development Plan 2017-2023 Variation no. I* to protect biodiversity, and specifically European sites. Policies CDP2.1 , CDP14.2 , CDP14.3, relate to the protection of European sites, AA and commitments to not permitting projects giving rise to adverse effects on the integrity of European sites without demonstrating there are no alternatives, there are imperative reasons of overriding public interest, and undertaking all compensation measures necessary to ensure the overall coherence of the network of European sites. The *Limerick County Development Plan 2010-2016* also includes policies to protect (from risk of pollution), manage and enhance the counties' surface water and groundwater resources, protect, conserve and enhance habitats, species and areas of European and national importance (CP 10, SE 01, ED P7, EH 01, EH 02, EH 03, EH 04, CP 10, SE 01, IN P11).

The environmental protective policies and objectives set out in the *Clare County Development Plan 2017-23* are mirrored in the Shannon Town and Environs Local Area Plan 2012-2018 in terms of the protection of European sites (policy B2) and the protection of County Clare's surface water and groundwater resources (policy W1, W2, W4, W5, W7).

Land use plans for the other local authorities (*e.g.* Galway County Council and Kerry County Council) whose functional areas include surface water features which drain to

Fergus and Shannon Estuaries, were examined and analysed and those land use plans also include protective environmental policies to protect European sites (Policy NHB 1 in Galway, and Policies NE-2, NE-11, NE-12 and NE-30 in Kerry) and the receiving surface water environments (i.e. policies FL 1, WW 1, WS 5, and NHB 4 in Galway, and Policies NE-18, NE-19, NE-20, NE-22, NE-23, NE-24 and NE-26 in Kerry).

7.9 RESIDUAL IMPACTS

The assessment, presented in the NIS, of the potential for the proposed development to impact upon the Lower River Shannon SAC, Dromore Woods and Loughs SAC, Old Domestic Buildings (Keevagh) SAC, Old Domestic Buildings, Rylane SAC, Ballyallia Lough SPA, River Shannon and River Fergus SPA, Sieve Aughty Mountains SPA and Corofin Wetlands SPA concluded that, with the implementation of the mitigation measures proposed, the proposed development, either on its own or in combination with other plans or projects, does not pose a risk of adversely affecting (either directly or indirectly) the integrity of these, or any other, European sites.

As discussed above, the proposed development has the potential to affect nationally designated areas for nature conservation downstream of the proposed development site due to the potential for effects on the receiving aquatic environment prior to mitigation. The proposed development will result in some habitat loss within the proposed development site. The proposed development has the potential to affect habitats indirectly as a result of habitat loss, hydrological, air quality, and disturbance and displacement impacts. It also has the potential to result in likely significant effects on amphibians, breeding birds, bats, badgers, wintering birds, other mammals, invertebrate, fish and reptiles at a local level, and the lesser horseshoe bat, otter, QI fish species, and SCI wintering birds at the international level.

The above impacts will not result in any significant residual negative effects on biodiversity, following the implementation of mitigation measures that will be undertaken. The landscape plan will ensure that the biodiversity value of the habitats to be retained and created as part of the proposed development are maximised in support of their important functions. A comprehensive suite of mitigation measures is proposed, in addition to the extensive and stringent environmental control measures that have been incorporated into the design of the proposed development. The development has been designed by an iterative process, to ensure that potential impacts are minimised and mitigated by design. These measures are included in Section 7.4. All of the mitigation measures will be implemented in full and are best practice, and tried and tested, effective control measures to protect biodiversity and the receiving environment.

Considering the elements included within the design of the proposed development (as described in the Project Description), and the implementation of the mitigation measures proposed in the EIAR and the associated planning application documents, to avoid or minimise the effects of the proposed development on the receiving environment, no likely significant residual effects on biodiversity are predicted. See Table 7.13 below for summary of potential impacts, mitigation, compensation and enhancement measures, and residual impacts of the proposed development.

Table 7.13 Summary of potential impacts, mitigation, compensation and enhancement measures, and residual impacts of the proposed development

Ecological Receptor	Ecological Valuation	Impacts with Potentially Significant Effects	Potential Significance of Effects	Mitigation, Compensation and Enhancement Measures	Significance of Residual Effects
Designated Sites					
Lower River Shannon SAC	International	Accidental pollution event during construction draining to watercourses and degrading habitats/QI species Otter habitat loss/fragmentation in the Spancelhill Stream Disturbance and/or displacement of otter Habitat degradation as a result of introducing non-native invasive species	International	Water protection measures on water quality for downstream QI habitats and species Pre-construction checks of Spancelhill Stream No night working adjacent to suitable otter habitat Measures to prevent introduction of non-native invasive species	None
Dromore Woods and Loughs SAC	International	Otter/lesser horseshoe bat habitat loss/fragmentation Accidental pollution event during construction draining to watercourses and degrading habitats for QI species (otter) Disturbance and/or displacement of QI species (otter/lesser horseshoe bat)	International	Water protection measures on water quality for downstream QI species Pre-construction checks of Spancelhill Stream Replacement planting of native hedgerows. Planting will be carried out in the first phase of construction, prior to any removal of vegetation. No lighting is permitted during night time construction works, and lighting for operation has been designed to result in no light spill on surrounding features used by lesser horseshoe bats. Lighting will be off in normal	None

Ecological Receptor	Ecological Valuation	Impacts with Potentially Significant Effects	Potential Significance of Effects	Mitigation, Compensation and Enhancement Measures	Significance of Residual Effects
				circumstances and only used during emergencies	
Old Domestic Building (Keevagh) SAC	International	Lesser horseshoe bat habitat loss/fragmentation Disturbance and/or displacement of QI species (lesser horseshoe bat)	International	Replacement planting of native hedgerows. Planting will be carried out in the first phase of construction, prior to any removal of vegetation. No lighting is permitted during night time construction works, and lighting for operation has been designed to result in no light spill on surrounding features used by lesser horseshoe bats. Lighting will be off in normal circumstances and only used during emergencies	None
Old Domestic Buildings, Rylane SAC	International	Lesser horseshoe bat habitat loss/fragmentation Disturbance and/or displacement of QI species (lesser horseshoe bat)	International	Replacement planting of native hedgerows. Planting will be carried out in the first phase of construction, prior to any removal of vegetation. No lighting is permitted during night time construction works, and lighting for operation has been designed to result in no light spill on surrounding features used by lesser horseshoe bats. Lighting will be off in normal circumstances and only used during emergencies	None
River Shannon and River Fergus Estuaries SPA	International	Accidental pollution event during construction draining to watercourses and degrading habitats for SCI species	International	Water protection measures on water quality for downstream QI habitats and species	None

Ecological Receptor	Ecological Valuation	Impacts with Potentially Significant Effects	Potential Significance of Effects	Mitigation, Compensation and Enhancement Measures	Significance of Residual Effects
		Disturbance/displacement of SCI species using the proposed development as ex-situ sites			
Ballyallia Lough SPA	International	Accidental pollution event during construction draining to watercourses and degrading habitats for SCI species Disturbance/displacement of SCI species using the proposed development as ex-situ sites	International	Water protection measures on water quality for downstream QI habitats and species	None
Slieve Aughty Mountains SPA	International	Accidental pollution event during construction draining to watercourses and degrading habitats for SCI species Disturbance/displacement of SCI species using the proposed development as ex-situ sites	International	N/A	None
Corofin Wetlands SPA	International	Accidental pollution event during construction draining to watercourses and degrading habitats for SCI species Disturbance/displacement of SCI species using the proposed development as ex-situ sites	International	Water protection measures on water quality for downstream QI habitats and species	None
Fergus Estuary and Inner Shannon, North Shore pNHA	National	Accidental pollution event during construction draining to watercourses and degrading habitats and supporting habitats for designated species	National	Water protection measures on water quality for downstream habitats and species Pre-construction checks of Spancelhill Stream	None

Ecological Receptor	Ecological Valuation	Impacts with Potentially Significant Effects	Potential Significance of Effects	Mitigation, Compensation and Enhancement Measures	Significance of Residual Effects
		Otter habitat loss/fragmentation in the Spancelhill Stream Disturbance and/or displacement of otter/bird species Habitat degradation as a result of introducing non-native invasive species		No night working adjacent to suitable otter habitat Measures to prevent introduction of non-native invasive species	
Old Domestic Building (Keevagh) pNHA	National	Lesser horseshoe bat habitat loss/fragmentation Disturbance and/or displacement of QI species (lesser horseshoe bat)	National	Replacement planting of native hedgerows. Planting will be carried out in the first phase of construction, prior to any removal of vegetation. No lighting is permitted during night time construction works, and lighting for operation has been designed to result in no light spill on surrounding features used by lesser horseshoe bats. Lighting will be off in normal circumstances and only used during emergencies	None
Ballyallia Lake pNHA	National	Accidental pollution event during construction draining to watercourses and degrading habitats for bird species Disturbance/displacement of bird species using the proposed development as ex-situ sites	National	Water protection measures on water quality for designated bird species of this pNHA using downstream watercourses as ex situ sites	None
Dromore Woods and Loughs pNHA	National	Otter/lesser horseshoe bat habitat loss/fragmentation	National	Water protection measures on water quality for otter using downstream	None

Ecological Receptor	Ecological Valuation	Impacts with Potentially Significant Effects	Potential Significance of Effects	Mitigation, Compensation and Enhancement Measures	Significance of Residual Effects
		Accidental pollution event during construction draining to watercourses and degrading habitats for otter Disturbance and/or displacement of otter/lesser horseshoe bat		watercourses to which the proposed development drains to Pre-construction checks of Spancelhill Stream Replacement planting of native hedgerows. Planting will be carried out in the first phase of construction, prior to any removal of vegetation. No lighting is permitted during night time construction works, and lighting for operation has been designed to result in no light spill on surrounding features used by lesser horseshoe bats. Lighting will be off in normal circumstances and only used during emergencies	
Newpark House (Ennis) pNHA	National	N/A	N/A	N/A	N/A
Lough Cleggan pNHA	National	Accidental pollution event during construction draining to watercourses and degrading habitats for bird species Disturbance/displacement of bird species using the proposed development as ex-situ sites	National	Water protection measures on water quality for designated bird species of this pNHA using downstream watercourses as ex situ sites	None
Durra Castle pNHA	National	Lesser horseshoe bat habitat loss/fragmentation Disturbance and/or displacement of designated species (lesser horseshoe bat)	National	Replacement planting of native hedgerows. Planting will be carried out in the first phase of construction, prior to any removal of vegetation.	None

Ecological Receptor	Ecological Valuation	Impacts with Potentially Significant Effects	Potential Significance of Effects	Mitigation, Compensation and Enhancement Measures	Significance of Residual Effects
				No lighting is permitted during night time construction works, and lighting for operation has been designed to result in no light spill on surrounding features used by lesser horseshoe bats. Lighting will be off in normal circumstances and only used during emergencies	
Habitats					
Hedgerows (WL1)	Local (High)	Loss of habitat (c. 2.7km) Degradation of habitat from dust emissions	Local (High)	Replacement planting of 4.86km of native hedgerow Root Protection Zones Protection from dust emissions and construction activities by dust screens and fencing Landscape and Biodiversity Management Plan Enhancement of existing hedgerows	None
Marsh (GM1)	Local (High)	Degradation of habitat from runoff from construction activities	Local (High)	N/A	None
Wet grassland (GS4) including the Annex I habitat *Molinia* Meadows [6410]	Local (High) - National	Loss of habitat (c. 1.4ha) Degradation of habitat from runoff from construction activities Degradation of habitats dependent on groundwater and	Local (High)	Additional planting of swale above attenuation pond with plant species that are typically associated with seasonally flooded habitats Protection from dust emissions and construction activities by dust screens and fencing	None

Ecological Receptor	Ecological Valuation	Impacts with Potentially Significant Effects	Potential Significance of Effects	Mitigation, Compensation and Enhancement Measures	Significance of Residual Effects
		subsequently degradation on groundwater regime Degradation of habitats due to changes in air quality from dust		Surface water and groundwater protection measures Non-native invasive species prevention measures	
Lowland/Depositing Rivers (FW2)	Local (High)	Loss of habitat (2m^2) Degradation of habitat from runoff from construction activities	Local (High)	Surface water protection measures Protection from dust emissions and construction activities by dust screens and fencing	None
Annex I habitat 'semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometea) (*important orchid sites) (6210)'	National	Relocation of habitat (c. 0.79ha) Degradation of habitats due to changes in air quality from dust emissions	National	Retention of habitat outside the development footprint Relocation and restoration of habitat Protection from dust emissions and construction activities by dust screens and fencing Landscape and Biodiversity Management Plan Planting of native wildflower meadows elsewhere in the site	None
Mesotrophic Lake (FL4)	Local (High)	Degradation of habitat from runoff from construction activities Degradation of habitat from dust emissions	Local (High)	Protection from dust emissions and construction activities by dust screens and fencing Surface water protection measures	None
Other Artificial Lakes and Ponds (FL8)	Local (High)	Degradation of habitat from runoff from construction activities		Protection from dust emissions and construction activities by dust screens and fencing	

Ecological Receptor	**Ecological Valuation**	**Impacts with Potentially Significant Effects**	**Potential Significance of Effects**	**Mitigation, Compensation and Enhancement Measures**	**Significance of Residual Effects**
		Degradation of habitat from dust emissions		Surface water protection measures	
Reed and Large Sedge Swamps (FS1) including the Annex I habitat *Cladium* Fens [*7210]	Local (High) - International	Degradation of habitat from runoff from construction activities Degradation of habitat from dust Degradation of habitats dependent on groundwater and subsequently degradation on groundwater regime	International	Protection from dust emissions and construction activities by dust screens and fencing Surface and ground water protection measures	None
Rich Fen and Flush (PF1) including the Annex I habitat Alkaline Fens [7230]	National	Degradation of habitat from runoff from construction activities Degradation of habitat from dust emissions	National	Protection from dust emissions and construction activities by dust screens and fencing Surface water protection measures	None
Riparian Woodland (WN5) including the Annex I habitat Alluvial Woodland [*91E0]	International	Degradation of habitat from runoff from construction activities Degradation of habitat from dust emissions Degradation of habitats dependent on groundwater and subsequently degradation of groundwater regime		Protection from dust emissions and construction activities by dust screens and fencing Surface and ground water protection measures	
Wet Willow-Alder-Ash Woodland (WN6) including the Annex I habitat Alluvial Woodland [*91E0]	International	Degradation of habitat from runoff from construction activities		Protection from dust emissions and construction activities by dust screens and fencing	

Ecological Receptor	Ecological Valuation	Impacts with Potentially Significant Effects	Potential Significance of Effects	Mitigation, Compensation and Enhancement Measures	Significance of Residual Effects
		Degradation of habitat from dust emissions Degradation of habitats dependent on groundwater and subsequently degradation of groundwater regime		Surface and ground water protection measures	
Fauna Species					
Bats	Local (High) - International	Tree roost loss Habitat loss Disturbance from lighting Roost loss	Local (High) - International	Layout designed to protect and retain confirmed bat roost buildings Demolition of structures/felling of trees following seasonal restrictions Roost presence/absence surveys prior to demolition of structures/felling of suitable bat roost trees and buildings Soft felling of suitable bat roost trees No night works will be normally undertaken during construction. Any lighting required during construction will be minimal and will avoid suitable foraging/roosting areas. Lighting will be off in normal circumstances and only used during emergencies Planting of native hedgerows and woodlands prior to any removal of vegetation to ensure commuting and/or foraging areas are retained throughout development and operation	None

Ecological Receptor	Ecological Valuation	Impacts with Potentially Significant Effects	Potential Significance of Effects	Mitigation, Compensation and Enhancement Measures	Significance of Residual Effects
				Lighting during operation designed to be as close to 0 Lux as possible on sensitive bat foraging and/or commuting routes, with lighting only used for emergencies at night and for egress through the site using torches/headlights.	
Otter	International	Otter habitat loss/fragmentation Accidental pollution event during construction draining to watercourses and degrading otter habitat Disturbance and/or displacement of otter	International	Surface water protection measures Pre-construction checks of Spancelhill Stream No night works adjacent to Spancelhill Stream	None
Badgers	Local (High)	Habitat loss Disturbance/Displacement	Local (High)	Pre-construction checks for new setts	None
Other mammal species	Local (High)	Habitat loss Disturbance and displacement	Local (High)	Planting of meadows and woodlands providing additional habitat for commuting and foraging mammal species Inclusion of ramps in excavation pits and/or covering of pits for small mammal egress	None
Breeding Birds	Local (High)	Disturbance and mortality during breeding season Habitat loss	Local (High)	Seasonal vegetation clearance Landscape planting of hedgerows and woodland areas	None

Ecological Receptor	Ecological Valuation	Impacts with Potentially Significant Effects	Potential Significance of Effects	Mitigation, Compensation and Enhancement Measures	Significance of Residual Effects
		Disturbance and displacement		Buildings with confirmed nests are being retained within the design of the development Nest boxes placed in areas of suitable habitat away from the development	
Wintering birds	Local (High) - International	Habitat loss Habitat degradation (surface water quality)	Local (High) - International	Seasonal vegetation clearance Surface water quality protection measures Construction compound situated away from suitable wintering bird habitat	None
Amphibians	Local (High)	Disturbance and Mortality Habitat degradation (Surface water quality)	Local (High)	Surface water protection measures Pre-construction checks of any suitable habitat features	None
Reptiles	Local (High)	Mortality during vegetation clearance	Local (High)	Seasonal clearance of vegetation ECoW supervision of vegetation clearance	None
Fish	Local (High) - International	Habitat degradation from an accidental pollution event Habitat loss Direct Injury/Mortality	Local (High)	Surface water protection measures Culvert and headwall and mattress designed in consultation with IFI Fencing off of surface water features from construction	None

Ecological Receptor	Ecological Valuation	Impacts with Potentially Significant Effects	Potential Significance of Effects	Mitigation, Compensation and Enhancement Measures	Significance of Residual Effects
				Specific measures to protect lamprey within the Spancelhill Stream by use of silt curtain and spill boom	
White-clawed crayfish	Local (High)	Habitat degradation from an accidental pollution event	Local (High)	Surface water protection measures ECoW supervision of any instream works, and silt curtain and spill boom	None
Other Invertebrates	Local (High)	Habitat loss	Local (High)	Protection from dust emissions and construction activities by dust screens and fencing off of calcareous grassland Relocation of calcareous grassland Wildflower meadows and swale species planted in regard to pollinator species Woodland embankments with bare ground for solitary bee species	None

7.10 INTERACTIONS

The most significant interactions for the Biodiversity Chapter are with the Hydrology Chapter (Chapter 6), the Land, Soils, Geology & Hydrogeology Chapter (Chapter 5), the Air Quality and Climate Chapter (Chapter 8), The Landscape and Visual Chapter (Chapter 10) and the Noise and Vibration Chapter (Chapter 9). The Hydrology Chapter was reviewed in terms of effects on water quality in the local and downstream receiving environment, and the ensure that there is no change in the overall water regime at water dependent habitats on site. The Land, Soils, Geology and Hydrogeology Chapter was reviewed in terms of the groundwater depended habitats on site, and to ensure there is no change in the overall groundwater regime within and outwith the proposed development site. The Air Quality and Climate Chapter and the assessment of NO_X and SO_2 levels in the nearby sensitive ecological areas and the resultant deposition levels presented in the chapter have been reviewed and assessed. The Landscape and Visual Chapter details the removal and addition of the planting regime proposed within the proposed development, this has been reviewed to ensure there will be no impact on the habitats and species within the proposed development site. The Noise and Vibration Chapter was assessed to determine and quantify the likely effects on sensitive species within the proposed development site, and propose suitable mitigation measures to reduce this potential impact.

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8.0 AIR QUALITY & CLIMATE

8.1 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 Environmental Protection Agency (EPA) documents Draft Guidelines on the Information to be contained in Environmental Impact Statements (EPA, 2017) and Draft Advice Notes for Preparing Environmental Impact Statements (EPA, 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 diesel-powered emergency backup generators was carried out using the United States Environmental Protection Agency's regulated model AERMOD as recommended by the EPA (EPA, 2020a). The modelling of air emissions from the site was carried out to assess concentrations of nitrogen dioxide (NO_2) at a variety of locations beyond the site boundary. The modelling was undertaken to assess the impact to ambient air quality from scheduled testing of the data centre standby generators and the energy centre engines when fuelled by diesel oil, and the infrequent emergency operation of the data centre standby generators.

The back-up diesel generators will have emissions of NO_2, CO, SO_2 and particulate matter (PM_{10}/$PM_{2.5}$). Odour is not considered relevant for the Proposed Development. Modelling for NO_2 was undertaken in detail. In relation to CO, SO_2, PM_{10} and $PM_{2.5}$ no detailed modelling was undertaken. Emissions of these pollutants are significantly lower than the NO_X emissions from the generators relative to their ambient air quality standards and thus ensuring compliance with the NO_2 ambient limit value will ensure compliance for all other pollutants. For example, the emission of CO from the generators is at least eight times lower than NO_X whilst the CO ambient air quality standard is 10,000 µg/m^3 compared to the 1-hour NO_2 standard of 200 µg/m^3. Similarly, levels of PM_{10}/$PM_{2.5}$ emitted from the generators will be 90 times lower whilst the ambient air quality standards are comparable. Emissions of SO_2 are approximately 55 times lower than emissions of NO_X.

As discussed in Chapter 2, the Proposed Development will have 84 no. back-up generators for the data centre and 18 no. lean-burn natural gas engines for the energy centre. A review of licensed facilities in the surrounding area has been conducted and none have been identified with the potential for cumulative impact with the Proposed Development. Consideration of all developments identified in Chapter 3 Appendix 3.1 was also undertaken and no potential for cumulative impact with the Proposed Development was identified as the planned developments have no or negligible potential for NO_2 emissions.

8.2 METHODOLOGY

8.2.1 Criteria for Rating of Impacts

8.2.1.1 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 8.1).

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 8.1 *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/m3 NO2
		Annual limit for protection of human health	40 µg/m3 NO2
Particulate Matter (as PM10)	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50 µg/m3 PM10
		Annual limit for protection of human health	40 µg/m3 PM10
PM2.5	2008/50/EC	Annual limit for protection of human health	25 µg/m3 PM2.5

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

8.2.1.2 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.

8.2.1.3 Gothenburg Protocol

In 1999, Ireland signed the Gothenburg Protocol to the 1979 UN Convention on Long Range Transboundary Air Pollution. In 2012, the Gothenburg Protocol was revised to include national emission reduction commitments for the main air pollutants to be achieved in 2020 and beyond and to include emission reduction commitments for $PM_{2.5}$. In relation to Ireland, 2020 emission targets are 25 kt for SO_2 (65% below 2005 levels), 65 kt for NO_X (49% reduction), 43 kt for VOCs (25% reduction), 108 kt for NH_3 (1% reduction) and 10 kt for $PM_{2.5}$ (18% reduction).

European Commission Directive 2001/81/EC National Emissions Ceiling Directive (NECD), prescribes the same emission limits as the 1999 Gothenburg Protocol. A National EPA Programme for the progressive reduction of emissions of these four transboundary pollutants has been in place since April 2005 (DEHLG, 2004; 2007). The data available from the EU in 2020 (EPA, 2020b) indicated that Ireland complied with the emissions ceilings for SO_2 in recent years but failed to comply with the ceilings for NMVOCs, NH_3 and NO_X. Directive (EU) 2016/2284 *"On the Reduction of National Emissions of Certain Atmospheric Pollutants and Amending Directive 2003/35/EC and Repealing Directive 2001/81/EC"* was published in December 2016. The Directive applies the 2010 NECD limits until 2020 and establish new national emission reduction commitments which will be applicable from 2020 and 2030 for SO_2, NO_X, NMVOC, NH_3, $PM_{2.5}$ and CH_4. In relation to Ireland, emission targets applicable from 2020 are 25 kt for SO_2 (65% on 2005 levels), 65 kt for NO_X (49% reduction on 2005 levels), 43 kt for VOCs (25% reduction on 2005 levels), 108 kt for NH_3 (1% reduction on 2005 levels) and 10 kt for $PM_{2.5}$ (18% reduction on 2005 levels). In relation to 2030, Ireland's emission targets are 10.9 kt (85% below 2005 levels) for SO_2, 40.7 kt (69% reduction) for NO_X, 51.6 kt (32% reduction) for NMVOCs, 107.5 kt (5% reduction) for NH_3 and 11.2 kt (41% reduction) for $PM_{2.5}$.

8.2.1.4 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 Greenhouse Gas (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'* (section 3(1) of No. 46 of 2015). This is referred to in the Act as the 'national transition objective'.

The Act makes 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 for the Climate Action (Amendment) Bill 2019 in December 2019 (Government of Ireland, 2020a). The General Scheme was prepared for the purposes of giving statutory effect to the core objectives stated within the CAP. The Climate Action and Low Carbon Development (Amendment) Bill 2021 (the Bill) was published in March 2021.

The purpose of the 2021 Climate Bill is to provide for the approval of plans '*for the purpose of pursuing the transition to a climate resilient and climate neutral economy by the end of the year 2050'*. The 2021 Climate Bill will also '*provide for carbon budgets and a decarbonisation target range for certain sectors of the economy'*. 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 Bill has set a target of a 51% reduction in the total amount of greenhouse gases over the course of the first two carbon periods ending 31 December 2030 relative to 2018 annual emissions. The 2021 Climate Bill defines the carbon budget as 'the total amount of greenhouse gas emissions that are permitted during the budget period'.

Individual county councils in Ireland have also published their own Climate Change Strategies which outline the specific climate objectives for that local authority and associated actions to achieve the objectives. Clare County Council's Climate Change Adaptation Strategy 2019 -2024 was published by Clare County Council in 2019 and includes the following two goals and associated objectives which relate to the Built Environment and Development:

- Theme 2 Infrastructure and Built Environment – Objective 2: "To promote County Clare as a Low Carbon County and support the development of low carbon and green technology businesses and industries throughout the County.";
- Theme 3 Land-use and Development – Objective 2: "To integrate climate action consideration into land-use planning policy and influence positive behaviour."; and
- Theme 5 Natural Resources and Cultural Infrastructure – Objective 4: "To promote and facilitate the provision of high quality, secure, efficient and reliable renewable energy sources along with appropriate energy storage facilities in order to assist in the creation of a low carbon County Clare."

8.2.2 Construction Phase

8.2.2.1 Air Quality

The current assessment focused firstly on identifying the existing baseline levels of NO_2, 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 on air quality was determined by a qualitative assessment of the nature and scale of dust generating construction activities associated with the Proposed Development.

8.2.2.2 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.

8.2.3 Operational Phase

8.2.3.1 Air Quality

Air dispersion modelling was carried out by AWN Consulting Ltd. using the United States Environmental Protection Agency's regulated model AERMOD (Version 19191). 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)"* (2020a).

The modelling of air emissions from the site was carried out to assess the concentrations of nitrogen dioxide (NO_2) 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 2016 – 2020 from the Met Éireann meteorological station at Shannon

Airport 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. This study adopted a conservative approach which will lead to an over-estimation of the actual levels that will arise.

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 8.1. 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.

A receptor grid and discrete receptors were identified 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 a Cartesian grid with the site at the centre. The outer grid measured 20 x 20 km with the site at the centre and with concentrations calculated at 1000 m intervals. A middle grid measured 10 x 10 km with the site at the centre and with concentrations calculated at 500 m intervals. The inner grid measured 5 x 5 km with the site at the centre and with concentrations calculated at 125 m intervals. Boundary receptor locations were also placed along the boundary of the site, at 100 m intervals, giving a total of 2,800 calculation points for the model. The impact of the data centre back-up diesel generators and the energy centre gas/diesel engine was also measured at nearby residential receptors which were added to the model as discrete receptors.

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.

Hourly-sequenced meteorological information has been used in the model covering the years 2016 – 2020 from the Met Éireann meteorological station at Shannon Airport as shown in Figure 8.1 (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 8.2).

Terrain has been mapped out in the model as using SRTM (Shuttle Radar Topography Mission) data with 30m resolution. All terrain features have been mapped in detail into the model using the terrain pre-processor AERMAP.

8.2.3.2 Process Emissions

The Proposed Development (Data Centre and Energy Centre) will have six data centres with a total of 84 no. back-up generators with associated stacks which will be built to a height of 8 m above ground level. The energy centre will have 18 no. lean-burn natural gas engines, with the associated stacks built to a height of 25 m above ground level. All modelling scenarios assumed all six data halls and all 18 energy centre engines are operational simultaneously. In reality the Proposed Development will become operational in phases over a period of 4 – 5 years, with two data centre halls and six energy centre engines in operation for each phase.

The natural gas engines may also be powered by diesel fuel oil as back-up to the normal gas supply. It is not expected that this operation mode would cause any significant impacts on ambient air quality considering the infrequent and unpredictable usage of this back-up fuel; the worst availability performance for disruption to natural gas supply is 22 hours in 5 years (Gas Networks Ireland, 2017). This potential level of disruption is also applicable to the data centre back-up generators, as the data centres are supplied by the energy centre. A worst-case assumption of 24 hours emergency operation powered by diesel fuel oil has been modelled.

In order for the data centre generators to be kept in good condition, ready to be started at full load during an emergency power failure, it is necessary to carry out a scheduled maintenance programme, which includes periodic testing. The diesel mode for the energy centre engines will also be tested. All testing is assumed to only occur between 8am and 5pm, Monday to Friday. The maintenance plan for the proposed development comprises the following two tests:

- Test 1: testing once per month of all 84 no. data centre back-up generators at up to 100% load for a maximum of one hour each, two generators at a time, sequentially;
- Test 2: testing once per month of all 18 no. energy centre engines powered by fuel oil at up to 100% load for a maximum of one hour each, one engine at a time, sequentially.

USEPA Guidance suggests that for emergency operations, an average hourly emission rate should be used rather than the maximum hourly rate (USEPA, 2011). For modelling purposes only, a worst case/conservative figure of 100 hours in total per year of operation has been applied to the Proposed Development. However, in reality, and based on recent experience over the past number of years, generators are rarely used other than during testing and maintenance described above. As a result, the maximum hourly emission rates from all the back-up generators were reduced by a factor of (100/8760) to give an average hourly emission rate (in line with USEPA protocol) and the generators were modelled over a period of one full year.

A second methodology for modelling back-up generators has been published by the UK Environment Agency. The consultation document is entitled “Diesel Generator Short-Term NO_2 Impact Assessment” (UK EA, 2016). The methodology is based on considering the statistical likelihood of an exceedance of the NO_2 hourly limit value (18 exceedances are allowable per year before the air standard is deemed to have been exceeded). The assessment assumes a hypergeometric distribution to assess the likelihood of exceedance hours coinciding with the operational hours of the back- up generators. The cumulative hypergeometric distribution of 19 and more hours per year is computed and the probability of an exceedance determined. The guidance suggests that the 95th percentile confidence level should be used to indicate if an exceedance is likely. More recent guidance (UK EA, 2019) has recommended this probability should be multiplied by a factor of 2.5 and therefore, the 98th percentile confidence level should be used to indicate if an exceedance is likely. The guidance suggests that the assessment should be conducted at the nearest residential receptor or at locations where people are likely to be exposed and that there should be no running time restrictions on these generators when providing power on site during an emergency.

Both the methodology advised in the USEPA guidance as well as the approach described in the UK EA guidance have been applied in this study to ensure a robust assessment of predicted air quality impacts from the back-up generators. The methodology for converting NO_X to NO_2 was based on the ozone limiting method (OLM) approach based on an initial NO_2/NO_X ratio of 0.1 and a background ozone level of 55 $\mu g/m^3$ based on a review of EPA data for similar Zone C locations.

The modelling was undertaken to assess the impact to ambient air quality from the following operations scenario:

- **Proposed Development (Worst-Case) Scenario:** This comprises the emission points associated with the Proposed Development (Data Centre and Energy Centre). This scenario involves the emergency operation of 84 no. data centre diesel generators, continuous operation of 18 no. energy centre natural gas engines and emergency operation of the natural gas engines on backup diesel fuel oil. The scenario also includes testing for all 84 data centre generators and all 18 energy centre engines. Application of selective catalytic reduction (SCR) has been assumed to reduce energy centre emissions for gas operation by 63% and by 87% for diesel operation to meet emission limits. Selective catalytic reduction is an abatement technique where ammonia or urea is injected into the gas stream to convert nitrogen oxides to nitrogen and water. The process emissions used for the Proposed Development Scenario are outlined in Table 8.2.
- **Proposed Development (Likely Average Operation) Scenario:** This comprises the emission points associated with the Proposed Development (Data Centre and Energy Centre). This scenario involved the emergency operation of 84 no. data centre diesel generators, continuous operation of 18 no. energy centre natural gas engines and emergency operation of the natural gas engines on backup diesel fuel oil. The scenario also included testing for all 84 data centre generators and all 18 energy centre engines. Application of SCR has been assumed to reduce energy centre emissions by 95% for both gas and diesel operation to meet emission limits. The process emissions used for the Proposed Development Scenario are outlined in Table 8.3.

Table 8.2 *Summary of Process Emission Information for Data Centre and Energy Centre –Proposed Development (Worst-Case) Scenario*

Stack Reference	Grid Reference (ITM, m)	Stack Height Above Ground Level (m)	Exit Diameter (m)	Cross-Sectional Area (m^2)	Temp (K)	Volume Flow (Nm^3/hr at 15% Ref. O2)	Exit Velocity (m/sec actual)	NO_X	
								Concentration (mg/Nm^3 at 15% Ref. O2)	Mass Emission (g/s)
Data Centre Emergency Operation for Back-up Diesel Generators (100% load)	505597, 5857039 – 504857, 5857040	8 m	0.6 m	0.28	755.15	24,900	39.7	2,362	0.14 Note 1
Data Centre Test 1 for Back-up Diesel Generators (100% load)	505597, 5857039 – 504857, 5857040	8 m	0.6 m	0.28	755.15	24,900	39.7	2,362	6.06 Note 2
Energy Centre Continuous Operation for Natural Gas Engines (100% load)	505027, 5857343 – 505081, 5857341	25 m	0.9 m	0.64	649.15	31,212	22.1	95	0.82
Energy Centre Test 2 for Back-up Diesel Powered Engines (100% load)	505027, 5857343 – 505081, 5857341	25 m	0.9 m	0.64	628.15	38,160	28.9	190	2.01 Note 2
Energy Centre Emergency Operation on Back-up Diesel Fuel Oil (100% load)	505027, 5857343 – 505081, 5857341	25 m	0.9 m	0.64	628.15	38,160	28.9	190	0.0055 Note 3

Note 1 Reduced emission rates based on USEPA protocol (assuming 100 hours / annum) used to model emissions during emergency operation of generators (100% load)

Note 2 Emission rates used to model emissions during testing at 100% load assumed to occur once per month, per generator

Note 3 Emergency operation of natural gas engines on backup diesel fuel oil assumed for 24 hours / annum as a worst-case.

Table 8.3 Summary of Process Emission Information for Data Centre and Energy Centre –Proposed Development (Likely Average Operation) Scenario

Stack Reference	Grid Reference (ITM, m)	Stack Height Above Ground Level (m)	Exit Diameter (m)	Cross-Sectional Area (m^2)	Temp (K)	Volume Flow (Nm^3/hr at 15% Ref. O2)	Exit Velocity (m/sec actual)	NO_X	
								Concentration (mg/Nm^3 at 15% Ref. O2)	Mass Emission (g/s)
Data Centre Emergency Operation for Back-up Diesel Generators (100% load)	505597, 5857039 – 504857, 5857040	8 m	0.6 m	0.28	755.15	24,900	39.7	2,362	0.14 Note 1
Data Centre Test 1 for Back-up Diesel Generators (100% load)	505597, 5857039 – 504857, 5857040	8 m	0.6 m	0.28	755.15	24,900	39.7	2,362	6.06 Note 2
Energy Centre Continuous Operation for Natural Gas Engines (100% load)	505027, 5857343 – 505081, 5857341	25 m	0.9 m	0.64	649.15	31,212	22.1	13	0.11
Energy Centre Test 2 for Back-up Diesel Powered Engines (100% load)	505027, 5857343 – 505081, 5857341	25 m	0.9 m	0.64	628.15	38,160	28.9	73	0.77 Note 2
Energy Centre Emergency Operation on Back-up Diesel Fuel Oil (100% load)	505027, 5857343 – 505081, 5857341	25 m	0.9 m	0.64	628.15	38,160	28.9	190	0.0021 Note 3

Note 1 Reduced emission rates based on USEPA protocol (assuming 100 hours / annum) used to model emissions during emergency operation of generators (100% load)

Note 2 Emission rates used to model emissions during testing at 100% load assumed to occur once per month, per generator

Note 3 Emergency operation of natural gas engines on backup diesel fuel oil assumed for 24 hours / annum as a worst-case.

8.2.3.3 Climate & Transboundary Pollution

The back-up diesel generators modelled for the purpose of this assessment will only be used in the event of a power failure at the site. In reality and based on recent experience over the past number of years, generators are rarely used other than during testing and maintenance described in the previous section. During normal operations at the facility, the electricity will be supplied from the national grid so there will be no direct emissions of CO_2 or transboundary pollutants from the site.

The impact of the operational phase of the Proposed Development on climate was determined by an assessment of the indirect CO_2 emissions associated with the electricity supplied from the national grid. The details and results of the assessment are provided in section 8.7.2.2.

8.3 RECEIVING ENVIRONMENT

8.3.1 Baseline Air Quality

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality *'Air Quality in Ireland 2019'* (EPA 2020c) 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 Monitoring Report 2018'* (EPA 2020c). 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, the Proposed Development is within Zone C, as defined in Scheule 19 of the Air Quality Standards Regulations 2011. As the Proposed Development is considered a Zone C environment, the baseline air quality for NO_2, PM_{10} and $PM_{2.5}$ is reviewed for all Zone C monitoring locations in the following sections.

8.3.1.1 NO_2

With regard to NO_2, continuous monitoring data from the EPA (2020c; 2021) from all Zone C locations of Dundalk, Kilkenny and Portlaoise in 2019 show that levels of NO_2 are below both the annual and 1-hour limit values (see Table 8.3). Average long-term concentrations at the three sites range from 5 – 14 µg/m^3 for the period 2015 – 2019; suggesting an upper average over the five-year period of no more than 14 µg/m^3. There were no exceedances of the maximum 1-hour limit of 200 µg/m^3 in any year (18 exceedances are allowed per year). Based on these results an estimate of the background NO_2 concentration in the region of the development is 14 µg/m^3. It is expected that this background concentration will remain at this level or decrease slightly over the operational lifetime of the project.

In relation to the annual average background, the ambient background concentration was added directly to the process concentration with the short-term peaks assumed to have an ambient background concentration of twice the annual mean background concentration.

Table 8.3 *Trends In Zone C Air Quality - Nitrogen Dioxide (µg/m³)*

Station	Averaging Period	Year				
		2015	2016	2017	2018	2019
Kilkenny	Annual Mean NO_2 (µg/m³)	5	7	5	6	5
	Max 1-hr NO_2 (µg/m³)	70	51	58	71	59
Portlaoise	Annual Mean NO_2 (µg/m³)	10	11	11	11	11
	Max 1-hr NO_2 (µg/m³)	84	86	80	119	77
Dundalk	Annual Mean NO_2 (µg/m³)	-	-	-	14	12
	Max 1-hr NO_2 (µg/m³)	-	-	-	91	144

8.3.1.2 PM_{10}

Continuous PM_{10} monitoring carried out at three Zone C locations in 2019 showed annual mean concentrations ranging from 13 to 18 µg/m³, with at most 12 exceedances (in Ennis) of the 24 hour limit value of 50 µg/m³ (35 exceedances are permitted per year) (EPA, 2020c). Long-term data for the period 2015 – 2019 for Ennis and Portlaoise shows that concentrations range from 10 – 18 µg/m³, suggesting an upper average concentration over the five-year period of no more than 17 µg/m³. Based on this EPA data, an estimate of the background PM_{10} concentration in the region of the development is 17 µg/m³. It is expected that this background concentration will remain at this level or decrease slightly over the operational lifetime of the project.

8.3.1.3 $PM_{2.5}$

Continuous $PM_{2.5}$ monitoring carried out at two Zone C locations at Ennis and Bray in 2019 showed annual mean concentrations ranging from 7 to 14 µg/m³. Long-term data for the period 2015 – 2019 for Bray and Ennis shows that concentrations range from 5 – 14 µg/m³. The $PM_{2.5}/PM_{10}$ ratio in Ennis ranged from 0.63 – 0.78 over the five year period. Based on this information, a conservative ratio of 0.8 was used to generate a background $PM_{2.5}$ concentration in the region of the Proposed Development of 13.6 µg/m³. It is expected that this background concentration will remain at this level or decrease slightly over the operational lifetime of the project.

8.3.1.4 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 provisional emissions up to 2019 (EPA, 2020d). The data published in 2020 states that Ireland will exceed its 2019 annual limit set under the EU's Effort Sharing Decision (ESD), 406/2009/EC by an estimated 6.98 Mt. For 2019, total national greenhouse gas emissions are estimated to be 59.90 million tonnes carbon dioxide equivalent (Mt CO2eq) with 45.71 MtCO2eq 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 2019 are estimated to be 4.5% lower than those recorded in 2018. Emission reductions have been recorded in 6 of the last 10 years. However, compliance with the annual EU targets has not been met for four years in a row. Emissions from 2016 – 2019 exceeded the annual EU targets by 0.29 MtCO2eq, 2.94 MtCO2eq, 5.57 MtCO2eq and 6.98 MtCO2eq 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 2020 GHG Emissions Projections Report for 2019 – 2040 (EPA, 2020e) 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. 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 – 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 10 Mt CO2eq under the *"With Existing Measures"* scenario and 9 Mt CO2eq under the *"With Additional Measures"* scenario (EPA, 2020e).

8.4 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.

8.4.1 Construction Phase

The Proposed Development will comprise construction of a six data storage facilities, a gas powered energy centre and associated ancillary development. The key civil engineering works which will have a potential impact on air quality and climate during construction are summarised below:

(i) During construction, an amount of soil will be generated as part of the site preparation works and during excavation for construction of roads, car parking areas, foundations, installation of drainage services and ancillary infrastructure;

(ii) Following completion of the building shell, commissioning of the mechanical and electrical equipment is undertaken;

(iii) Infilling and landscaping will be undertaken. Spoil generated during site preparation will be re-used where possible;

(iv) Temporary storage of construction materials; and

(v) Construction traffic accessing the site will emit air pollutants and greenhouse gases during transport.

As outlined in Section 8.6, a dust minimisation plan will be formulated for the construction phase of the Proposed Development to ensure no dust nuisance occurs at nearby sensitive receptors.

8.4.2 Operational Phase

The key works which will have a potential impact on air quality and climate during operation of the Proposed Development are summarised below:

(i) The scheduled testing for maintenance of the back-up diesel generators in the data storage facility will release air pollutant emissions (primarily NO_X emissions);

(ii) The infrequent emergency operation of the natural gas engines on backup diesel fuel oil in the event of disruption to the natural gas supply.

(iii) The infrequent emergency operation of the back-up diesel generators for the data storage facility in the event of a power outage would release air pollutant emissions (primarily NO_X emissions). A review of operational data from similar operational data storage facilities in Ireland indicates that that standby generators are rarely used other than during the scheduled maintenance and testing.

(iv) Road traffic accessing the site will emit air pollutants and greenhouse gases. However, the operational phase of the Proposed Development is not expected to contribute a significant volume of additional traffic on the local road network (see Chapter 12 (Traffic & Transportation)). Therefore, no local air quality assessment of the traffic impact is required for this development; and

(v) The indirect impact of emissions from electricity to operate the data storage facilities will have an impact on climate and regional air quality. However, it is predicted that these will not be significant in relation to Ireland's national emission ceiling limits for CO_2, NO_X, SO_2 and NMVOCs.

8.4.3 Decommissioning Phase

The Proposed Development may be decommissioned at some stage in the future. At that time a dust minimisation plan will be formulated for the decommissioning phase of the Proposed Development to ensure no dust nuisance occurs at nearby sensitive receptors.

8.5 POTENTIAL IMPACTS OF THE DEVELOPMENT

8.5.1 Construction Phase

8.5.1.1 Air Quality & Climate

The greatest potential impact on air quality during the construction phase of the Proposed Development is from construction dust emissions as a result of excavation works, infilling and landscaping activities and storage of soil in stockpiles. This leads to 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 (IAQM, 2014). 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 350m of the site boundary on the R352 Tulla Rd and unnamed local roads.

Construction traffic is 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' (IAQM, 2014) states that site traffic and plant is unlikely to make a significant impact on climate.

Initial commissioning activities will involve testing of the data centre back-up generators and energy centre engines with fuel oil on site in a similar manner to the operational phase testing, i.e. the first testing sequence will be commissioning of the standby generators. The operational modelling has considered testing of the generators on a monthly basis and this does not result in a significant impact to air quality. Therefore, it is predicted that the initial commissioning tests will result in an ***imperceptible*** impact to air quality in the ***short-term***.

It is important to note that the potential impacts associated with the construction phase of the Proposed Development are short-term in nature. When the dust minimisation measures detailed in the mitigation section (see Section 8.6) of this chapter are implemented, fugitive emissions of dust from the site will not be significant and will pose no nuisance at nearby receptors. Due to the duration and nature of the construction activities, CO_2 and N_2O emissions from construction vehicles and machinery will have a ***short-term*** and ***imperceptible*** impact on climate.

8.5.2 Operational Phase

8.5.2.1 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 data centre back-up diesel generators and the energy centre engines. However, as outlined in Section 8.6, 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.

8.5.2.2 Climate

The back-up diesel generators modelled for the purpose of this assessment will only be used in the event of a power failure at the site and for testing purposes. During normal operations at the facility, the electricity will be supplied by the energy centre on site, which is powered by natural gas. The predicted impact is stated in section 8.7.2.2.

8.5.3 Decommissioning Phase

8.5.3.1 Air Quality & Climate

The greatest potential impact on air quality during the decommissioning phase of the Proposed Development is from dust emissions as a result of demolition works and associated landscaping activities and truck movements to and from the facility. This leads to the potential for nuisance dust.

Traffic associated with decommissioning is expected to be the dominant source of greenhouse gas emissions as a result of the decommissioning phase of the Proposed Development. Vehicles and machinery will give rise to CO_2 and N_2O emissions during decommissioning of the Proposed Development. 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.

It is important to note that the potential impacts associated with the decommissioning phase of the Proposed Development are short-term in nature. When the dust minimisation measures detailed in the mitigation section (see Section 8.6) of this chapter are implemented, fugitive emissions of dust from the site will not be significant and will pose no nuisance at nearby receptors. Due to the duration and nature of the decommissioning activities, CO_2 and N_2O emissions from construction vehicles and machinery will have a ***short-term*** and ***imperceptible*** impact on climate.

8.6 REMEDIAL AND MITIGATION MEASURES

8.6.1 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 develop a workable and transparent dust control strategy, the following management plan has been formulated by drawing on best practice guidance from Ireland, the UK and the USA based on the following publications:

- 'Guidance on the Assessment of Dust from Demolition and Construction' (IAQM, 2014);
- 'Planning Advice Note PAN50 Annex B: Controlling The Environmental Effects Of Surface Mineral Workings Annex B: The Control of Dust at Surface Mineral Workings' (The Scottish Office, 1996);
- 'Controlling the Environmental Effects of Recycled and Secondary Aggregates Production Good Practice Guidance' (UK Office of Deputy Prime Minister, 2002);
- 'Controlling Particles, Vapours & Noise Pollution From Construction Sites' (BRE, 2003);
- 'Fugitive Dust Technical Information Document for the Best Available Control Measures' (USEPA, 1997); and
- 'Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition' (periodically updated) (USEPA, 1986).

8.6.1.1 Site Management

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

At the construction planning stage, the siting of activities and storage piles will take note of the location of sensitive receptors and prevailing wind directions in order to minimise the potential for significant dust nuisance (see Figure 8.1 for the windrose for Shannon Airport). As the prevailing wind is predominantly westerly to south-westerly, locating construction compounds and storage piles downwind (to the east or north-east) of sensitive receptors will minimise the potential for dust nuisance to occur at sensitive receptors.

Good site management will include the ability to respond to adverse weather conditions by either restricting operations on-site or quickly implementing effective control measures before the potential for nuisance occurs. When rainfall is greater than 0.2 mm/day, dust generation is generally suppressed (UK Office of Deputy Prime Minister (2002), BRE (2003)). The potential for significant dust generation is also reliant on threshold wind speeds of greater than 10 m/s (19.4 knots) (at 7 m above ground) to release loose material from storage piles and other exposed materials (USEPA, 1986). Particular care should be taken during periods of high winds (gales) as these are periods where the potential for significant dust emissions are highest. The prevailing meteorological conditions in the vicinity of the site are favourable in general for the suppression of dust for a significant period of the year. Nevertheless, there will be infrequent periods where care will be needed to ensure that dust nuisance does not occur. The following measures shall be taken in order to avoid dust nuisance occurring under unfavourable meteorological conditions:

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

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

8.6.1.2 Site Roads / Haulage Routes

Movement of construction trucks along site roads (particularly unpaved roads) can be a significant source of fugitive dust if control measures are not in place. The most effective means of suppressing dust emissions from unpaved roads is to apply speed restrictions. Studies show that these measures can have a control efficiency ranging from 25 to 80% (UK Office of Deputy Prime Minister, 2002). The following measures shall be taken in order to avoid dust nuisance occurring:

- A speed restriction of 20 km/hr will be applied as an effective control measure for dust for on-site vehicles using unpaved site roads;
- Access gates to the site will be located at least 10m from sensitive receptors where possible;
- Bowsers or suitable watering equipment will be available during periods of dry weather throughout the construction period. Research has found that watering can reduce dust emissions by 50% (USEPA, 1997). Watering shall be conducted during sustained dry periods to ensure that unpaved areas are kept moist. The required application frequency will vary according to soil type, weather conditions and vehicular use; and

- Any hard surface roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads shall be restricted to essential site traffic only.

8.6.1.3 Land Clearing / Earth Moving

Land clearing/earth-moving works during periods of high winds and dry weather conditions can be a significant source of dust. The following measures shall be taken in order to avoid dust nuisance occurring:

- During dry and windy periods, and when there is a likelihood of dust nuisance, watering shall be conducted to ensure moisture content of materials being moved is high enough to increase the stability of the soil and thus suppress dust; and
- During periods of very high winds (gales), activities likely to generate significant dust emissions shall be postponed until the gale has subsided.

8.6.1.4 Storage Piles

The location and moisture content of storage piles are important factors which determine their potential for dust emissions. The following measures will be implemented to minimise dust formation from storage piles:

- Overburden material will be protected from exposure to wind by storing the material in sheltered regions of the site. Where possible storage piles will be located downwind of sensitive receptors;
- Regular watering will take place to ensure the moisture content is high enough to increase the stability of the soil and thus suppress dust. The regular watering of stockpiles has been found to have an 80% control efficiency (UK Office of Deputy Prime Minister, 2002); and
- Where feasible, hoarding will be erected around site boundaries to reduce visual impact. This will also have an added benefit of preventing larger particles from impacting on nearby sensitive receptors.

8.6.1.5 Site Traffic on Public Roads

Spillage and blow-off of debris, aggregates and fine material onto public roads will be reduced to a minimum by employing the following measures:

- Vehicles delivering or collecting material with potential for dust emissions shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust; and
- At the main site traffic exits, a wheel wash facility shall be installed. All trucks leaving the site must pass through the wheel wash. In addition, public roads outside the site shall be regularly inspected for cleanliness, as a minimum on a daily basis, and cleaned as necessary.

8.6.1.6 Summary of Dust Mitigation Measures

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

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

8.6.2 Operational Phase

The stack heights of the data centre back-up diesel generators and energy centre engines for the Proposed Development have been designed in an iterative fashion 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.

In terms of climate, the opportunity to export heat from the data halls to a proposed Vertical Farm is considered. These farms require heating to the soil to promote growth internally, and so the heat from the data centres would be ideal and would not require the temperatures to be elevated any further, so no additional energy input.

8.6.3 Decommissioning Phase

The objective of dust control at the site during the decommissioning phase is to ensure that no significant nuisance occurs at nearby sensitive receptors. In order to develop a workable and transparent dust control strategy, a dust minimisation plan will be formulated for the decommissioning phase of the Proposed Development to ensure no dust nuisance occurs at nearby sensitive receptors.

8.7 PREDICTED IMPACTS OF THE DEVELOPMENT

8.7.1 Construction Phase

8.7.1.1 Air Quality

When the dust mitigation measures detailed in the mitigation section (section 8.6.1) of this report are implemented, fugitive emissions of dust and particulate matter from the site will be ***negative***, ***short-term*** and ***imperceptible*** in nature, posing no nuisance at nearby receptors.

8.7.1.2 Climate

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. Based on the scale and temporary nature of the construction works and the intermittent use of equipment, the potential impact on climate change and transboundary pollution from the Proposed Development is deemed to be ***short-term***, ***negative*** and ***imperceptible*** in relation to Ireland's obligations under the EU 2030 target.

8.7.1.3 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***, ***short-term*** and ***imperceptible*** with respect to human health.

8.7.2 Operational Phase

8.7.2.1 Air Quality

Proposed Development (Worst-Case) Scenario (USEPA Methodology)

The NO_2 modelling results at the worst-case location at and beyond the site boundary are detailed in Table 8.5 using the USEPA methodology outlined within the guidance document titled *'Additional Clarification Regarding Application of Appendix W Modelling Guidance for the 1-Hour National Ambient Air Quality Standard'* (USEPA, 2011). This scenario involved the continuous operation of the energy centre gas engines, using SCR to reduce mass emissions to meet limits. It also included the emergency operation of 84 no. data centre back-up diesel generations associated the Proposed Development for 100 hours per year and emergency operation of the natural gas engines on backup diesel fuel oil for 24 hours per year, as well as considering scheduled testing for all 84 no. data centre back-up generators and 18 no. energy centre engines using back-up fuel oil. This is considered a worst-case assessment as historical data suggests that back-up diesel generators would typically only be required for 22 hours over a five-year period.

The results indicate that the ambient ground level concentrations are in compliance with the relevant air quality standards for NO_2. For the worst-case year modelled, emissions from the site lead to an ambient NO_2 concentration (including background) which is 72% of the maximum ambient 1-hour limit value (measured as a 99.8th percentile) and 92% of the annual limit value at the worst-case off-site receptor. Concentrations decrease with distance from the site boundary. The geographical variations in the 1 hour mean (99.8th percentile) and annual mean NO_2 ground level concentrations for the Proposed Development Scenario are illustrated as concentration contours in Figures 8.2 and 8.3.

Table 8.5 *NO_2 Dispersion Model Results – Proposed Development (Worst-Case) 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 / 2016	Annual mean	19.6	14	33.6	40	84%
	99.8th%ile of 1-hr Means	112.2	28	140.2	200	70%
NO_2 / 2017	Annual mean	22.7	14	36.7	40	92%
	99.8th%ile of 1-hr Means	111.5	28	139.5	200	70%
NO_2 / 2018	Annual mean	21.1	14	35.1	40	88%
	99.8th%ile of 1-hr Means	108.3	28	136.3	200	68%
NO_2 / 2019	Annual mean	20.7	14	34.7	40	87%
	99.8th%ile of 1-hr Means	113.8	28	141.8	200	71%
NO_2 / 2020	Annual mean	22.2	14	36.2	40	91%
	99.8th%ile of 1-hr Means	116.1	28	144.1	200	72%

For this scenario the emissions of continuous operations and non-continuous operations have also been modelled separately. Table 8.6 details the NO_2 modelling results for the continuous operation of the energy centre gas engines. Table 8.7 details the NO_2 modelling results for the emergency operation and testing of the data centre backup generators, and the emergency operation and testing of the energy centre engines in diesel mode.

The results indicate that the ambient ground level concentrations are in compliance with the relevant air quality standards for NO_2. For the worst-case year modelled, emissions from the continuous operation of the energy centre gas engines 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 percentile) and 72% of the annual limit value at the worst-case off-site receptor. Emissions from the emergency and testing operations lead to an ambient NO_2 concentration (including background) which is 86% of the maximum ambient 1-hour limit value (measured as a 99.8th percentile) and 72% of the annual limit value at the worst-case off-site receptor.

Table 8.6 *NO_2 Dispersion Model Results – Proposed Development (Worst-Case) Scenario: Continuous Operation of Energy Centre Gas Engines*

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 / 2016	Annual mean	13.2	14	27.2	40	68%
	99.8th%ile of 1-hr Means	71.3	28	99.3	200	50%
NO_2 / 2017	Annual mean	15.0	14	29.0	40	72%
	99.8th%ile of 1-hr Means	71.0	28	99.0	200	50%
NO_2 / 2018	Annual mean	14.0	14	28.0	40	70%
	99.8th%ile of 1-hr Means	70.8	28	98.8	200	49%
NO_2 / 2019	Annual mean	13.4	14	27.4	40	69%
	99.8th%ile of 1-hr Means	71.0	28	99.0	200	50%
NO_2 / 2020	Annual mean	15.4	14	29.4	40	73%
	99.8th%ile of 1-hr Means	71.1	28	99.1	200	50%

Table 8.7 *NO_2 Dispersion Model Results – Proposed Development (Worst-Case) Scenario: Emergency Operation and Testing*

Pollutant/ Year	Averaging Period	Process Contribution NO2 (µg/m3)	Background Concentration (µg/m3)	Predicted Environmental Concentration NO2 (µg/m3)	Limit Value (µg/m3)	PEC as a % of Limit Value
NO2 / 2016	Annual mean	17.8	14	31.8	40	79%
	99.8th%ile of 1-hr Means	111.7	28	139.7	200	70%
NO2 / 2017	Annual mean	20.3	14	34.3	40	86%
	99.8th%ile of 1-hr Means	111.0	28	139.0	200	69%
NO2 / 2018	Annual mean	19.2	14	33.2	40	83%
	99.8th%ile of 1-hr Means	107.8	28	135.8	200	68%
NO2 / 2019	Annual mean	19.3	14	33.3	40	83%
	99.8th%ile of 1-hr Means	113.8	28	141.8	200	71%
NO2 / 2020	Annual mean	19.7	14	33.7	40	84%
	99.8th%ile of 1-hr Means	115.8	28	143.8	200	72%

This scenarios assumed all six data halls and all 18 energy centre engines are operational simultaneously. In reality the Proposed Development will become operational in phases over a period of 4 – 5 years, with two data centre halls and six energy centre engines in operation for each phase. Initial emissions will therefore be lower than those reported here. Overall, the operational phase impact of the Proposed Development is considered ***long-term***, ***localised***, ***negative*** and ***slight***.

Proposed Development (Likely Average Operation) Scenario (USEPA Methodology)

This scenario involved the continuous operation of the energy centre gas engines, using SCR to reduce mass emissions by 95%. It also included the emergency operation of 84 no. data centre back-up diesel generations associated the Proposed Development for 100 hours per year and emergency operation of the natural gas engines on backup diesel fuel oil for 24 hours per year, as well as considering scheduled testing for all 84 no. data centre back-up generators and 18 no. energy centre engines using back-up fuel oil. The NO_2 modelling results at the worst-case location at and beyond the site boundary are detailed in Table 8.8.

The results indicate that the ambient ground level concentrations are in compliance with the relevant air quality standards for NO_2. For the worst-case year modelled, emissions from the site lead to an ambient NO_2 concentration (including background) which is 72% of the maximum ambient 1-hour limit value (measured as a 99.8th percentile) and 86% of the annual limit value at the worst-case off-site receptor. Concentrations decrease with distance from the site boundary.

Table 8.8 NO_2 Dispersion Model Results – Proposed Development (Likely Average Operation) 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 / 2016	Annual mean	18.1	14	32.1	40	80%
	99.8th%ile of 1-hr Means	112.1	28	140.1	200	70%
NO_2 / 2017	Annual mean	20.6	14	34.6	40	86%
	99.8th%ile of 1-hr Means	111.2	28	139.2	200	70%
NO_2 / 2018	Annual mean	19.6	14	33.6	40	84%
	99.8th%ile of 1-hr Means	108.1	28	136.1	200	68%
NO_2 / 2019	Annual mean	19.6	14	33.6	40	84%
	99.8th%ile of 1-hr Means	113.8	28	141.8	200	71%
NO_2 / 2020	Annual mean	20.1	14	34.1	40	85%
	99.8th%ile of 1-hr Means	115.8	28	143.8	200	72%

For this scenario the emissions of continuous operations and non-continuous operations have also been modelled separately. Table 8.9 details the NO_2 modelling results for the continuous operation of the energy centre gas engines. Table 8.10 details the NO_2 modelling results for the emergency operation and testing of the data centre backup generators, and the emergency operation and testing of the energy centre engines in diesel mode.

The results indicate that the ambient ground level concentrations are in compliance with the relevant air quality standards for NO_2. For the worst-case year modelled, emissions from the continuous operation of the energy centre gas engines lead to an ambient NO_2 concentration (including background) which is 27% of the maximum ambient 1-hour limit value (measured as a 99.8th percentile) and 44% of the annual limit value at the worst-case off-site receptor. Emissions from the emergency and testing operations lead to an ambient NO_2 concentration (including background) which is 72% of the maximum ambient 1-hour limit value (measured as a 99.8th percentile) and 86% of the annual limit value at the worst-case off-site receptor.

Table 8.9 *NO_2 Dispersion Model Results – Proposed Development (Likely Average Operation) Scenario: Continuous Operation of Energy Centre Gas Engines*

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 / 2016	Annual mean	2.9	14	16.9	40	42%
	99.8th%ile of 1-hr Means	25.6	28	53.6	200	27%
NO_2 / 2017	Annual mean	3.5	14	17.5	40	44%
	99.8th%ile of 1-hr Means	26.4	28	54.4	200	27%
NO_2 / 2018	Annual mean	3.1	14	17.1	40	43%
	99.8th%ile of 1-hr Means	26.2	28	54.2	200	27%
NO_2 / 2019	Annual mean	3.1	14	17.1	40	43%
	99.8th%ile of 1-hr Means	26.2	28	54.2	200	27%
NO_2 / 2020	Annual mean	3.3	14	17.3	40	43%
	99.8th%ile of 1-hr Means	26.0	28	54.0	200	27%

Table 8.10 *NO_2 Dispersion Model Results – Proposed Development (Likely Average Operation) Scenario: Emergency Operation and Testing*

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 / 2016	Annual mean	17.9	14	31.9	40	80%
	99.8th%ile of 1-hr Means	112.0	28	140.0	200	70%
NO_2 / 2017	Annual mean	20.4	14	34.4	40	86%
	99.8th%ile of 1-hr Means	111.2	28	139.2	200	70%
NO_2 / 2018	Annual mean	19.3	14	33.3	40	83%
	99.8th%ile of 1-hr Means	108.0	28	136.0	200	68%
NO_2 / 2019	Annual mean	19.4	14	33.4	40	83%
	99.8th%ile of 1-hr Means	113.8	28	141.8	200	71%
NO_2 / 2020	Annual mean	19.8	14	33.8	40	84%
	99.8th%ile of 1-hr Means	115.8	28	143.8	200	72%

This scenarios assumed all six data halls and all 18 energy centre engines are operational simultaneously. In reality the Proposed Development will become operational in phases over a period of 4 – 5 years, with two data centre halls and six energy centre engines in operation for each phase. Initial emissions will therefore be lower than those reported here. Overall, the operational phase impact of the Proposed Development on human health is considered ***long-term***, ***localised***, ***negative*** and ***slight***.

<u>*Proposed Development (Worst-Case) Scenario (UK Environment Agency Methodology)*</u>

The methodology, based on considering the statistical likelihood of an exceedance of the NO_2 hourly limit value assuming a hypergeometric distribution and which identifies the number of hours the back-up generators can operate before there is a likelihood of an exceedance, has been undertaken at the worst-case residential receptor for the Proposed Development Scenario. This scenario involved the emergency operation of 84 no. data centre back-up generators on the site. This methodology allows a comparison to be made between the maximum number of hours which the back-up generators can operate without exceeding the ambient air quality standards and the historical frequency of power outage. As outlined below the maximum number of hours the back-up generators can operate is 99 hours per year whilst the historical data suggests that back-up operation of the generators is only likely to be required for 22 hours overs a five-year period. Thus, the assessment shows there is adequate flexibility to allow for the operation of the back-up generators during any foreseeable power outages.

The cumulative hypergeometric distribution of 19 and more hours per year is computed and the probability of an exceedance determined as outlined in Table 8.11. The results have been compared to the 98th percentile confidence level to indicate if an exceedance is likely at various operational hours for the back-up diesel generators. The results indicate that in the worst-case year, the emergency generators for the Proposed Development can operate for up to 99 hours per year before there is a likelihood of an exceedance of the ambient air quality standard (at a 98th percentile confidence level). Figure 8.4 shows the statistical distribution predicted for the 98th percentile (based on 99 hours of operation per year). However, the UK guidance recommends that there should be no running time restrictions placed on back-up generators which provide power on site only during an emergency power outage.

Table 8.11 Hypergeometric Statistical Results at Worst-Case Residential Receptor – NO_2 Proposed Development (Worst-Case) Scenario

Pollutant/ Year	Hours of operation (Hours) (98th%ile) Allowed Prior To Exceedance Of Limit Value	UK Guidance – Probability Value = 0.02 (98th%ile) Note 1
NO_2 / 2016	133	0.02
NO_2 / 2017	99	
NO_2 / 2018	123	
NO_2 / 2019	119	
NO_2 / 2020	128	

Note 1 Guidance Outlined In UK EA publication “Diesel Generator Short-term NO_2 Impact Assessment” (EA, 2016)

8.7.2.2 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. A detailed flood risk assessment has been undertaken as part of this planning application and adequate attenuation and drainage have been provided for to account for increased rainfall in future years. Therefore, the impact will be ***imperceptible***.

Electricity providers form part of the EU-wide Emission Trading Scheme (ETS) and thus greenhouse gas emissions from these electricity generators are not included when determining compliance with the targeted 30% reduction in the non-ETS sector i.e. electricity associated greenhouse gas emissions will not count towards the Effort Sharing Decision target. Thus, any necessary increase in electricity generation due to data centre demand will have no impact on Ireland’s obligation to meet the EU Effort Sharing Decision. Under this scenario, as outlined in the Regulation, the new electricity provider will be treated as a “new entrant” under Phase IV of the ETS (i.e. an electricity generator obtaining a greenhouse gas emissions permit for the first time after 30th June 2018). The new electricity provider will be required to purchase allocations in the same manner as existing players in the market using the European Energy Exchange. EU leaders have also decided that during Phase IV (2021-2030) 90% of the revenue from the auctions will be allocated to the Member States on the basis of their share of verified emissions with 10% allocated to the least wealthy EU member states. The revised EU ETS Directive has enshrined in law the requirement that at least 50% of the auctioning revenues or the equivalent in financial value should be used for climate and energy related purposes.

In 2018, the market reported a fall of 4.1% (73 million tonnes CO_2eq) from 2017, the EU noted that much of the revenue raised by the cap and trade scheme is going towards climate and energy objectives (European Commission, 2019):

"In 2018, a strengthened carbon price signal led to a record amount of revenues for Member States from the selling of ETS allowances. The generated amount equalled some EUR 14 billion - more than doubling the revenues generated in 2017. Member States spent or planned to spend close to 70% of these revenues on advancing climate and energy objectives - well above the 50% required in the legislation"

In terms of the Proposed Development, as the facility generates over the threshold of 20 MW, a greenhouse gas emission permit will be required which will be regulated under the ETS scheme also. Thus, whether the facility is operated by electricity or gas engines onsite, the emissions are not included when determining compliance with the targeted 30% reduction in the non-ETS sector. In addition, on a EU-wide basis, where the ETS market in 2018 is approximately 1,655 million tonnes CO_2eq, the impact of the emissions associated with the proposed development will be less than 0.040% of the total EU-wide ETS market which is imperceptible.

In terms of wider energy policy, as outlined in the EPA publication "*Ireland's Greenhouse Gas Projections 2019-2040"* (EPA, 2020e) under the With Additional Measures scenario, emissions from the energy industries sector are projected to decrease by 34% to 7 Mt CO_2eq over the period 2019 to 2030 including the proposed increase in renewable energy generation to approximately 70% of electricity consumption:

- "*In this scenario it is assumed that for 2020 there is a 36.3% share of renewable energy in electricity generation. In 2030 it is estimated that renewable energy generation increases to approximately 70% of electricity consumption. This is mainly a result of further expansion in wind energy (comprising 3.5 GW offshore and approximately 8.2 GW onshore). Expansion of other renewables (e.g. solar photovoltaics) also occurs under this scenario;*
- *Under the With Additional Measures scenario two peat stations are assumed to run on 100% peat to the end of 2020 but PSO support finishes at the end of 2019. For 2020 the operation of the peat plants is determined by the electricity market. The third peat station operates to the end of 2023 with 30% co-firing;*
- *In this scenario the Moneypoint power station is assumed to operate in the market up to end 2024 at which point it no longer generates electricity from coal as set out in the Climate Action Plan; and*
- *In terms of inter-connection, it is assumed that the Greenlink 500MW interconnector to the UK to come on stream in 2025 and the Celtic 700MW interconnector to France to come on stream in 2026*". (EPA, 2020e)

Data centres are typically 84% more efficient than on-premises servers and the GHG savings associated with this are not included in the GHG emissions total. In addition, in terms of total forecasted capacity, it is predicted that 1,700MW of data centres capacity will be operational by 2025 in Ireland. However, the carbon intensity of electricity is predicted to decrease from 331 gCO_2/kWh in 2019 to 100 gCO_2/kWh in 2030 as a result of the increase in renewables to 70% of the electricity market by 2030. Overall, it is predicted that data centres will peak at 2.2% of total GHG emissions in 2024 and will fall or level off after this date.

The indirect CO_2 emissions from electricity to operate the facility will not be significant in relation to Ireland's national annual CO_2 emissions. A Report titled *'Energy Related CO_2 Emissions In Ireland 2005 – 2018 (2019 Report)'* published by the Sustainable Energy Authority of Ireland (SEAI, 2020) states the average CO_2 emission factor for electricity generated in Ireland was 375 gCO_2/kWh in 2018. This average CO_2 emission factor is based on the national power generating portfolio. On the basis that the Proposed Development will consume 200 MW of power this equates to 1752 GWh annually based on the assumption of the national fuel mix. This translates to approximately 657,000 tonnes of CO_2eq per year. This will have an ***indirect***, ***long-term***, ***negative*** and ***slight*** impact on climate.

In terms of air quality it is appropriate to limit the cumulative assessment to regions where there will be significant overlap between the facilities and thus the cumulative assessment was limited to the site. In terms of climate, again it is appropriate to review the facility. As emissions from the onsite energy centre and electricity purchased will both form part of the EU-wide ETS scheme, the relevant cumulative impact would be the EU as a whole rather than Ireland. However, as highlighted above, the facility's impact will be less than 0.040% of the total EU-wide ETS market thus the cumulative impact will lead to an ***indirect***, ***long-term***, ***negative*** and ***slight*** impact on climate.

In addition, in terms of total forecasted capacity, it is predicted that 1,700MW of data centres capacity will be operational by 2025. However, the carbon intensity of electricity is predicted to decrease from 331 gCO_2/kWh in 2019 to 100 gCO_2/kWh in 2030 as a result of the increase in renewables to 70% of the electricity market by 2030. Overall, it is predicted that data centres will peak at 2.2% of total GHG emissions in 2024 and will fall or level off after this date (Host In Ireland, 2020).

8.7.2.3 Regional Air Quality

Directive (EU) 2016/2284 *"On The Reduction Of National Emissions Of Certain Atmospheric Pollutants And Amending Directive 2003/35/EC And Repealing Directive 2001/81/EC"* was published in December 2016. The Directive will apply the 2010 National Emission Ceiling Directive limits until 2020 and establish new national emission reduction commitments which will be applicable from 2020 and 2030 for SO_2, NO_X, NMVOC, NH_3 and $PM_{2.5}$ as detailed in Section 8.2.1.3.

Assuming that 200 MW is generated using the national fuel mix for the data centre, the NO_X emissions associated with this electricity over the course of one year (i.e. 1,752 GWh based on 200MW for 8,760 hours per annum) will equate to 584 tonnes per annum which is 0.90% of the National Emission Ceiling limit for Ireland from 2020 onwards. Similarly, SO_2 emissions associated this electricity over the course of one year (1,752 GWh) will equate to 221 tonnes per annum which is 0.53% of the National Emission Ceiling limit for Ireland from 2020. Additionally, NMVOC emissions associated this electricity over the course of one year (1,752 GWh) will equate to 664 tonnes per annum which is 1.21% of the National Emission Ceiling limit for Ireland from 2020. This range of increases (0.5 – 1.2%) in concentrations of NO_X, SO_2 and NMVOC indirect emissions associated with the operation of the Proposed Development is considered ***indirect***, ***long-term***, ***negative*** and ***slight*** with regards to regional air quality.

As discussed in Chapter 2 of this EIA Report, the Proposed Development's energy sources also consist of energy from solar panels to be installed where feasible on data centre buildings and heat pumps serving both the energy and data centres, as well as the main supply of natural gas. With these sources the Proposed Development is in compliance with the Building Regulations Technical Guidance Document (TGD) Part L 2017 (NZEB) Part L 2017 - Conservation of Fuel and Energy – 'Buildings other than Dwellings'.

8.7.2.4 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. The construction and decommissioning phases of the development will not lead to exceedances of the relevant ambient air quality standards and thus will not have a significant effect on human health.

In terms of the operational phase, as demonstrated by the dispersion modelling results, emissions from the site, assuming scheduled testing as well as emergency operation of the back-up generators, are compliant with all National and EU ambient air quality limit values and, therefore, will not result in a significant impact on human health. In relation to the spatial extent of air quality impacts from the site, ambient concentrations will decrease significantly with distance from the site boundary. Further details of the potential impacts on human health associated with the Proposed Development are discussed in Chapter 4 of this EIA Report.

8.7.2.5 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) –** Ballycar Lough pNHA, Cahircalla Wood pNHA, Dromoland Lough pNHA, Durra Castle pNHA, Fergus Estuary And Inner Shannon pNHA, North Shore pNHA, Fin Lough (Clare) pNHA, Inchicronan Lough pNHA, Lough Cleggan pNHA, Lough Cullaunyheeda pNHA, Newpark House (Ennis) pNHA, Poulnagordon Cave (Quin) pNHA, Rosroe Lough pNHA;
- **Natural Heritage Areas (NHA) –** Maghere Mountain Bogs NHA, Oysterman's Marsh NHA;
- **Special Areas of Conservation (SAC) –** Ballyallia Lake SAC/pNHA, Ballycullinan Lake SAC/pNHA, Ballycullinan Old Domestic Building SAC, Dromore Woods And Loughs SAC/pNHA, East Burren Complex SAC/pNHA, Knockanira House SAC, Lower River Shannon SAC, Moyree River System SAC/pNHA, Newgrove House SAC, Newhall And Edenvale Complex SAC/pNHA, Old Domestic Building (Keevagh) SAC/pNHA, Old Domestic Buildings, Rylane SAC, Old Farm Buildings, Ballymacrogan SAC, Pouladatig Cave SAC/pNHA, Poulnagordon Cave (Quin) SAC, Toonagh Estate SAC; and
- **Special Protection Area (SPA) –** Ballyallia Lough SPA, Corofin Wetlands SPA, River Shannon and River Fergus Estuaries SPA, and Slieve Aughty Mountains SPA.

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 (2016 – 2020). The receptor spacing ranged from 25 m to 100 m with 2,486 discrete receptors modelled in total within the sensitive ecosystems.

The NO_X modelling results are detailed in Table 8.12. Emissions from the facility lead to an ambient NO_X concentration (excluding background) which ranges from 6 – 7% of the annual limit value at the worst-case location within the designated sites over the five years of meteorological data modelled. In addition, modelling results based on conservative assumptions indicate that the Proposed Development combined with background concentrations will have an slight impact on NO_X concentrations within the sensitive ecosystems contributing at most 70% of the limit value at the worst-case location in the worst-case year modelled.

Table 8.12 *Modelled NO_X Concentrations (µg/m^3) Within the Modelled Ecological Receptors for all Emission Points at the Proposed Development*

Pollutant/ Year	Averaging Period	Process Contribution NO_X (µg/m^3)	Background Concentration (µg/m^3)	Predicted Environmental Concentration NO_X (µg/m^3)	Limit Value (µg/m3) Note 1	PEC as a % of Limit Value
NO_X / 2016	Annual mean	2.0	19	21.0	30	70%
NO_X / 2017	Annual mean	1.9	19	20.9	30	70%
NO_X / 2018	Annual mean	1.8	19	20.8	30	69%
NO_X / 2019	Annual mean	1.8	19	20.8	30	69%
NO_X / 2020	Annual mean	1.5	19	19.0	30	68%

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 8.12 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” (EA, 2014):

Dry deposition flux (µg/m^2/s) = ground-level concentration (µg/m^3) x deposition velocity (m/s)

The deposition velocities for NO_X are outlined in AQTAG06 (EA, 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 (EA, 2014)) to convert it to a nitrogen (N) deposition flux (kg/ha/yr).

The N deposition flux for the worst-case year is 3.02 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 Scheme are not significant.

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

8.7.2.6 Impact of NO_X on Onsite Sensitive Habitats

There are also sensitive habitats without National or European designations within the site boundary. As outlined above, the annual limit value of 30 µg/m^3 for NO_X is specified within EU Directive 2008/50/EC for the protection of ecosystems. However, this standard should not be applied to areas which fall into the following categories:

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

Thus, onsite levels of NO_X are exempt from the application of the EU standard for the protection of ecosystems. Nevertheless, the results from the assessment are outlined below.

The NO_X modelling results are detailed in Table 8.13, to demonstrate the worst-case change in ambient concentration of NO_X these habitats are predicted to experience due to the Proposed Development. Emissions from the facility lead to an ambient NO_X concentration (excluding background) which ranges from 43.6 - 56.4 µg/m^3 at the worst-case location within the site over the five years of meteorological data modelled. In addition, modelling results based on conservative assumptions indicate that the Proposed Development combined with background concentrations lead to an ambient NO_X concentration which ranges from 62.6 - 75.4 µg/m^3 at the worst-case location within the site over the five years of meteorological data modelled

In terms of deposition, the habitat onsite includes rich fen (including Alkaline fens), wet grassland (including Molinia meadows), marsh, reed and large sedge swamps and various types of woodland (see Chapter 7 (Biodiversity) for further details). The maximum Nitrogen (N) deposition flux for the worst-case year is 10.86 kg/ha/yr. This can be compared to the range of critical loads for the various onsite habitats outlined in the UNECE 2010 Report "Empirical Critical Loads And Dose-Response Relationships". Rich fen critical loads range from 15-30 kg/ha/yr, wet grassland range from 10-20 kg/ha/yr, Molinia meadows ranged from 15-25 kg/ha/yr, marshes range from 20-30 kg/ha/yr whilst woodland ranged from 10-20 kg/ha/yr (UNECE, 2010). Thus the maximum critical load of N is below the upper ranges of all habitats onsite and also below most of the lower ranges of the onsite habitat sites also.

Table 8.13 *Modelled NO_X Concentrations (µg/m^3) Within the On-Site Modelled Ecological Receptors for all Emission Points at the Proposed Development*

Pollutant/ Year	Averaging Period	Process Contribution NO_X (µg/m^3)	Background Concentration (µg/m^3)	Predicted Environmental Concentration NO_X (µg/m^3)
NO_X / 2016	Annual mean	55.3	19	74.3
NO_X / 2017	Annual mean	44.5	19	63.5
NO_X / 2018	Annual mean	48.0	19	67.0
NO_X / 2019	Annual mean	56.4	19	75.4
NO_X / 2020	Annual mean	43.6	19	62.6

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

8.8 CUMULATIVE IMPACTS

A review of licensed facilities in the surrounding area has been conducted and none have been identified with the potential for cumulative impact with the Proposed Development. Consideration of all developments identified in Chapter 3 Appendix 3.1 was also undertaken and no potential for cumulative impact with the Proposed Development was identified as the planned developments have no or negligible potential for NO_2 emissions.

In terms of climate, emissions from the onsite energy centre and electricity purchased will both form part of the EU-wide ETS scheme, the relevant cumulative impact would be the EU as a whole rather than Ireland. However, the facility's impact will be less than 0.040% of the total EU-wide ETS market thus the cumulative impact will lead to an ***indirect***, ***long-term***, ***negative*** and ***slight*** impact on climate.

8.9 RESIDUAL IMPACTS

Once the mitigation measures outlined in Section 8.6 are implemented, the residual impacts on air quality or climate from the construction of the Proposed Development will be ***short-term*** and ***imperceptible***. In terms of human health, the operational phases of the Proposed Development will be ***long-term***, ***negative*** and ***slight***. In relation to designated habitat sites, the construction and operational phase impacts of the Proposed Development on designated habitat sites is considered ***long-term***, ***localised***, ***negative*** and ***imperceptible***.

Interactions are presented in Chapter 15.

8.10 REFERENCES

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FIGURES

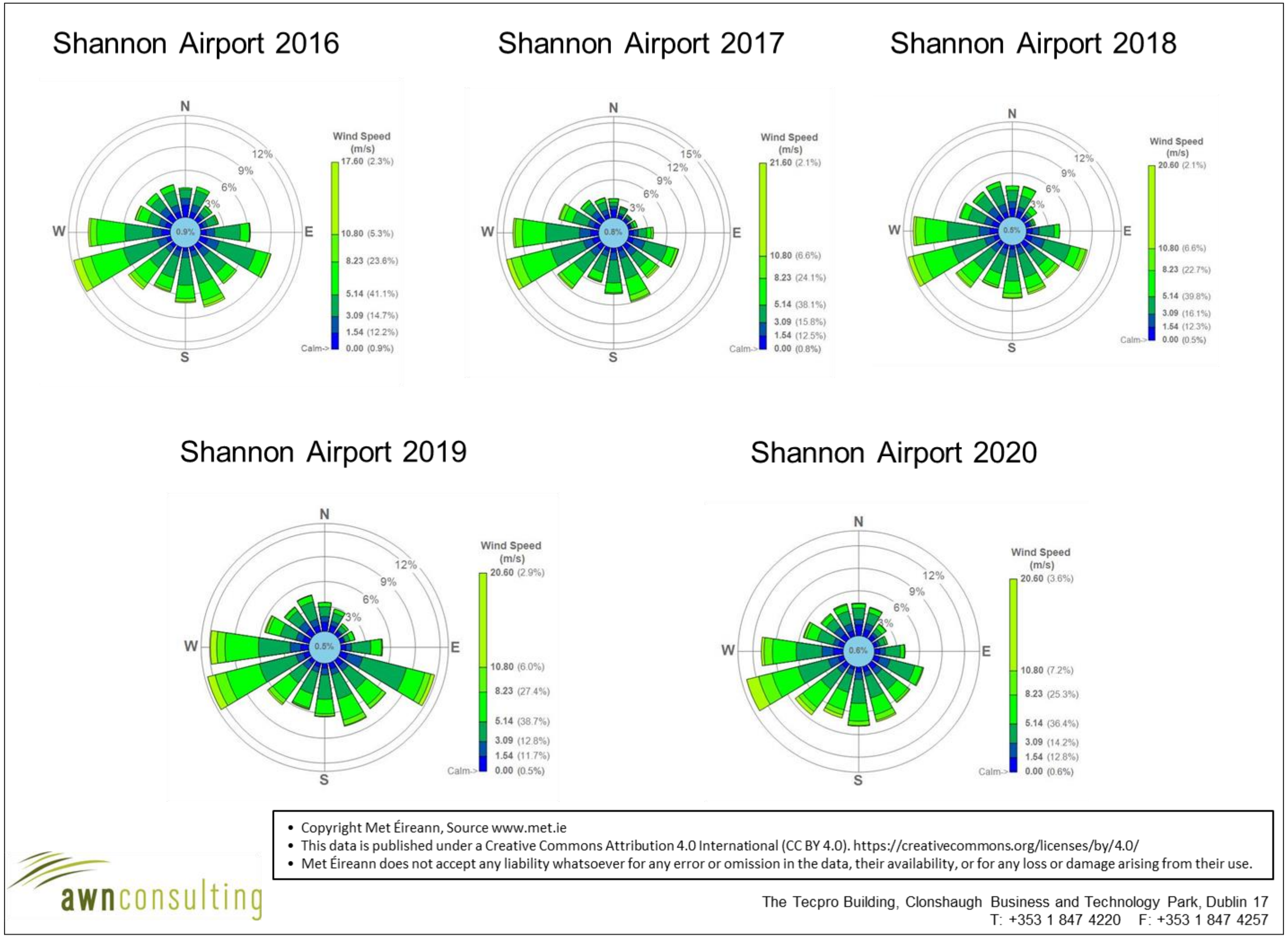


Figure 8.1 *Shannon Airport Windrose 2016 – 2020*

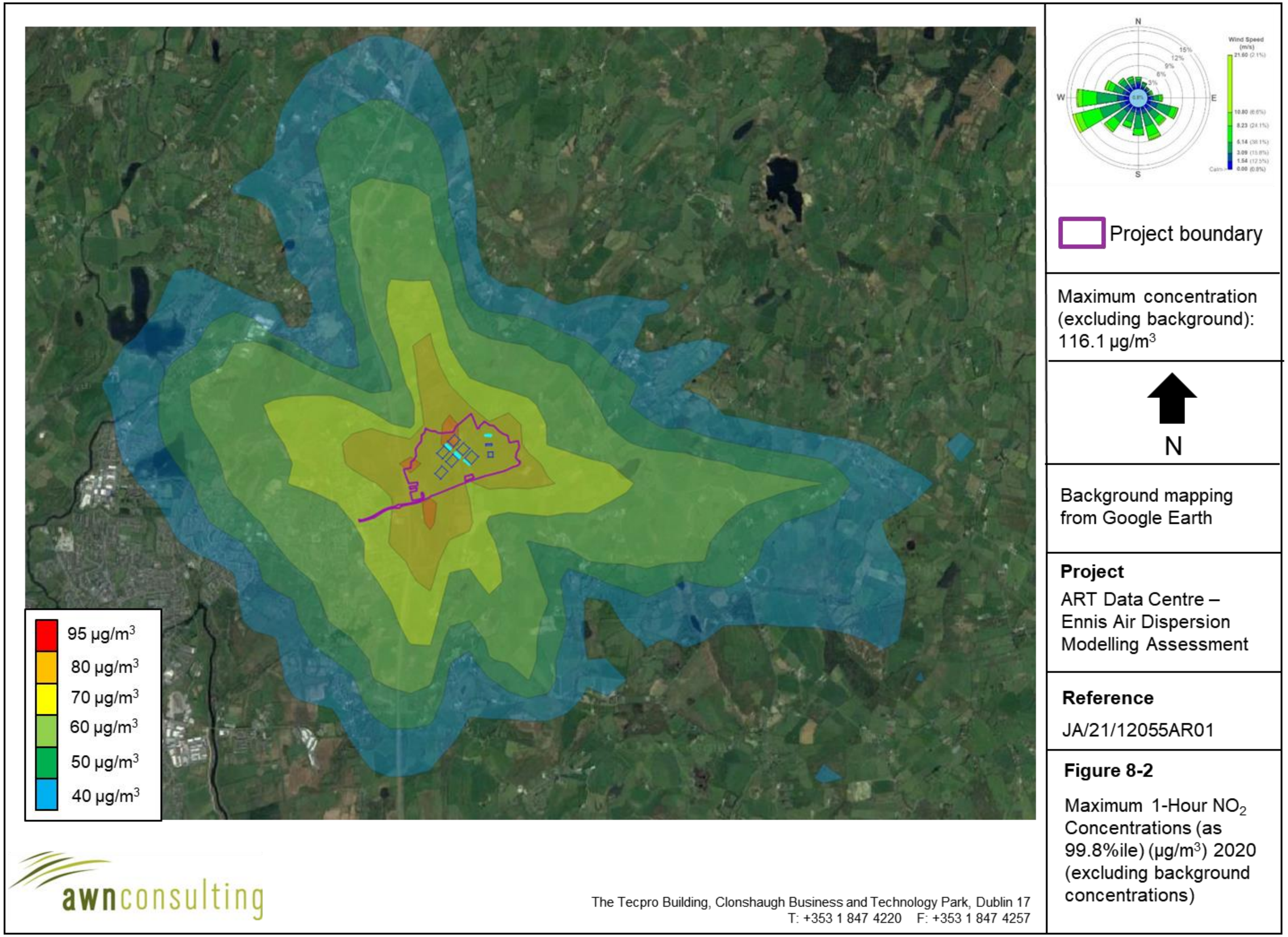


Figure 8.2 *Maximum 1-Hour NO_2 Concentrations (as 99.8%ile) (µg/m^3) 2020 (excluding background concentrations)*

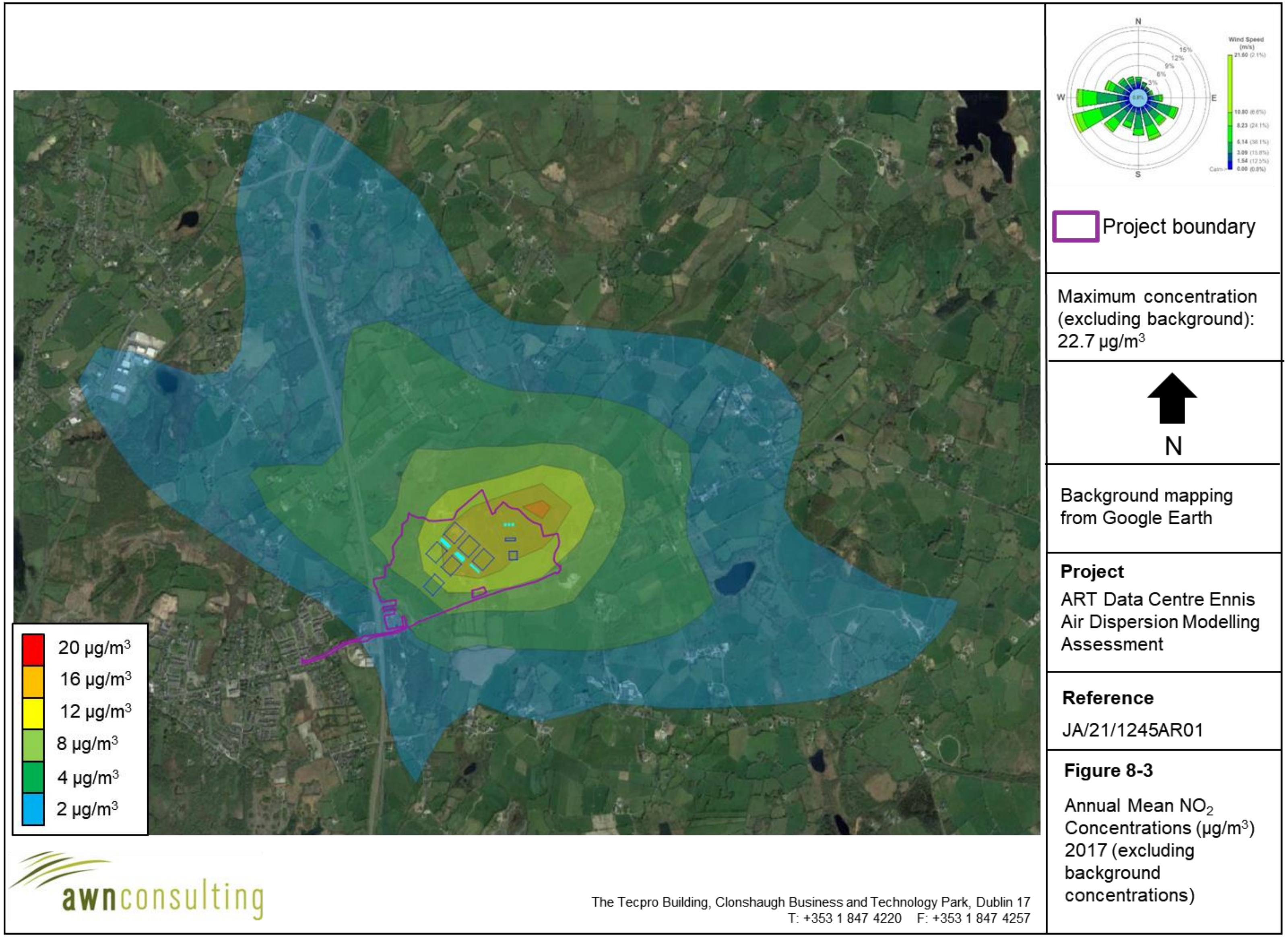


Figure 8.3 *Annual Mean NO_2 Concentrations (µg/m^3) 2017 (excluding background concentrations)j*

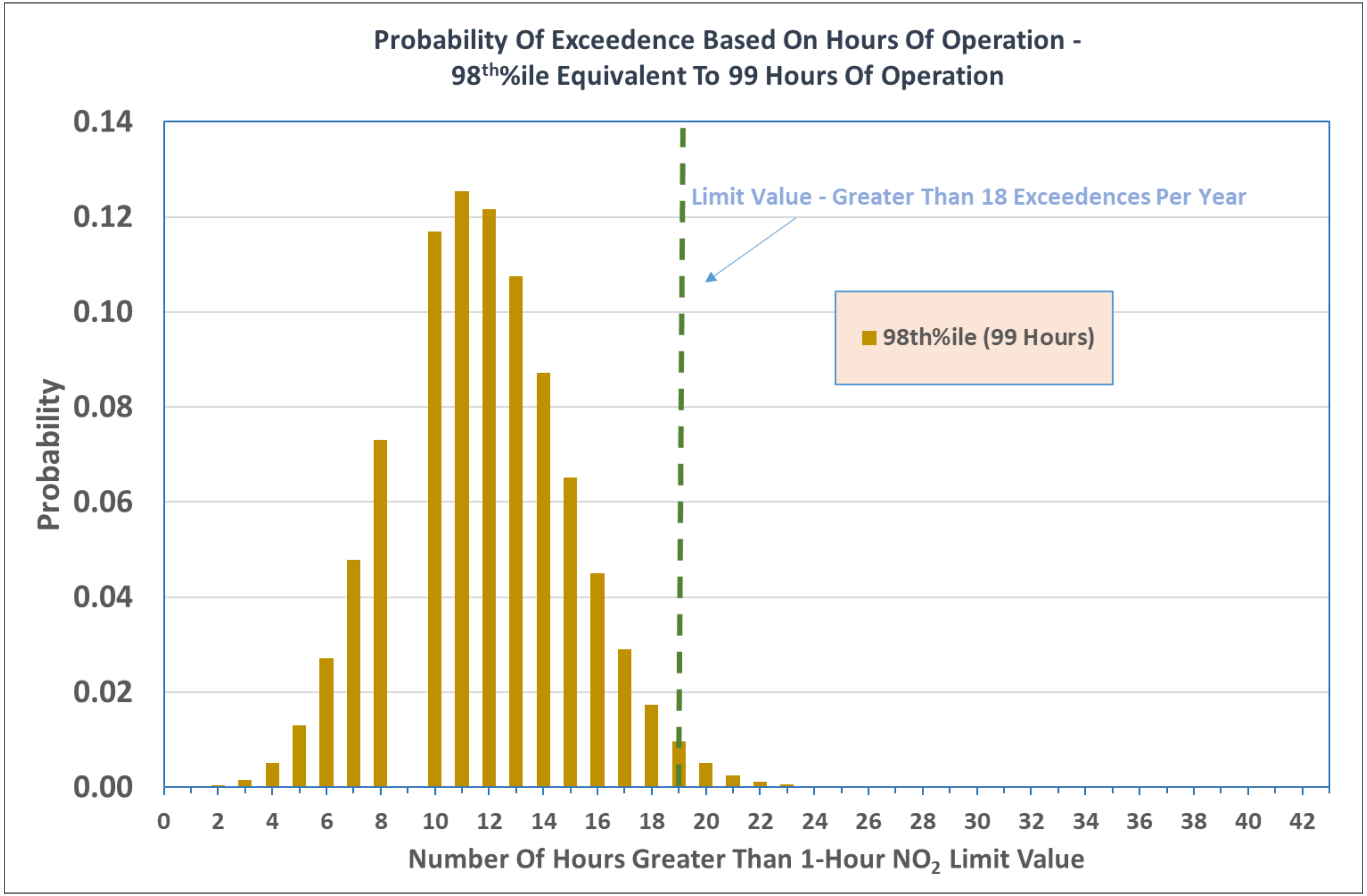


Figure 8.4 *Probability of Exceedance of 1-Hour NO_2 Ambient Air Quality Limit Value based on Hours of Operation for Emergency Generators for Proposed Development*

9.0 NOISE & VIBRATION

9.1 INTRODUCTION

As detailed in Chapter 1 Introduction, this EIA Report has been prepared to accompany an application for a data storage facility and associated ancillary development at a site north east of the junction of the M18 and the R352 (Tulla Road), Ennis, Co. Clare. The Proposed Development site is illustrated in Figure 9.1 below.

Residential noise sensitive locations are located along a section of the southern boundary of the site where two private residential locations on the north side of the R352 are located. A number of other detached private residences are located opposite the extent of the southern boundary of the site on the opposite side of the R352. To the east of the site the closest noise sensitive residential location is some 250 m from the red line boundary. The nearest noise sensitive locations to the north consist of a number of private residential properties located along a local road at some 430 m from the red line boundary.

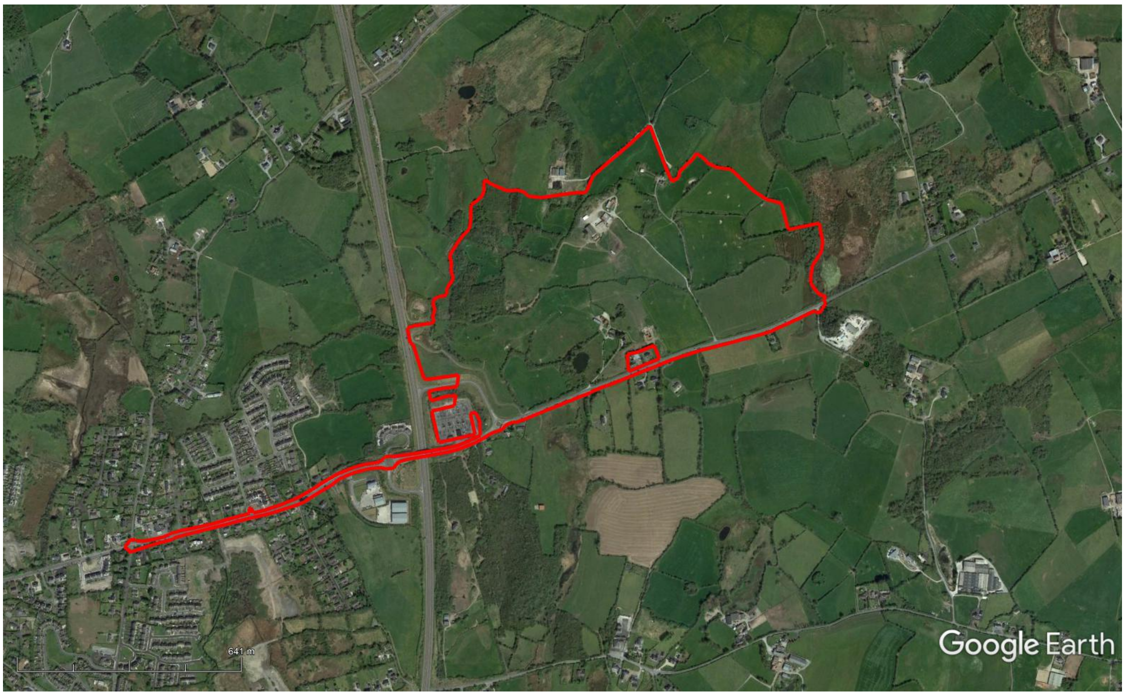


Figure 9.1 *Project Boundary and Context*

The Proposed Development will consist of the construction of a six data storage facility and associated elements will include AHU plant (i.e. 48 per data centre), roof plant (i.e. 1 chiller per data centre) and emergency stand-by generators (i.e. 14 per data centre). The Proposed Development will also include an energy centre a substation and a vertical farm building.

This Proposed Development has been assessed and discussed in this assessment in terms of potential noise and vibration impacts on the surrounding environment.

A glossary of the acoustic terminology used in this chapter is presented in Appendix 9.1.

9.2 METHODOLOGY

9.2.1 Proposed Approach

The following methodology has been adopted for this assessment:

- review appropriate guidance, typical local authority planning conditions, etc. in order to identify appropriate noise criteria for the site operations;
- carry out noise monitoring at a number of locations (e.g. in the vicinity of nearest sensitive properties/boundaries) to identify existing levels of noise in the vicinity of the development;
- development of a detailed 3D noise model to consider the Proposed Development; and
- comment on predicted levels against the appropriate criteria and existing noise levels and outline required mitigation measures (if any).

In the first instance it is considered appropriate to review some basic fundamentals of acoustics.

9.2.2 Fundamentals of Acoustics

In order to provide a broader understanding of some of the technical discussion in this report, this section provides a brief overview of the fundamentals of acoustics and the basis for the preparation of this noise assessment.

A sound wave travelling through the air is a regular disturbance of the atmospheric pressure. These pressure fluctuations are detected by the human ear, producing the sensation of hearing. In order to take account of the vast range of pressure levels that can be detected by the ear, it is convenient to measure sound in terms of a logarithmic ratio of sound pressures. These values are expressed as Sound Pressure Levels (SPL) in decibels (dB).

The audible range of sounds expressed in terms of Sound Pressure Levels is 0dB (for the threshold of hearing) to 120dB (for the threshold of pain). In general, a subjective impression of doubling of loudness corresponds to a tenfold increase in sound energy which conveniently equates to a 10dB increase in SPL. It should be noted that a doubling in sound energy (such as may be caused by a doubling of traffic flows) increases the SPL by 3dB.

The frequency of sound is the rate at which a sound wave oscillates and is expressed in Hertz (Hz). The sensitivity of the human ear to different frequencies in the audible range is not uniform. For example, hearing sensitivity decreases markedly as frequency falls below 250Hz. In order to rank the SPL of various noise sources, the measured level has to be adjusted to give comparatively more weight to the frequencies that are readily detected by the human ear. Several weighting mechanisms have been proposed but the ‘A-weighting’ system has been found to provide one of the best correlations with perceived loudness. SPL’s measured using ‘A-weighting’ are expressed in terms of dB(A). An indication of the level of some common sounds on the dB(A) scale is presented in Figure 9.2.

The ‘A’ subscript denotes that the sound levels have been A-weighted. The established prediction and measurement techniques for this parameter are well developed and widely applied. For a more detailed introduction to the basic principles of acoustics, reference should be made to an appropriate standard text.

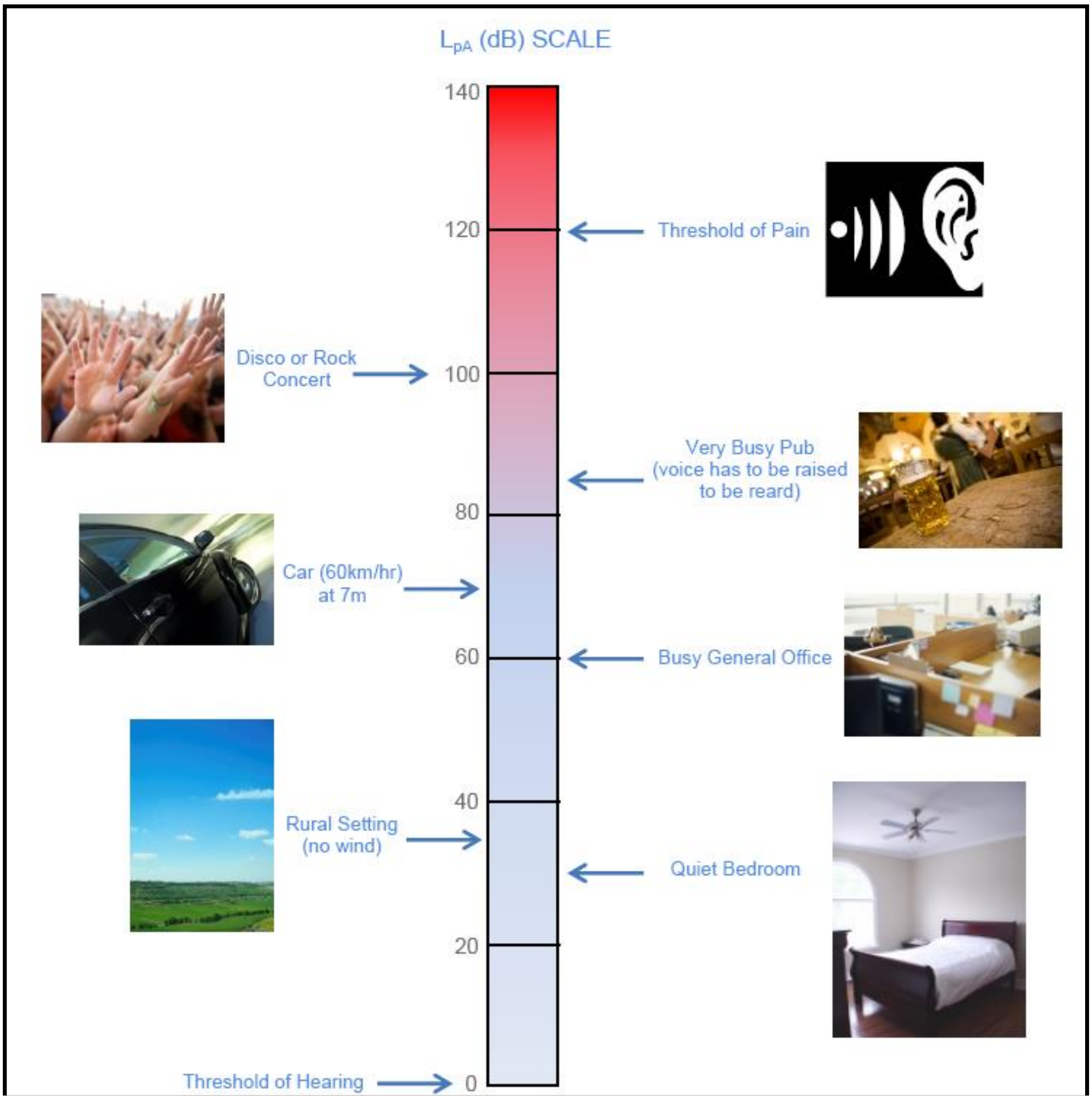


Figure 9.2 *dB(A) Scale & Indicative Noise Levels – (EPA: Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4 – 2016))*

9.2.3 Significance of Impacts

The significance of noise and vibration impacts has been assessed in accordance with the EPA Draft EIA Report Guidelines 2017 and EPA Draft Advice Notes for EIS 2015 see Tables 9.1 to 9.3 below. As these guidelines do not quantify the impacts in decibel terms, further reference has been made to the draft '*Guidelines for Noise Impact Assessment*' produced by the Institute of Acoustics/Institute of Environmental Management and Assessment Working Party.

With regard to the quality of the impact, ratings may have positive, neutral or negative applications where:

Table 9.1 *Quality of Potential Effects*

Quality of Effects	Definition
Negative	A change which reduces the quality of the environment (e.g. by causing a nuisance).
Neutral	No effects or effects that are imperceptible, within the normal bounds of variation or within the margin of forecasting error.
Positive	A change that improves the quality of the environment (e.g. by removing a nuisance).

The significance of an effect on the receiving environment are described as follows:

Table 9.2 *Significance of Effects*

Significance of Effects on the Receiving Environment	Description of Potential Effects
Imperceptible	An effect capable of measurement but without significant consequences.
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
Significant	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters a sensitive aspect of the environment.
Profound	An effect which obliterates sensitive characteristics.

The duration of effects as described in the Draft EPA Guidelines are:

Table 9.3 *Duration of Effects*

Duration of Impact	Definition
Momentary	Effects lasting from seconds to minutes
Brief	Effects lasting less than a day
Temporary	Effects lasting one year or less
Short-term	Effects lasting one to seven years
Medium-term	Effects lasting seven to fifteen years
Long-term	Effects lasting fifteen to sixty years
Permanent	Effects lasting over sixty years
Reversible	Effects that can be undone, for example through remediation or restoration

9.2.4 Construction Phase Guidance

Criteria for Rating Noise Impacts

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Local authorities normally control construction activities by imposing limits on the hours of operation and may consider noise limits at their discretion.

In the absence of specific noise limits, appropriate criteria relating to permissible construction noise levels for a development of this scale may be found in the British Standard BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise*.

The approach adopted here calls for the designation of an NSL into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. A threshold noise value is applied to each category. Exceedances (construction noise only) of the threshold value, at the facade of a sensitive receptor during construction, indicates a potential significant noise impact associated with the construction activities. The threshold values recommended by BS5228-1 are depicted in Table 9.4.

Table 9.4 *Example Threshold of Significant Effect at Dwellings*

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A Note A	Category B Note B	Category C Note C
Night-time (23:00 to 07:00hrs)	45	50	55
Evenings and weekends Note D	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

Note A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.
Note B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.
Note C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.
Note D) 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

It should be noted that this assessment method is only valid for residential properties.

For the appropriate period (e.g. daytime) the ambient noise level is determined and rounded to the nearest 5 dB. Based on review of baseline noise monitoring to hand (see Section 9.3) the relevant BS5228-1 threshold values at the various assessment locations are discussed in the Table 9.5.

Table 9.5 *Rounded Baseline Noise Levels and Associated Categories*

Period	Baseline Noise Category	Construction Noise Threshold Value $L_{Aeq,1hr}$ (dB)
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	A	65
Evening (19:00 to 23:00hrs)	A	55
Night time (23:00 to 07:00hrs)	A	45

Guidance on the degree of significance is presented the UK document Design Manual for Roads and Bridges (2020) *LA 111 Sustainability & Environmental Appraisal. Noise and Vibration Rev 2*. The approach is as follows:

- to determine the threshold value for construction noise according to the method from BS5228 described above and
- to compare the predicted construction noise level with the existing noise levels and the threshold value according to the criteria in the table below.

Potentially this procedure is to be followed separately for each noise-sensitive location, however in this instance as the existing noise levels at all survey locations correspond in Category A according to table above, all noise-sensitive locations are considered together.

Similarly, for this proposed development the vast majority of construction works will take place within the 'Daytime' period, i.e. 07:00 – 19:00 on Mondays to Fridays and 07:00 – 13:00 on Saturdays.

The magnitude of the construction noise impact according the DMRB is mapped to the EPA significance terms as detailed in Table 9.6:

Table 9.6 *Description of the magnitude of impacts. Adapted from DMRB Table 3.16*

Predicted Construction Noise Level is	Magnitude of Impact (DMRB)	EPA Significance of Effect
Below or equal Baseline Noise Level	Negligible	Not Significant
Above Baseline and below or equal to threshold	Minor	Slight – Moderate
Above threshold and below or equal to threshold + 5dB	Moderate	Moderate – Significant
Above threshold + 5dB	Major	Significant – Very Significant

This assessment process determines if a significant construction noise impact is likely. Notwithstanding the outcome of this assessment, the overall acceptable levels of construction noise are set out in the Transport Infrastructure Ireland (TII) publication *Guidelines for the Treatment of Noise and Vibration in National Road Schemes*[1], which should not be exceeded at noise sensitive locations during the construction phase of the development. Table 9.7 sets out these levels.

Table 9.7 *Maximum Permissible Noise Levels at the Facade of Dwellings during Construction*

Days and Times	Noise Levels (dB re. $2x10^{-5}$ Pa)	
	$L_{Aeq(1hr)}$	L_{Amax}
Monday to Friday 07:00 to 19:00hrs	70	80
Monday to Friday 19:00 to 22:00hrs	60*	65*
Saturdays 08:00 to 16:30hrs	65	75
Sundays & Bank Holidays 08:00 to 16:30hrs	60*	65*

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

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

In exceptional circumstances there may be a requirement that certain construction works are carried out during night-time periods. In these instances, the relevant evening (60 dB L_{Aeq1hr}) and night-time (50 dB $L_{Aeq,1hr}$) will apply.

Therefore, based on the above the following construction noise criteria are proposed for the site in relation to day to day works during the stated construction hours:

70 dB $L_{Aeq,1hr}$ at noise sensitive location

75 dB $L_{Aeq,1hr}$ at commercial property

Criteria for Rating Vibration Impacts

Vibration standards come in two varieties: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. In both instances, it is appropriate to consider the magnitude of vibration in terms of Peak Particle Velocity (PPV).

It is acknowledged that humans are particularly sensitive to vibration stimuli and that any perception of vibration may lead to concern. In the case of road traffic, vibration is perceptible at around 0.5 mm/s and may become disturbing or annoying at higher magnitudes. However, higher levels of vibration are typically tolerated for single events or events of short duration. For example, rock breaking and piling, two of the primary sources of vibration during construction, are typically tolerated at vibration levels up to 12 mm/s and 5 mm/s respectively. This guidance is applicable to the daytime only; it is unreasonable to expect people to be tolerant of such activities during the night.

Guidance relevant to acceptable vibration within buildings is contained in the following documents:

- British Standard BS 7385: 1993: *Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration*, and;
- British Standard BS 5228-2: 2009+A1:2014: *Code of practice for noise and vibration control on construction and open sites – Vibration*.

BS 7385 states that there should typically be no cosmetic damage if transient vibration does not exceed 15 mm/s at low frequencies rising to 20 mm/s at 15 Hz and 50 mm/s at 40 Hz and above. These guidelines relate to relatively modern buildings and should be reduced to 50% or less for more critical buildings.

BS 5228 recommends that, for soundly constructed residential property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak component particle velocity (in frequency range of predominant pulse) of 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz and 50 mm/s at 40 Hz and above. Below these values minor damage is unlikely. Where continuous vibration is such as to give rise to dynamic magnification due to resonance, the guide values may need to be reduced by up to 50%. BS 5288-2 also comments that important buildings which are difficult to repair might require special consideration on a case by case basis.

The TII document *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* also contains information on the permissible construction vibration levels as follows:

Table 9.8 Allowable Vibration during Construction Phase

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

9.2.5 Operational Phase – Noise Guidance

The relevant local authority, Clare County Council (CCC), does not have any standard noise conditions listed in the *Noise Action Plan 2018*. Therefore, consideration has been given to the following best practice and national guidance and a review of planning conditions recently applied to similar developments in the area.

In order to establish whether the noise sensitive locations in the vicinity of the site would be considered 'low background noise' areas as defined in the Environmental Protection Agency (EPA) publication *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities* (NG4 2016) guidance, the noise levels measured during the environmental noise survey need to satisfy the following criteria:

- Arithmetic Average of L_{A90} During Daytime Period ≤40dB L_{A90}, and;
- Arithmetic Average of L_{A90} During Evening Period ≤35dB L_{A90}, and;
- Arithmetic Average of L_{A90} During Night-time Period ≤30dB L_{A90}.

Determining Appropriate Noise Criteria

Table 9.9 below outlines the noise emission limit criteria detailed in the NG4 document.

Table 9.9 *NG4 Approach for Determining Appropriate Noise Criteria*

Scenario	Daytime Noise Criterion, dB $L_{Ar,T}$ (07:00 to 19:00hrs)	Evening Noise Criterion, dB $L_{Ar,T}$ (19:00 to 23:00hrs)	Night Noise Criterion, dB L_{Aeq} (23:00 to 07:00hrs)
Areas of Low Background Noise	45dB	40dB	35dB
All Other Areas	55dB	50dB	45dB

The arithmetic average L_{A90} results at each location are compared against the criteria in Table 9.10.

Table 9.10 *Comparison of Measurement Results with NG4 Low Background Noise Area Criteria*

Location	Period	$L_{A90,T}$ (dB)	NG4 Screening (dB $L_{A90,T}$)	Satisfies All Criteria for Low Background Noise Area?
A	Daytime	35	≤40	Yes
	Evening	30	≤35	
	Night-time	30	≤30	
B	Daytime	40	≤40	Yes
	Evening	35	≤35	
	Night-time	29	≤30	
C	Daytime	37	≤40	Yes
	Evening	35	≤35	
	Night-time	31	≤30	
D	Daytime	43	≤40	No
	Evening	45	≤35	
	Night-time	32	≤30	

Based on a review of the noise data , in the vicinity of the development site obtained during the baseline noise survey, see Section 9.3, a number of the noise sensitive locations in the vicinity of the site are defined as areas of low background noise as per the NG4 guidance. In these instances, a 45 dB $L_{Aeq,15min}$ daytime, 40 dB $L_{Aeq,15min}$ evening and 35dB $L_{Aeq,15min}$ night-time criteria are applied to day to day operations of the site.

Operational plant and equipment will be selected such that there are no audible tonal or impulsive emissions at noise sensitive locations off site.

Assessment of Significance

The '*Guidelines for Environmental Noise Impact Assessment*' produced by the Institute of Environmental Management and Assessment (IEMA) (2014) have been referenced in order to categorise the potential effect of changes in the ambient noise levels during the operational phases of the proposed development.

The guidelines state that for any assessment, the potential significance should be determined by the assessor, based upon the specific evidence and likely subjective response to noise. Due to varying factors which effect human response to environmental noise (prevailing environment, noise characteristics, time periods, duration and level etc.) assigning a subjective response must take account of these factors.

The scale adopted in this assessment is shown in Table 9.11 below and is based on an example scale within the IEMA guidelines. The corresponding significance of impact presented in the Draft '*Guidelines on the Information to be Contained in Environmental Impact Assessment Reports'* (EPA, 2017) is also presented.

The criteria above reflect the key benchmarks that relate to human perception of sound. A change of 3 dB(A) is generally considered to be the smallest change in environmental noise that is perceptible to the human ear. A 10 dB(A) change in noise represents a doubling or halving of the noise level. The difference between the minimum perceptible change and the doubling or halving of the noise level is split to provide greater definition to the assessment of changes in noise level.

It is considered that the criteria specified in the above table provide a good indication as to the likely significance of changes on noise levels in this case and have been used to assess the impact of operational noise.

Table 9.11 *Operational Noise Impact Scale*

Noise Level Change dB(A)	Subjective Response	Impact Guidelines for Noise Impact Assessment Significance (Institute of Acoustics)	Impact Guidelines on the Information to be contained in EIA Reports (EPA)
0	No change	None	Imperceptible
0.1 – 2.9	Barely perceptible	Minor	Not Significant
3.0 – 4.9	Noticeable	Moderate	Slight, Moderate
5.0 – 9.9	Up to a doubling or halving of loudness	Substantial	Significant
10.0 or more	More than a doubling or halving of loudness	Major	Very Significant, Profound

Emergency Operation

In order to provide continuity of service, a number of back-up emergency generators will be provided as part of the current proposal. These generators will only operate in the event of a loss of power supply i.e. temporary grid blackout, when diesel powered back-up generators will be provided to maintain power supply. It is anticipated, based on the Operator's experience, that back-up generators will rarely be used. They will be tested periodically to maintain operational readiness. Routine testing will be conducted during regular weekday daytime periods only. Section 4.4.1 of the Environmental Protection Agency (EPA) document "*Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities*" (NG4 - 2016) contains the following comments in relation to emergency plant items:

> *'In some instances, …sites will have certain items of emergency equipment (e.g. standby generators) that will only operate in urgent situations (e.g. grid power failure). Depending upon the context, it may be deemed permissible for such items of equipment to give rise to exceedances in the noise criteria/limits during limited testing and emergency operation only. If such equipment is in regular use for any purposes other than intermittent testing, it is subject to the standard limit values for the site'.*

It is therefore considered that the proposed noise criterion of 55 dB $L_{Aeq,1hr}$ on these emergency units is appropriate. Generators will be designed and mitigated in order to achieve this design goal at nearby residential noise sensitive locations.

Recommended Criteria

Following review of relevant guidance, the following noise criteria are proposed for the development:

Table 9.12 *Review of Adopted Noise Limits*

Activity	Noise Limit dB $L_{Aeq,15min}$ per Period			Source
	Day 07:00 – 19:00hrs	Evening 19:00 – 23:00hrs	Night 23:00 – 07:00hrs	
Day to Day Operations	45	40	35	EPA NG4
Generator Testing	45 Note A	--	--	EPA NG4
Emergency Operation (NSL)	55			EPA NG4

Note A Testing of the emergency generators shall take place between the hours of 08:00 and 17:00 Monday to Friday, testing shall not be permitted on Saturdays, Sundays or public holidays.

Note plant noise emissions are to be designed and plant selected such that they do not contain audible tones and do not have impulsive characteristics at the nearest noise sensitive locations.

9.2.6 Operational Phase – Vibration Guidance

Criteria for Rating Vibration Impacts

Guidance as to an acceptable magnitude of vibration during the operational phase of the development is best taken from British Standard *BS 6472 (1992): Guide to Evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz).* The Standard contains recommendations that continuous vibration in residential buildings should not exceed nominally 0.3 mm/s by daytime and 0.2 mm/s by night-time.

It should be noted that the Proposed Development will not give rise to any significant levels of vibration (i.e. less than 0.5 mm/s) off site and therefore the associated impact is identified as long term not significant.

9.2.7 Forecasting Methods

Construction noise calculations have been conducted generally in accordance with BS 5228: 2009+A1:2014: *Code of practice for noise control on construction and open sites - Noise.*

Prediction calculations for operational building services noise, car park activity and vehicle movements on site have been conducted generally in accordance with ISO 9613 (1996): *Acoustics – Attenuation of sound outdoors – Part 2: General method of calculation.*

Changes in road traffic noise on the local road network have been considered using prediction guidance contained within *Calculation of Road Traffic Noise (CRTN)* issued by the Department of Transport in 1988.

9.3 RECEIVING ENVIRONMENT

A series of noise surveys have been undertaken as part of the EIA Report preparation for the Proposed Development. Table 9.13 reviews the findings of these surveys. Full details of the noise monitoring campaign are presented in Appendix 9.2.

If the development is not progressed the existing noise environment will remain largely unchanged. Traffic noise is currently a significant noise source in the vicinity of road networks in the area. In the absence of the proposed development increases in traffic volumes on the local road network would be expected over time and would likely result in slight increases in the overall ambient and background noise levels in the area.

9.3.1 Comment on Noise Levels

Figure 9.3 illustrates the noise sensitive locations in the vicinity of the site at which noise monitoring was undertaken as part of the current assessment.

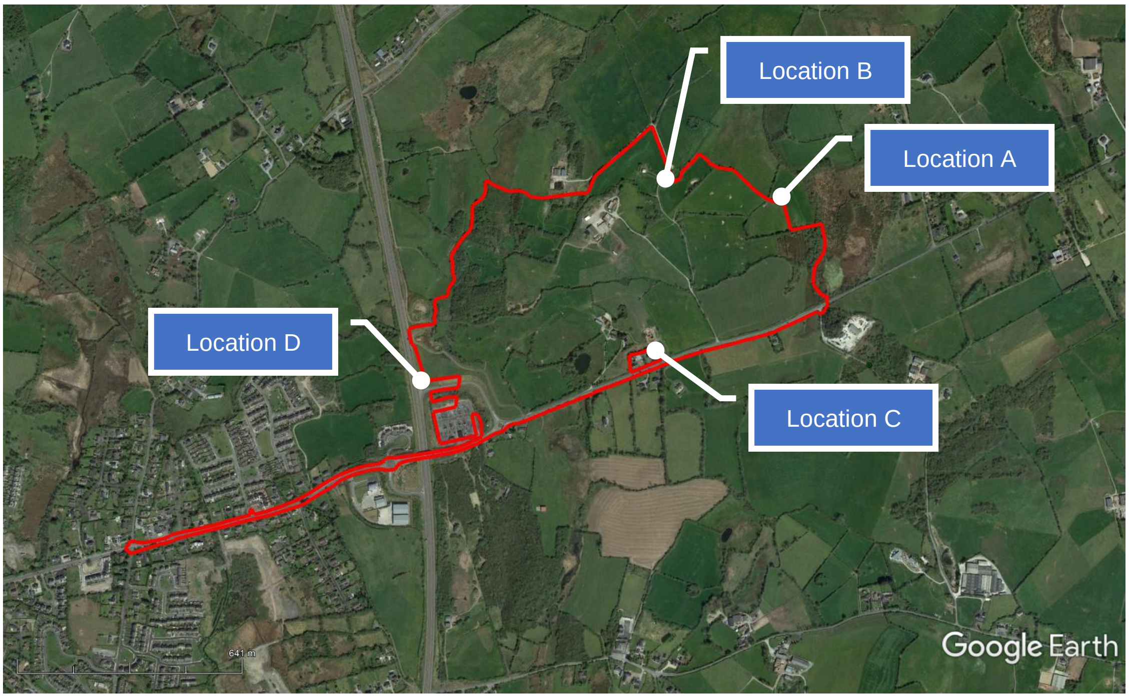


Figure 9.3 *Noise Sensitive Locations*

Location A Located towards the eastern boundary of the site. This location would be considered to be representative of the noise sensitive residences located to the east of the site.

Location B Located on open ground in the northern section of the site. The location is considered to be representative of noise sensitive locations located to the north along a minor road.

Location C Located to the rear of the closest residential properties located on the southern boundary of the site and off the R352 (Tulla Road). This location would be representative of the various noise sensitive properties located on both sides of the R352 (Tulla Road).

Location D Located to the west of the site. The location would be considered to be representative of noise levels in the vicinity of the Knockaneen halting site.

Road traffic noise, both distant and local was noted as the most significant source of noise and typically dictated ambient noise levels (i.e. $L_{Aeq,T}$) at the nearest noise sensitive locations to the site during daytime and night-time periods.

Background noise levels (e.g. $L_{A90,T}$) at the various locations were typically dictated by local and distant road traffic noise. These levels fell as would be expected into the early hours of the morning when the volume of traffic on the local and wider road network reduced.

Table 9.13 reviews the typical ambient and background noise levels at the sample locations discussed above.

Table 9.13 *Review of Typical Noise Levels*

Location	Period	Start Time	Sound Pressure Level (dB)	
			$L_{Aeq,15min}$	$L_{AF90,15min}$
A	Day	11:10	49	38
		12:38	44	33
		14:33	38	33
		Average	46	35
	Evening	21:36	36	30
	Night	22:58	39	30
		00:16	34	30
		Average	37	30
B	Day	11:36	45	40
		12:58	45	36
		14:55	49	43
		Average	47	40
	Evening	21:54	42	35
	Night	23:14	42	31
		00:32	37	28
		Average	40	29
C	Day	13:23	53	36
		14:11	51	37
		15:18	50	37
		Average	52	37
	Evening	22:13	53	35
	Night	23:33	50	31
		00:51	32	31
		Average	47	31
D	Day	12:10	63	50
		13:48	64	52
		15:40	65	56
		Average	64	53
	Evening	22:35	63	45
	Night	23:55	54	31
		01:11	45	32
		Average	52	32

These typical noise levels have been considered when discussing appropriate noise criteria in relation to the development as outlined in Table 9.13. Traffic noise from the R352, M18 and other roads in the study area dictated noise levels at all locations during the survey periods in question. It is considered that these conservative assumptions ensured and will ensure that appropriate noise criteria are applied to Proposed Development.

9.4 CHARACTERISTICS OF THE DEVELOPMENT

The Proposed Development will comprise the construction of the proposed data storage facilities and associated ancillary development over a seven year construction period. The Proposed Development consists of six data storage buildings, an energy centre and associated ancillary development.

When considering a development of this nature, the potential noise and vibration impact on the surroundings must be considered for each of two distinct stages:

- construction phase
- operational phase.

As stated, the construction phase will involve excavation, general site preparation over the development site and the erection of the new buildings over a phased construction period. Comment will also be presented in the following sections in relation to construction traffic on local roads in terms of noise and vibration.

The primary sources of outward noise in the operational context are deemed long term and will involve:

- building services noise;
- emergency site operations, and;
- additional vehicular traffic on public roads.

These issues are discussed in detailed in the following sections.

9.5 POTENTIAL IMPACTS OF THE DEVELOPMENT

9.5.1 Construction Phase

It is predicted that the construction programme will create typical construction activity related noise on site. During the construction phase of the proposed development, a variety of items of plant will be in use, such as excavators, lifting equipment, dumper trucks, compressors and generators.

The proposed general construction hours are 07:00 to 18:00hrs, Monday to Friday and 08:00 to 14:00hrs on Saturdays. Occasional weekday evening works may also be required; however evening activities will be significantly reduced in order to manage any associated noise impacts in an appropriate manner and more stringent construction noise criteria will be applicable during any evening works that may be required. As a result, noise emissions from evening activities are expected to be significantly lower than for other general daytime activities.

Due to the nature of daytime activities undertaken on a construction site there is potential for generation of significant levels of noise. The flow of vehicular traffic to and from a construction site is also a potential source of relatively high noise levels. The potential for vibration at neighbouring sensitive locations during construction is typically limited to excavation works and lorry movements on uneven road surfaces. Due to the proximity of sensitive locations to site works however, there is little likelihood of structural or even cosmetic damage to existing neighbouring dwellings as a result of vibration.

As the construction programme has been established in outline form only, it is difficult to calculate the actual magnitude of noise emissions to the local environment. However, it is possible to predict typical noise levels using guidance set out in BS 5228-1. Table 9.14 outlines typical plant items and associated noise levels that are anticipated for various phases of the construction programme.

For the purposes of the assessment, we have assumed that standard good practice measures for the control of noise from construction sites will be implemented. These issues are commented upon in further detail in the mitigation section of this report.

Table 9.14 *Typical Noise Levels associated with Construction Plant Items (BS5228-1)*

Phase	Item of Plant (BS 5228-1 Ref.)	Construction Noise Level at 10m Distance (dB $L_{Aeq,1hr}$)
1 – Site Preparation	Pneumatic Breaker (C5.6)	95
	Rock Breaker (C9.12)	85
	Wheeled Loader Lorry (C2 28)	74
	Tracked Semi-Mobile Crusher (C9.14)	90
	Track Excavator (C2 22)	72
	Dozer (C2.13)	78
	Dump Truck (C4.2)	78
2 – Foundations	Large Rotary Bored Piling Rig – Cast In-Situ (C3.14)	83
	Tracked Excavator (C3.24)	74
	Concrete Pump (C3.25)	78
	Compressor (C3 19)	75
	Poker Vibrator (C4 33)	78
3 – Steel Erection	Tower Crane (C4.48)	76
	Sarens SCG 120 Crane	86
	Articulated lorry (C11.10)	77
4 – General Construction	Hand tools	81
	Pneumatic Circular Saw (D7.79)	75
	Internal fit – out	70
5 - Landscaping	Dozer (C2.13)	78
	Dump Truck (C4.2)	78
	Surfacing (D8.25)	68

A number of representative noise sensitive locations have been considered in relation to the Proposed Development as illustrated in Figure 9.4.

Table 9.15 *Assessment Locations*

ID	Description
NSL01	Single storey residences located to the south west of the development site opposite the junction of the access ramp to the M18.
NSL02	
NSL03	Residence located on the opposite side of the R352 (Tulla Road) set back some 80m from the road edge.
NSL04	Closest residential locations along the R352 (Tulla Road) which share a common boundary of the overall proposed development site.
NSL05	Residence located on the opposite side of the R352 (Tulla Road) set back some 80m from the road edge.
NSL06	
NSL07	Closest residential locations along the R352 (Tulla Road) which share a common boundary of the overall proposed development site.
NSL08	Residence located on the opposite side of the R352 (Tulla Road) set back some 70m from the road edge.
NSL09	Residence located on the opposite side of the R352 (Tulla Road) set back some 25m from the road edge.

ID	Description
NSL10	Closest noise sensitive location to the east of the development site.
NSL11	Closest noise sensitive location to the north of the development site.
NSL12	Noise sensitive location within Knockaneen halting site on the opposite side of the M18 to the west of the development site.

Table 9.16 presents the predicted construction noise levels in the vicinity of the site. Calculations have assumed an on time 66% for each item of plant i.e. 8-hours over a 12 hours assessment period.

For the purposes of the indicative predictions it has been assumed that works are taking place at Locations I, II, III or IV on site (see Figure 9.5). The predicted construction noise levels at the specific assessment locations for the various construction stages has been detailed in Table 9.16a (based on plant at Location I), Table 9.16b (based on plant at Location II), Table 9.16c (based on plant at Location III) and Table 9.16d (based on plant at Location IV).

The highest predicted construction noise level at a specific assessment for the various construction stages has been detailed in Table 9.16e in order that the assessment of significance is based on the worst case predictions presented in Tables 9.16a to 9.16e.

Table 9.16 *Review of Potential Daytime Construction Noise Impact*

Ref.	Baseline Noise Level dB $L_{Aeq,1hr}$	BS5228-1 Threshold dB $L_{Aeq,1hr}$	Predicted Construction Noise Level for Various Phases (dB $L_{Aeq,1hr}$)				
			Site Preparation	Foundations	Steel Erection	General Construction	Landscaping
NSL01	60	53	55	48	45	60	53
NSL02	61	55	56	49	46	61	55
NSL03	59	52	54	47	44	59	52
NSL04	60	54	55	49	45	60	54
NSL05	58	52	53	47	45	58	52
NSL06	60	54	56	49	46	60	54
NSL07	63	56	57	51	48	63	56
NSL08	59	53	55	47	44	59	53
NSL09	56	50	53	46	42	56	50
NSL10	43	36	40	32	26	43	36
NSL11	45	39	43	34	32	45	39
NSL12	50	43	46	38	35	50	43

Table 9.17 details the baseline noise level measured at the nearest survey noise monitoring location or based on expected ambient noise levels in the vicinity of the location based on proximity to an existing noise source (e.g. road). If the predicted construction noise level is below this value the associated impact is deemed to be 'Not Significant'.

Where the predicted construction noise level is above the baseline noise level but below the stated BS5228-1 threshold value the associated impact is deemed be 'Slight' if 5 dB or more below the threshold and 'Moderate' up to the threshold value. If a predicted noise level is below or equal to the BS5228-1 threshold value, the impact is deemed to be 'Not Significant'. Where the predicted construction noise level is 5dB or mode higher than the BS5228-1 threshold value the impact is assumed to be ‘Moderate’ to ‘Significant’.

Based on the above rationale, and the predicted noise levels presented the assigned impacts are summarised as follows:

Table 9.17 *Review of Potential Daytime Construction Noise Impact*

Ref.	Baseline Noise Level dB $L_{Aeq,1hr}$	BS5228-1 Threshold	Construction Phase (dB $L_{Aeq,1hr}$)				
			Site Preparation	Foundations	Steel Erection	General Construction	Landscaping
NSL01	52	65	Moderate	Slight	Slight	Not Significant	Not Significant
NSL02	52	65	Moderate	Slight	Slight	Not Significant	Not Significant
NSL03	52	65	Slight	Not Significant	Slight	Not Significant	Not Significant
NSL04	52	65	Moderate	Not Significant	Slight	Not Significant	Not Significant
NSL05	52	65	Slight	Not Significant	Slight	Not Significant	Not Significant
NSL06	52	65	Moderate	Slight	Slight	Not Significant	Not Significant
NSL07	52	65	Moderate	Slight	Slight	Not Significant	Not Significant
NSL08	52	65	Slight	Slight	Slight	Not Significant	Not Significant
NSL09	52	65	Slight	Not Significant	Slight	Not Significant	Not Significant
NSL10	46	65	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant
NSL11	47	65	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant
NSL12	64	70	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant

There is no item of plant that would be expected to give rise to noise levels that would be considered out of the ordinary or in exceedance of the levels outlined in Table 9.7 or give rise to a significant impact through the process outlined here. In the majority of cases, the construction noise impact is Not Significant; in a number of cases, a Slight to Moderate impact is predicted.

It is anticipated that the construction of the facility will be completed during normal construction hours i.e. 08:00 to 18:00hrs Monday to Friday and 08:00 to 14:00hrs on Saturdays. However, it is possible that the contractor may wish to carry out certain operations outside these hours i.e. evening hours during long summer days etc. Such occurrences will be kept to a minimum and take place over a short timeframe and as such are unlikely to cause excessive disturbance. A more stringent construction noise criteria (as per Table 9.7) will be applicable during any evening works that may be required.

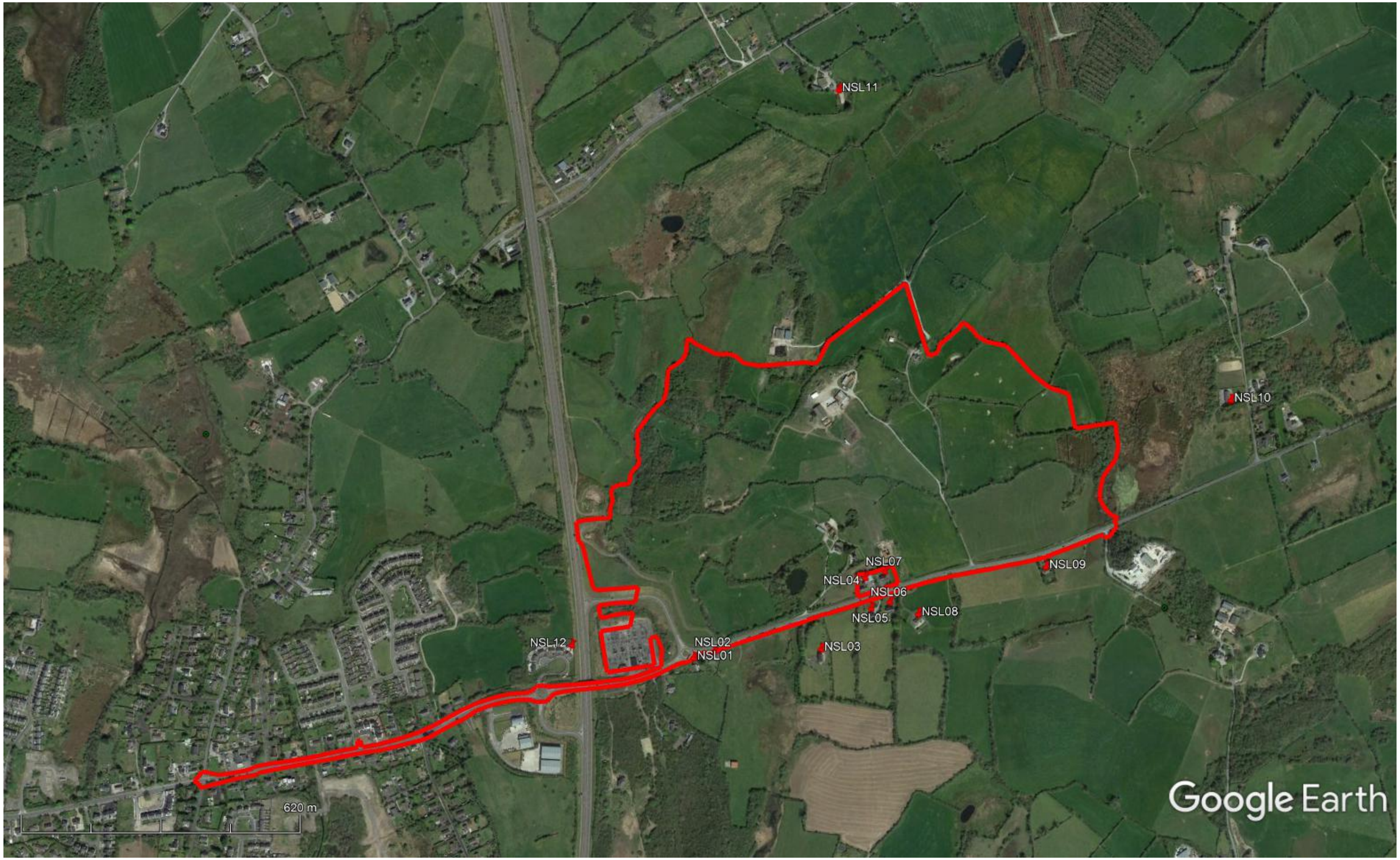


Figure 9.4 *Sample Sensitive Locations Considered for Assessment*

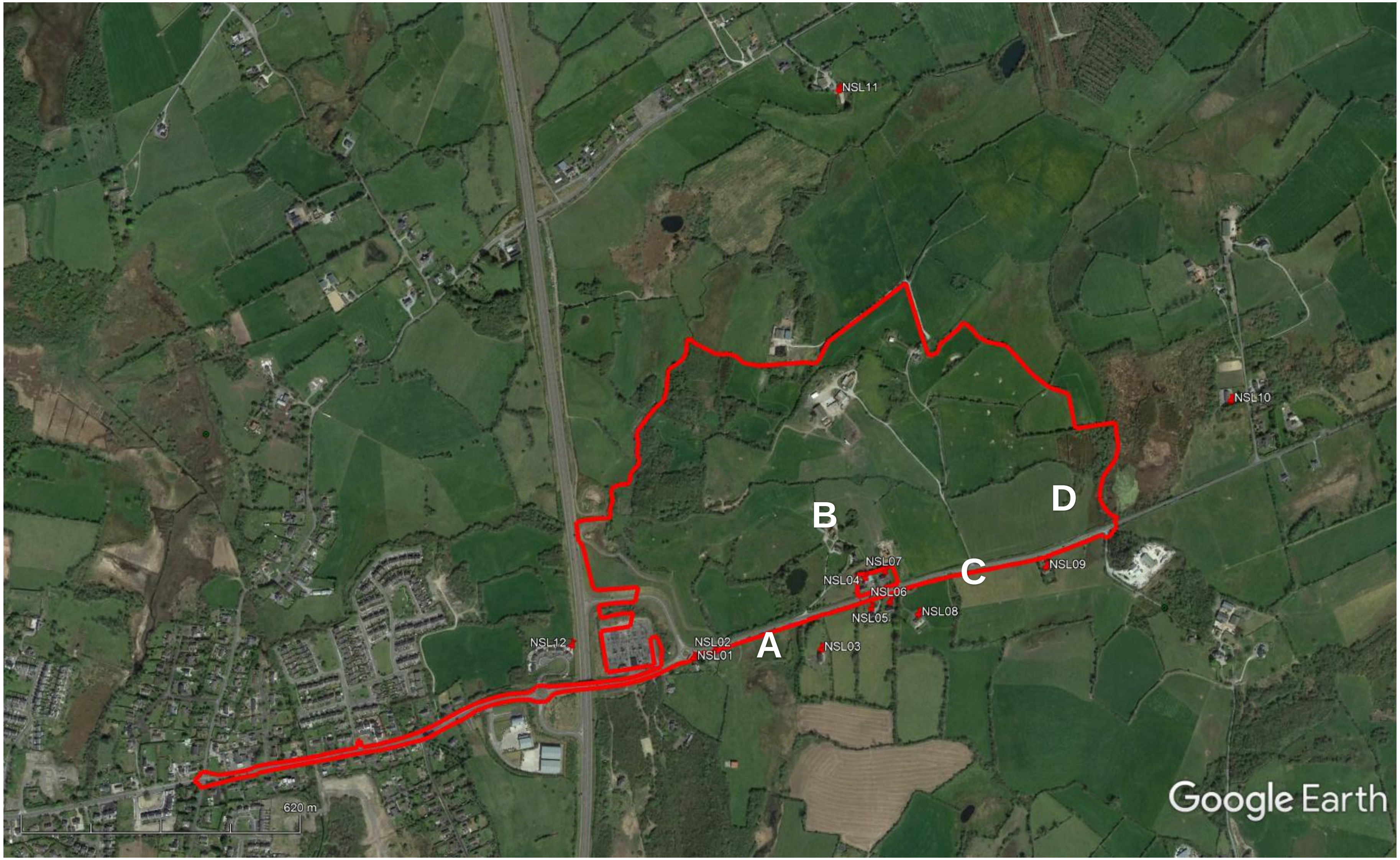


Figure 9.5 *Construction Noise Predictions – Assumed Location of Plant*

Construction Traffic

In terms of the additional construction traffic on local roads that will be generated as a result of the Proposed Development the following comment is presented: Considering that in order to increase traffic noise levels by 1dB traffic volumes would need to increase by the order of 25% it is considered that additional traffic introduced onto the local road network due to the construction phase associated with various phases of the development, as outlined in the relevant sections of Chapter 12 will not result in a significant noise impact.

Review of Construction Impacts

In terms of noise associated with these construction activities the associated effect is stated to be:

Quality	Significance	Duration
Negative	Slight to Moderate	Short Term

In terms of vibration due to the distance of activities from the site to the nearest sensitive locations and controlling vibration levels to those detailed in Table 9.7 the associated effect is stated to be

Quality	Significance	Duration
Neutral	Imperceptible	Short Term

9.5.2 Operational Phase

The primary sources of outward noise in the operational context are deemed long term and will involve:

- building services noise;
- emergency site operations; and
- additional vehicular traffic on public roads.

These issues are discussed in detailed in the following sections. See Appendix 9.3 for details of the noise modelling undertaken for this assessment and associated assumptions.

Building Services Noise / Emergency Site Operation

Three scenarios have been developed to consider the noise impact of the proposed operations. These are as follows:

- Scenario A – Proposed Data Storage Facility – Day to Day
- Scenario B – Proposed Data Storage Facility – Emergency
- Scenario C – Proposed Data Storage Facility – Generator Testing

Scenario A would be considered to be the most representative of the day to day operation. Scenario B is representative of emergency situation when a power outage or issue with supply from the national grid has occurred. It should be noted that such an event would be expected to be an extremely rare occurrence.

Scenario C considers the impact associated with the occasional testing of proposed back-up emergency generators on the site. Typically, only two generator units will be tested at any one time. The assessment presented here assumes the closest generators to existing noise sensitive locations are running when presenting expected noise levels associated with the generator testing.

Figure 9.4 highlights the nearest noise sensitive locations at which predictions have been carried out. Various noise contours are also presented for scenarios A, B and C in order to demonstrate the noise impact of the Proposed Development over a wider area.

The results of the iterations of the noise model are presented in Table 9.18. Note all plant will be selected such that no tonal noise emissions are evident at noise sensitive locations.

Table 9.18 *Predicted Plant Noise Levels for Various Scenarios*

Location	Predicted dB $L_{Aeq,T}$		
	Scenario A Day to Day	Scenario B Emergency	Scenario C Generator Testing
NSL01	32	41	33
NSL02	32	42	34
NSL03	33	47	35
NSL04	34	53	43
NSL05	33	50	40
NSL06	33	50	39
NSL07	34	54	43
NSL08	35	49	39
NSL09	34	45	38
NSL10	32	36	32
NSL11	29	36	29
NSL12	28	36	29

The above predicted levels are based on a situation where the receiver is downwind of all noise sources. For the purposes of the assessment against the adopted criteria this is a robust worst-case assumption.

Comment on Adopted Noise Criteria Day to Day Operations

The predicted noise levels presented in Table 9.18 have been compared to the relevant daytime, evening and night time noise criteria as adopted for this assessment, presented in Table 9.12. It should be noted that the back-up generator testing shall take place only between 08.00 and 17.00hrs. Residents of the adjacent dwelling houses shall be provided with adequate prior warning of the proposed testing times exceeding 1 hour in duration.

Table 9.19 Comparison of Predicted Noise Levels vs. Adopted Noise Criteria

Location	Period	Scenario A Day to Day			Scenario B Emergency			Scenario C Generator Testing		
		Predicted dB $L_{Aeq,T}$	Criterion dB $L_{Aeq,T}$	Complies?	Predicted dB $L_{Aeq,T}$	Criterion dB $L_{Aeq,T}$	Complies?	Predicted dB $L_{Aeq,T}$	Criterion dB $L_{Aeq,T}$	Complies?
NSL01	Day	32	45	✓	41	55	✓	33	45	✓
	Evening		40	✓				--		
	Night		35	✓						
NSL02	Day	32	45	✓	42	55	✓	34	45	✓
	Evening		40	✓				--		
	Night		35	✓						
NSL03	Day	33	45	✓	47	55	✓	35	45	✓
	Evening		40	✓				--		
	Night		35	✓						
NSL04	Day	34	45	✓	53	55	✓	43	45	✓
	Evening		40	✓				--		
	Night		35	✓						
NSL05	Day	33	45	✓	50	55	✓	40	45	✓
	Evening		40	✓				--		
	Night		35	✓						
NSL06	Day	33	45	✓	50	55	✓	39	45	✓
	Evening		40	✓				--		
	Night		35	✓						
NSL07	Day	34	45	✓	54	55	✓	43	45	✓
	Evening		40	✓				--		
	Night		35	✓						
NSL08	Day	35	45	✓	49	55	✓	39	45	✓
	Evening		40	✓				--		
	Night		35	✓						
NSL09	Day	34	45	✓	45	55	✓	38	45	✓
	Evening		40	✓				--		
	Night		35	✓						

Location	Period	Scenario A Day to Day			Scenario B Emergency			Scenario C Generator Testing		
		Predicted dB $L_{Aeq,T}$	Criterion dB $L_{Aeq,T}$	Complies?	Predicted dB $L_{Aeq,T}$	Criterion dB $L_{Aeq,T}$	Complies?	Predicted dB $L_{Aeq,T}$	Criterion dB $L_{Aeq,T}$	Complies?
NSL10	Day	32	45	✓	36	55	✓	32	45	✓
	Evening		40	✓				--		
	Night		35	✓						
NSL11	Day	29	45	✓	36	55	✓	29	45	✓
	Evening		40	✓				--		
	Night		35	✓						
NSL11	Day	28	45	✓	36	55	✓	29	55	✓
	Evening		40	✓				--		
	Night		35	✓						

Figure 9.6 Scenario A Proposed Data Storage Facility – Day to Day Noise Contour (Extent of 30dB(A))

Figure 9.7 Scenario B Proposed Data Storage Facility (current planning application) – Emergency Noise Contour (Extent of 55dB(A) noise contour)

Figure 9.8 Scenario C Proposed Data Storage Facility (current planning application) – Generator Testing Noise Contour (Extent of 45dB(A) noise contour)

<u>Scenario A</u> All locations are within the relevant adopted daytime, evening and night time limits. All locations comply with the adopted criteria in relation to day to day operations. Figure 9.6 presents a noise contour for Scenario A.

<u>Scenario B</u> All locations are within the relevant adopted emergency operation limit in the rare event that a power loss to the site occurs. Figure 9.7 presents a noise contour for Scenario B.

<u>Scenario C</u> All locations are within the relevant adopted daytime limits by a during periods when two generators are undergoing routine testing. Figure 9.8 presents a noise contour for Scenario C.

Review of Changes in Noise Level

Tables 9.20, 9.21 and 9.22 present the predicted changes in existing noise levels associated with the development for Scenario A at the nearest residential noise sensitive locations to the site.

Table 9.20 *Review of Predicted Changes in Existing Noise Levels – Day*

Ref.	Daytime (07:00 – 19:00 hrs)				
	Predicted dB $L_{Aeq,T}$	Background Level dB $L_{A90,T}$	Cumulative Noise Level (dB(A))	Change in Noise Level (dB)	EPA Glossary of Impacts
NSL01	32	37	38.2	+1.2	Not Significant
NSL02	32	37	38.2	+1.2	Not Significant
NSL03	33	37	38.5	+1.5	Not Significant
NSL04	34	37	38.8	+1.8	Not Significant
NSL05	33	37	38.5	+1.5	Not Significant
NSL06	33	37	38.5	+1.5	Not Significant
NSL07	34	37	38.8	+1.8	Not Significant
NSL08	35	37	39.1	+2.1	Not Significant
NSL09	34	37	38.8	+1.8	Not Significant
NSL10	32	35	36.8	1.8	Not Significant
NSL11	29	40	40.3	+0.3	Not Significant
NSL12	28	43	43.1	+0.1	Not Significant

Review of the predicted increases in noise level at the nearest residential noise sensitive locations conclude that the associated impact is ‘Not Significant’ at all locations for daytime periods.

Table 9.21 Review of Predicted Changes in Existing Noise Levels – Evening

Ref.	Evening (19:00 – 23:00 hrs)				
	Predicted dB $L_{Aeq,T}$	Background Level dB $L_{A90,T}$	Cumulative Noise Level (dB(A))	Change in Noise Level (dB)	EPA Glossary of Impacts
NSL01	32	35	36.8	+1.8	Not Significant
NSL02	32	35	36.8	+1.8	Not Significant
NSL03	33	35	37.1	+2.1	Not Significant
NSL04	34	35	37.5	+2.5	Not Significant
NSL05	33	35	37.1	+2.1	Not Significant
NSL06	33	35	37.1	+2.1	Not Significant
NSL07	34	35	37.5	+2.5	Not Significant
NSL08	35	35	38.0	+3.0	Moderate

Ref.	Evening (19:00 – 23:00 hrs)				
	Predicted dB $L_{Aeq,T}$	Background Level dB $L_{A90,T}$	Cumulative Noise Level (dB(A))	Change in Noise Level (dB)	EPA Glossary of Impacts
NSL09	34	35	37.5	+2.5	Not Significant
NSL10	32	30	34.1	+4.1	Moderate
NSL11	29	35	36.0	+1.0	Not Significant
NSL12	28	45	45.1	+0.1	Not Significant

Review of the predicted increases in noise level at the nearest residential noise sensitive locations conclude that the associated impact is 'Not Significant' at ten locations for evening periods and 'Moderate' for the remaining locations.

Table 9.22 Review of Predicted Changes in Existing Noise Levels – Night

Ref.	Night (23:00 – 07:00 hrs)				
	Predicted dB $L_{Aeq,T}$	Background Level dB $L_{A90,T}$	Cumulative Noise Level (dB(A))	Change in Noise Level (dB)	EPA Glossary of Impacts
NSL01	32	31	34.5	+3.5	Moderate
NSL02	32	31	34.5	+3.5	Moderate
NSL03	33	31	35.1	+4.1	Moderate
NSL04	34	31	35.8	+4.8	Moderate
NSL05	33	31	35.1	+4.1	Moderate
NSL06	33	31	35.1	+4.1	Moderate
NSL07	34	31	35.8	+4.8	Moderate
NSL08	35	31	36.3	+4.9	Moderate
NSL09	34	31	35.8	+4.8	Moderate
NSL10	32	30	34.1	+4.1	Moderate
NSL11	29	29	32.0	+3.0	Moderate
NSL12	28	32	33.5	+1.5	Not Significant

Review of the predicted increases in noise level at the nearest residential noise sensitive locations conclude that the associated impact is 'Moderate' at eleven locations during night-time periods with the predicted impact being 'Not Significant' at one further location.

It is reiterated the predicted noise levels are within the relevant noise criteria considered suitable for the development considering the guidance outlined in EPA: *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4 – 2016)*.

In terms of noise associated with day to day activities the associated effect is stated to be as follows:

Quality	Significance	Duration
Negative	Not Significant to Moderate	Long Term

Additional Vehicular Traffic on Public Roads

In terms of the additional traffic on local roads that will be generated as a result of this development the following comment is presented: Considering that in order to increase traffic noise levels by 1dB traffic volumes would need to increase by the order of 25% it is considered that additional traffic introduced onto the local road network due to this development will not result in a significant noise impact. The resultant noise impact is ***neutral***, ***imperceptible*** and ***long-term***.

Vibration

There is no source of vibration associated with the day to day operation of the development that will give rise to impacts at nearby sensitive locations. In terms of these the operational phase of the development the associated effect is stated to be:

Quality	Significance	Duration
Neutral	Imperceptible	Long Term

9.6 REMEDIAL AND MITIGATION MEASURES

In order to sufficiently ameliorate the likely noise impact, a schedule of noise control measures has been formulated for both construction and operational phases associated with the Proposed Development.

9.6.1 Construction Phase

With regard to construction activities, reference has been made to BS5228 Parts 1 and 2, which offer detailed guidance on the control of noise and vibration from demolition and construction activities. Various mitigation measures will be considered and applied during the construction of the Proposed Development. As an example, the following measures will be implemented on site:

- limiting the hours during which site activities likely to create high levels of noise or vibration are permitted;
- establishing channels of communication between the contractor/developer, Local Authority and residents;
- appointing a site representative responsible for matters relating to noise and vibration;
- monitoring levels of noise and/or vibration during critical periods and at critical sensitive locations; and
- all site access roads will be kept even so as to mitigate the potential for vibration from lorries.

Furthermore, a variety of practicable noise control measures will be employed, such as:

- selection of plant with low inherent potential for generation of noise and/ or vibration;
- erection of barriers as necessary around items such as generators or high duty compressors;
- situate any noisy plant as far away from sensitive properties as permitted by site constraints and the use of vibration isolated support structures where necessary.

We would recommend that vibration from construction activities to off-site residences be limited to the values set out in Table 9.8. It should be noted that these limits are not absolute but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage these limits may need to be reduced by up to 50%.

Note Appendix 9.4 presents an recommended construction noise and vibration management plan that will be implemented in terms of the day to day operation of the site. This will focus on opening up and maintaining lines of communication with the local community to address issues in relation to noise and/or vibration and to advise the community of periods where specific activities take place (e.g. rock breaking) that have an increased potential in giving rise to issues off site (Note: no rock breaking is anticipated as part of the Proposed Development).

9.6.2 Operational Phase

Building Services Noise / Emergency Site Operation

Noise from external plant will be minimised by the following measures:

- Purchasing low noise generating equipment, and;
- Incorporating appropriately specified in line attenuators for stacks and exhausts where necessary.

With due consideration as part of the detailed design process, this approach will result in the site operating well within the constraints of the best practice guidance noise limits that have been adopted as part of this detailed assessment.

Additional Vehicular Traffic on Public Roads

The noise impact assessment outlined previously has demonstrated that mitigation measures are not required.

9.7 PREDICTED IMPACTS OF THE DEVELOPMENT

This section summarises the likely noise and vibration impact associated with the Proposed Development, taking into account the mitigation measures.

9.7.1 Construction Phase

During the construction phase of the Proposed Development there will be some impact on nearby noise sensitive properties due to noise emissions from site traffic and other activities. The application of noise limits and hours of operation (i.e. as per Table 9.7 and Section 9.2.4), along with implementation of appropriate noise and vibration control measures (as summarised in Section 9.6.1), will ensure that noise and vibration impact is kept to a minimum. Also, it is reiterated that any construction noise impacts will be ***slight to moderate*** *(dependant on location)*, ***negative*** and ***short-term*** in nature. Also, it is considered that as the Proposed Development progresses from initial ground works that construction noise impacts will reduce from slight to ***not significant.***

9.7.2 Operational Phase

Building Services Noise / Emergency Site Operation

Proprietary noise and vibration control measures will be employed in order to ensure that noise emissions from building services plant do not exceed the adopted criterion at the façade of any nearby noise sensitive locations. In addition, noise emissions should be broadband in nature and should not contain any tonal or impulsive elements. The resultant noise impact is ***negative***, ***not significant to moderate*** (dependant on location) and ***long-term***.

It is reiterated the predicted noise levels are within the relevant noise criteria considered suitable for the development considering the guidance outlined in EPA: *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4 – 2016)*.

Additional Vehicular Traffic on Public Roads

Any change in noise levels associated with vehicles at road junctions in the vicinity of the Proposed Development is expected to be ***imperceptible*.** The resultant noise impact is ***neutral, imperceptible*** and ***long-term.***

9.8 CUMULATIVE IMPACTS

During construction of the Proposed Development it is anticipated that construction work on the Proposed Development site will be an audible noise source for certain periods / activities at certain locations. Any construction being completed at other sites within the study area, whilst potentially significant in their own right, as a matter of good practice, would be expected to control impacts on nearest noise sensitive locations to these sites within appropriate limits. Once the mitigation measures outlined in Section 9.6 of Chapter 9 are implemented there should be no significant cumulative impact with permitted, planned or existing developments (as outlined in Chapter 3 Appendix 3.1) as a result of the Proposed Development. There are no similar construction developments noted as being undertaken at the same time as the Proposed Development.

The environmental noise survey takes account of noise emissions from existing developments. It was noted that the existing ambient noise levels in the area were dominated primarily by road traffic on the surrounding road network. The potential cumulative noise emissions during the operational phase of the entirety of the Proposed Development have been modelled with cumulative predicted noise levels presented in Table 9.18 and Figure 9.6 in Chapter 9. In addition, a cumulative assessment, identifying expected increases in noise level is presented in Tables 9.20, 9.21 and 9.22 of Chapter 9. In terms of noise associated with day to day activities the associated effect is stated to be as follows, ***negative***, ***not significant to moderate*** (dependent on location) and ***long term***.

It is reiterated the predicted noise levels are within the relevant noise criteria considered suitable for the development considering the guidance outlined in EPA: *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4 – 2016)*.

9.9 RESIDUAL IMPACTS

The construction noise assessment has shown that in accordance with the 'significance' thresholds presented in the *British Standard BS 5228 – 1: 2009+A1:2014: Code of practice for noise and vibration control on construction and open sites – Noise* there is not a significant impact at residential locations, subject to the implementation of the mitigation measures outlined in Section 9.6.1.

The robust analysis of potential operational phase plant has shown that in accordance with the scale in the EPA Draft EIA Report Guidelines 2017 there will be a ***not significant to moderate*** (dependant on location)***, negative, long term*** impact at the closest residences identified on Figure 9.4. Ambient noise (i.e. $L_{Aeq,T}$) levels are, and will continue to be, dictated by road traffic noise in the area while a low level of plant noise is expected to be audible during lulls in other sources (e.g. distant traffic noise). The predicted change in background noise level due to current application is in the range of 2 to 6 dB during night-time periods. It is reiterated the predicted noise levels are within the relevant noise criteria considered suitable for the development considering the guidance outlined in EPA: *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4 – 2016)*.

The operational noise assessment of vehicle movements associated with the site has shown that in accordance with the scale in the EPA Draft EIA Report Guidelines 2017 there will be an ***imperceptible, neutral, long-term*** impact off site noise sensitive locations considering existing traffic volumes on the local road network.

Interactions are addressed in Chapter 16 of this EIA Report.

9.10 REFERENCES

- EPA Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIA Reports) (2017) and draft revised Guidelines on information to be contained in Environmental Impact Statements; and Advice Notes for preparing EIS (2015).

- Draft '*Guidelines for Noise Impact Assessment*' produced by the Institute of Acoustics/Institute of Environmental Management and Assessment Working Party.

- *British Standard BS 5228 – 1: 2009+A1:2014: Code of practice for noise and vibration control on construction and open sites – Noise*.

- Transport Infrastructure Ireland (TII) publication *Guidelines for the Treatment of Noise and Vibration in National Road Schemes.*

- British Standard BS 7385: 1993: *Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration*.

- British Standard BS 5228-2: 2009+A1:2014: *Code of practice for noise and vibration control on construction and open sites – Vibration*.

- BS 8233:2014: *Guidance on sound insulation and noise reduction for buildings.*

- Environmental Protection Agencies *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)* (January 2016).

- ISO 1996-2:2017 *Acoustics - Description, measurement and assessment of environmental noise – Part 2: Determination of environmental noise levels.*

- British Standard *BS 6472 (1992): Guide to Evaluation of human exposure to vibration in buildings (1Hz to 80Hz).*

- ISO 9613 (1996): *Acoustics – Attenuation of sound outdoors – Part 2: General method of calculation.*

- *Calculation of Road Traffic Noise (CRTN)* issued by the Department of Transport in 1988.

- BS EN 1793-1:1998: Road traffic noise reducing devices – Test method for determining the acoustic performance – Part 1: Intrinsic characteristics of sound absorption

- BS EN 1793-2:1998: *Road traffic noise reducing devices – Test method for determining the acoustic performance – Part 2: Intrinsic characteristics of airborne sound insulation.*

- BS EN 1794-1:2003: Road traffic noise reducing devices. Non-acoustic performance. Mechanical performance and stability requirements

- BS EN 1794-2:2003: Road traffic noise reducing devices. Non-acoustic performance. General safety and environmental requirements.

10.0 LANDSCAPE AND VISUAL IMPACT ASSESSMENT

10.1 INTRODUCTION

Art Data Centres is seeking Planning Permission for a Data Centre, Vertical Farm, and associated infrastructure on a c. 60 ha site at Tulla Road, Spancilhill, to the northeast of Ennis, as described in more detail in Chapter 2. Figure 1 *Site Extents* maps the site location. The site is allocated in the adopted *Clare County Development Plan 2017 - 2023 (As Varied)*. Figure 10.1 illustrates the extents of the site boundary.

This Landscape and Visual Impact Assessment (LVIA) has been prepared to identify potential landscape and visual impacts arising from the development of this site. The assessment of the landscape and visual impact arising from the proposal has taken account of the proposed built form together with the landscaping proposals. The findings of this Assessment will inform Clare County Council (the Council) in determining the Application for the site.

The EIAR, including this LVIA, was submitted as part of Planning Application No. 21757 on 16th July 2021. Since then, the detailed design of the corresponding SID Application has been progresses resulting in updates to the design of the substation and the drop-down towers for the electric cable undergrounding. Consequently, the assessment within this LVIA has been revised to reflect the new larger substation and the lattice work drop-down towers in place of wood pole drop-down towers. Where text is superseded is has been retained but marked with the 'strikethrough' symbol, so it is clear what has been removed. Where new text has been added this has been done in a red font so that it is readily evident. Figures 10.7-10.10 and 10.13a-b have also been updated as part of these revisions.

10.2 METHODOLOGY

The methodology of this LVIA follows the Guidelines for Landscape and Visual Impact Assessment (3rd Edition, 2013) (GLVIA) published by the Landscape Institute and the Institute of Environmental Management and Assessment[1].

10.2.1 Study Area

An approximate extent of visibility was initially determined through OS mapping, online mapping, and aerial imagery. The findings of this desktop study were later followed up and confirmed by a field study on 3rd March 2021. As a result of these initial studies a preliminary 10km LVIA Study Area was identified. The 10km distance was based on a combination of the desktop analysis and previous professional experience in relation to the distance within which significant impacts can potentially occur for a proposal of this type.

Zone of Theoretical Visibility (ZTV) mapping has been prepared to aid in the assessment process and to confirm the extent of the study area for the LVIA. The ZTVs have been generated using the digital terrain modelling (DTM) data of the existing landform. DTM data does not take cognisance of the height of intervening

1 Landscape Institute and Institute of Environment Management and Assessment, *Guidelines for Landscape and Visual Impact Assessment*, 3rd Edition, 2013

built form or vegetative cover and is based purely on a bare ground surface. The ZTV defines the extent from which the proposal will be theoretically visible (the extent of land/sea from which it may be possible to see any part of the proposal). It is correct in so much as it confirms where the proposal will not be visible. As the DTM used was for the existing landform it does not take account of the proposed bunds, which will further reduce actual visibility to some degree. The ZTV is used to gauge the anticipated effects of the proposal upon the wider visual amenity.

A Preliminary ZTV was generated to cover the preliminary 10km LVIA Study Area to confirm the likely extent of visibility as a result of the proposal. A draft layout of the proposals dated 1st March 2021 was used as the basis for the generation of the Preliminary ZTV.

The Preliminary ZTV indicated that the extents of potential visibility beyond 5km from the proposed development were relatively limited and broken. As such actual visibility, given intervening built forms and vegetation, will be very limited. It was therefore decided to reduce the LVIA Study Area to a 5km radius from the Site Boundary in order to ensure a focused LVIA. This LVIA Study Area is illustrated in Figure 10.3.

10.2.2 Planning Context

A review of policy comprising the *Clare County Development Plan 2017 - 2023 (As Varied)* has been carried out. This identifies the policies and designations of relevance to the production of an LVIA. The designations set by the *Landscape Designations* map for the adopted County Development Plan are shown in Figure 10.5.

10.2.3 Establishing the Baseline

The visual character and amenity of the Study Area is assessed to establish the baseline against which landscape and visual effects can be quantified. This process is informed by the ZTV and allows appropriate receptors to be identified. These receptors represent a range of views and viewer types from where the proposed development is likely to be visible. In addition, this process allows specific receptors to be identified that are particularly sensitive and accordingly, require special consideration.

10.2.3.1 Landscape Baseline

The landscape baseline addresses the site within its wider landscape context and describes the landscape character, condition, and value, including any landscape designations or sensitivities within the Study Area.

10.2.3.2 Landscape Fabric

The landscape fabric comprises the separate components that when combined form the overall landscape of the site. These components include:

- Location and Access
- Boundaries
- Landform and Hydrology
- Land Use and Land Cover

The elements that form these components are described in Section 10.4.1 of this report. The main landscape features of the site are illustrated in Figure 10.1.

10.2.3.3 Landscape Character

The *Landscape Character Assessment of County Clare*, carried out in 2004 by ERM Ireland Ltd, is reviewed to identify the baseline character of the site and the wider landscape. The Landscape Character Areas for the site and the Study Area are illustrated in Figure 10.4.

10.2.3.4 Landscape Designations

The review of the relevant planning policy identifies the designations and classifications which should be taken into account in this LVIA. A review of other relevant sources is also carried out to identify any further classifications that may be of relevance. The designations and classifications within the Study Area are mapped in Figure 10.5.

10.2.3.5 Visual Baseline

Visual receptors include users of public footpaths and cycle ways, users of roads and railways and views of or from within valued landscapes. Potential receptors were identified through desk study using OS mapping, aerial imagery and the ZTV. The key routes within the Study Area are mapped in Figure 10.6.

An initial list of representative viewpoint locations was prepared based on a desktop exercise. The selection of the viewpoints was based on the extent of visibility illustrated by the ZTV and the landscape and visual receptors identified within the Study Area. This initial list of viewpoint was then analysed on site to identify if actual views were feasible.

Table 10.1 below sets out the final list of the six LVIA viewpoints. Three visualisations are provided for each viewpoint illustrating the proposed development:

1. Upon completion of Phase 1 (after minimum 1 year establishment of the structure planting)

2. Upon full completion (after minimum 5 years establishment of the structure planting)

3. After minimum 15 years establishment of the structure planting (approx. 10 years after completion of the proposed development).

Table 10.1 Agreed LVIA Viewpoints

No.	Viewpoint Name	Representative of
1	R352 South of Site	Users of the regional road, Residential dwellings, ‘Ennis Drumlin Farmland’ LCA, ‘Working Landscape’ designation, Views from the South
2	West of R352-M18 roundabout	Users of the regional road, ‘Ennis Drumlin Farmland’ LCA, ‘Working Landscape’ designation, Views from the Southwest
3	M18 (Adjacent service track) West of Site	Users of the motorway, ‘Ennis Drumlin Farmland’ LCA, ‘Working Landscape’ designation, Views from the West
4	L4608 North of Site at Cappagh More	Users of the local road, ‘Ennis Drumlin Farmland’ LCA, ‘Working Landscape’ designation, Views from the North
5	L4608 at Ballymacahill	Users of the local road, ‘Ennis Drumlin Farmland’ LCA, ‘Working Landscape’ designation, Views from the northwest
6	R352 at TII Depot to west of M18	Users of the regional road, Settlement, ‘Ennis Drumlin Farmland’ LCA, ‘Working Landscape’ designation, Views from the Southwest

A number of secondary potential viewpoints were identified. However, as potential visibility from these locations is very limited or unlikely, it was decided to include single image views, rather than montages. Two views from the motorway are also included and as these are not safely accessible locations, images from Google Streetview have been included instead. These secondary views help to demonstrate that visibility of the proposed development will be unlikely from these locations. These secondary views are listed in the following table and included in Appendix 10.1.

Table 10.2 Agreed Secondary Viewpoints

No.	Viewpoint Name
A	R352 at Tullyvoghan junction
B	R352, at entrance to Rath Ban Housing Development
C	Junction of L 4608 (Ballymacahill Road) and R352, and opposite side of R352
D	Within Rath Ban Housing Development - centre section, at the eastern extreme of the development
E	Within Rath Ban Housing Development - Northern end section, at the eastern extreme of the development
F	Ballymachill Road
G	Gort Leamhain Housing Development, Eastern extreme of the development
H	Knockanean National School
I	Cappagh Beg
J	M18, at Ballymachill Road Passover
K	M18, at Rail line Passover
L	R469 (Quin Road), at Fergus River
M	N85, at Railway Line

The locations of all the viewpoints are identified on Figure 10.9.

10.2.4 Nature of Receptor

The sensitivity of a receptor is defined by GLVIA3 as the combination of *…judgements of the susceptibility of the receptor to the specific type of change or development proposed and the value related to that receptor*. Susceptibility is defined by GLVIA3 as *…the ability of defined landscape or visual receptor to accommodate the specific proposed development without undue negative consequences*. The baseline analysis considers the existing elements and their character, condition, and value to determine sensitivity.

A breakdown of this analysis is shown in the following table:

Table 10.3: Landscape Sensitivity

Sensitivity	Landscape Effects	Visual Effects
High	Landscape value recognised by existing or proposed designation. Sense of tranquillity or remoteness specifically noted in Landscape Character Assessment. High sensitivity to disturbance specifically noted in Landscape Character Assessment. The qualities for which the landscape is valued are in a good condition, with a clearly apparent distinctive character. This distinctive character is susceptible to relatively small changes.	Viewers' attention very likely to be focused on landscape e.g., users of strategic recreational footpaths and cycle ways, and people experiencing views from important landscape features of physical, cultural, or historic interest, beauty spots and picnic areas. Residents experiencing views from dwellings.

Medium	Landscape value is recognised locally, but not designated; the landscape is relatively intact, with a distinctive character; and the landscape is reasonably tolerant of change.	Viewers' attention may be focused on landscape, such as road or rail users, users of secondary footpaths, and people engaged in outdoor sport or recreation (other than appreciation of the landscape) e.g., fishing, water sports, golf
Low	Landscape value is low (e.g., industrial landscapes) with no designations; landscape integrity is low, with a landscape in poor condition and a degraded character; and the landscape has the capacity to potentially accommodate significant change.	Viewers' attention not focused on landscape e.g., workers or people engaged in outdoor recreation whose attention may be focussed on their activity rather than the landscape. Views from heavily industrialised areas.

10.2.5 Nature of Effects

This relates to the effect of the proposal on each landscape or visual receptor and considers the magnitude of change as a result of the proposal. The effect on each receptor will be assessed in terms of its size and scale, the geographical extent of the area influenced, and its duration and reversibility. Effects can be negative (adverse), positive (beneficial) or neutral in quality. Effects in this Assessment are considered to be negative (adverse) unless otherwise stated. Effects can also vary in duration or even be reversible. Effects in this assessment are considered to be ‘long term’ unless otherwise stated.

In accordance with GLVIA3, informed professional judgement is made to determine the magnitude of change. In order to maintain a consistency and transparency to the assessment process, the following table provides a guide to the determination levels of magnitude of change.

Table 10.4 Magnitude of Change

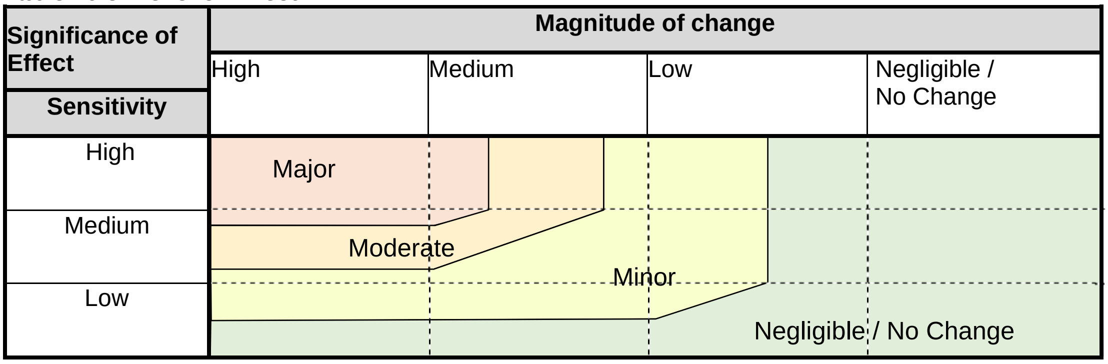
Magnitude of Change	**Landscape**	**Visual**
High	Total loss or considerable alteration / interruption of key elements, features or characteristics of the landscape character / designation resulting in a fundamental change to baseline conditions.	Dominant / Prominent Highly noticeable change, affecting most key characteristics and dominating the experience of the landscape. The introduction of incongruous development. A large proportion of the view is affected.
Medium	Partial loss or alteration to one or more key elements, features or characteristics of the baseline, resulting in localised change to the landscape character and composition within a broader unaltered context.	Conspicuous Noticeable, partial change to a proportion of the landscape affecting some key characteristics and the experience of the landscape. The introduction of some uncharacteristic elements. Part of the view is affected.
Low	Minor loss or alteration to one or more key elements, features or characteristics of the baseline landscape so that the change arising from the loss / alteration would be discernible, but the underlying landscape character and composition would be similar to baseline.	Apparent Apparent minor change, affecting some characteristics and the experience of the landscape to an extent. The introduction of elements that are not uncharacteristic. A small proportion of the view is affected.

Negligible / No Change	Very limited or imperceptible loss or alteration to one or more key elements, features or characteristics of the baseline. The change will be barely distinguishable. No aspect of the proposed development will be discernible. No aspect of the proposed development will be discernible.	Inconspicuous Little perceptible change. The proposal will result in no appreciable change to the view. May go unnoticed.

10.2.6 Level of Effect and Significance

The likely level of the landscape and visual effects are assessed through a combination of the sensitivity to change and the magnitude of change. The diagram below defines categories for likely levels of effect. However, formulaic conclusions cannot be drawn directly from the categories for the levels of effect of effect and the significance. Conclusions are therefore qualified by the professional judgement of the landscape architect.

Table 10.5: Level of Effect



In line with the recommendations in GLVIA3 the above matrix is not used as a prescriptive tool or arithmetically, and the methodology and analysis of potential effects at any particular location must allow for the exercise of professional judgement. Descriptions of effects, especially those considered significant in EIA terms, are described in narrative text.

In accordance with the EPA guidelines the Significance is determined as per Table 10.6 below.

Table 10.6 Level of Significance

Term	Description
Imperceptible	An effect capable of measurement but without noticeable consequences
Not significant	An effect which causes noticeable changes in the character of the environment but without noticeable consequences
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate	An effect that alters the character of the environment in a manner consistent with existing and emerging trends
Significant	An effect, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters the majority of a sensitive aspect of the environment.
Profound	An impact which obliterates sensitive characteristics

10.2.7 Methodology for the Photomontages

The photomontages model representations of the proposal. The digital modelling used for the photomontages is verifiable. The photomontages for this assessment were prepared by Innovision, Sligo Airport Business Park, Strandhill, Co. Sligo. Where applicable, Innovision adheres to the guidelines as set out by the British Landscape Institute Technical Guidance Note 06/19 - "*Visual Representation of Development Proposals*". Using professional cameras and tripod set-up, and with a selection of lenses, Innovision will carry out the field work at the best available weather opportunity. All necessary additional information is captured on-site including camera position, date and time, as well as locations of any key objects which can aid accurate placement of the proposal. The above information is recorded using mapping-grade professional GPS equipment.

Once the field work has been carried out and photography processed, the proposed development will be "placed" into the existing photography using professional GIS and 3D modelling software. Once placement has been achieved, a photo-realistic render is output depicting what the proposed development will look like if built. At this point, any landscape mitigation can be added to the image if necessary. The resulting output is a highly accurate, verifiable photomontage. This methodology and modelling process renders an accurate representation of the proposal.

10.2.8 Approach to Mitigation

Mitigation measures are designed to avoid, reduce, or offset adverse effects arising from the proposal. By taking a flexible approach to design and building a degree of mitigation into the design through an iterative process from the outset, the overall scale of adverse effects can be reduced, and optimum environmental fit of the proposal can be achieved.

Mitigation falls into two main categories: primary and secondary.

Primary mitigation is comprised of fundamental measures undertaken as part of the iterative design process. This includes aspects such as the spatial organisation of the site, used to avoid or reduce adverse effects on either the landscape or visual resource. These are based on principles of good design and also emerge in response to technical assessment. This is part of an iterative design process and seeks to develop the site in the most effective way possible, taking account of all relevant considerations. Section 3.6.3 *Alternative Layouts/Designs* of Chapter 3 sets out the alternative building layouts that were considered and the reasons for the selection of the chosen option.

Secondary mitigation measures are designed to address any remaining adverse effects of the final development proposals following primary mitigation. These could include mounding or planted buffer zones for screening effect. However, there may also be no requirement for secondary mitigation measures if both the design approach and primary mitigation measures have already removed any significant adverse effects and the optimal environmental fit has been achieved.

Residual effects are those remaining following primary and secondary mitigation.

Screening of a development is not always the best or most appropriate option. In many circumstances it is better to provide a framework and principles to create an appropriate balance of built development and open space. This improved balance helps integrate with existing patterns of development within the surrounding context.

The proposal can therefore contribute positively to the landscape and visual character of the area.

For the purposes of this project, mitigation was embedded in the design of the proposal. As such there is no pre-mitigation scenario to assess. Therefore, as the mitigations measures were inherent to the design of the proposal, and not part of a sperate design process, the LVIA assess the residual effects directly.

10.3 PLANNING CONTEXT

10.3.1 Introduction

The site is zoned and designated for the use and development of data centres and power generating infrastructure in the *Variation No.1* to the Clare County Development Plan 2017-2023. This variation to the Development Plan was adopted on 11th March 2019.

The variation provides the following summary of the changes:

(1) Volume 1 - Written Statement of the Clare County Development Plan 2017-2023:

- *To incorporate the use and development of data centres and power generating infrastructure into the enterprise zoning definition, the following additional text has been added into the zoning objective for enterprise as set out in Chapter 19*

Lands zoned for 'enterprise' shall be taken to include the use and development of land for high end research and development, business science and technology-based industry, financial services, call centres/telemarketing, software development, data centres, enterprise and incubator units, small/medium manufacturing or corporate office in high quality campus/park type development.

It is intended that such developments will have high quality architectural design and landscaping. This zoning allows for 'walk to' support facilities such as canteen, restaurant or crèche services which are integrated into employment units and are of a nature and scale to serve the needs of employees on the campus.

This zoning also allows for associated power generating infrastructure as well as transportation infrastructure such as car and bicycle parking and bus stop shelters. This zoning excludes general retail, retail park outlets, motor sales/servicing activities and heavy industrial undertakings.

Lands zoned for 'enterprise' in large villages and small villages shall be taken to include the use and development of land for small-scale business and enterprise development such as incubator units, craft centres/workshops, small-scale manufacturing, local digital/technology business etc. Retail use on these sites shall only be considered where it is ancillary to the main activity taking place.

Enterprise developments in large villages and small villages must have a high standard of architecture and landscaping and must be relative and appropriate to their scale, size and character.

10.3.2 Planning Policy

10.3.2.1 <u>Variation No.1 to the Clare County Development Plan 2017-2023</u>

The variation sets out the following in relation to planning policy for the zoned lands:

Site ENT3 Toureen

Project Ireland 2040 - National Planning Framework sets out the strategic importance of data centres in Irelands' Enterprise Strategy. Having regard to the Government Statement on The Role of Data Centres in Ireland, which in particular recommends having a plan-led approach to data centres, this 55ha site has been identified and zoned as Enterprise (45ha) and Buffer (10ha) with a specific use for a Data Centre Campus due to; its proximity to the electricity sub-station; its proximity to the M18 motorway and adjoining regional road network; the location of the site relative to the Gas Pipeline; the availability of Dark Fibre and the proximity of the site to Shannon International Airport and Ennis Town.

This site is zoned to accommodate a Data Centre campus which consists of one or more than one structure, used primarily for the storage, management and dissemination of data and the provision of associated power electricity connections and energy generating infrastructure. Development proposals for this site shall include the following;

- *A Traffic Management Plan for the construction and operation phase of development.*
- *Any proposed development shall adopt sustainable practice in terms of building design, materials, construction and operation.*
- *A Hydrological Assessment to determine the effects of the development on groundwaters and groundwater quality shall be submitted with development proposals for the site.*
- *At the southern boundary of the site is a mesotrophic lake, which will require protection through the provision of a buffer incorporating the dense clump of trees to the west of the lake and shall be included in an overall Landscape Management Plan for the site.*
- *A Construction and Environmental Management Plan shall be submitted as part of development proposals on site. This shall include a Flood Risk Assessment, a Surface Water Management Plan for the construction and operation phase of the development, a Pollution Prevention Plan and shall incorporate principles of Sustainable Urban Drainage Systems. During the construction phase of developments on site where applicable all relevant best practice guidelines shall be adhered to.*
- *An Air Quality Impact Assessment with reference to potential impacts on European Sites and the surrounding area within the zone of influence of the proposed development shall be submitted, this shall inform an Appropriate Assessment Screening report and/or Natura Impact Report.*
- *The hedgerows and scrub area on this site provide a potential foraging and commuting area for wildlife including Lesser Horseshoe bats. Future development proposals must be informed by a series of bat surveys to record the known usage of the site by in particular Lesser Horseshoe bats and ensure that there is no net loss of supporting habitat. The surveys must include a full light spill modelling study. Any habitat loss must be offset by additional landscape planting to ensure connectivity across the landscape.*
- *Impacts of development of the site on conservation interest bird species of surrounding SPAs and breeding birds should be avoided, through protection and retention of breeding bird habitat in accordance with the Wildlife Acts. Development proposals for the site shall be accompanied by bird surveys (to include a winter bird survey) to assess the use of the site by bird species and where disturbance and/or displacement are predicted appropriate mitigation*

measures shall be identified. Hedgerow and treeline pruning or removal shall be conducted outside the breeding bird season (March 01st through August 31st).

- *An Ecological Impact Assessment (designed by an appropriately qualified landscape architect and ecologist) and a Habitat Survey shall form part of development proposals for the site.*
- *A Landscape and Biodiversity Management plan shall be submitted to provide landscape, visual and environmental screening and enhancement measures through planting and design.*
- *An Invasive Species Survey and Management plan (if required) shall accompany development proposals for the site.*
- *Development proposals shall also include an Otter Use Survey of the site, and where disturbance and/or displacement are predicted appropriate mitigation measures shall be identified.*
- *A buffer will be required to be provided with regard to the location of a National Monument (CL-034-007) on site.*
- *Adequate wastewater treatment and disposal measures shall accompany development proposals for this site to ensure that there is no impact to water quality in the area.*

Of particular note to the preparation of this LVIA are the following elements:

- Provision of a buffer around the mesotrophic lake at the southern boundary of the site;
- Provision of a Landscape and Biodiversity Management plan to provide landscape, visual and environmental screening and enhancement measures through planting and design; and
- Provision of a buffer to the Recorded Monument (CL-034-007) (This is mistakenly referred to as a 'National Monument' in the Variation).

10.3.2.2 Clare County Development Plan 2017 - 2023 (As Varied)

There are a range of development management policies that are of relevance in the determination of a planning application for the proposal. These include Development Plan Objectives, setting out design requirements, and those policies related to safeguarding and improving the environment.

The following *Development Plan Objectives* are most relevant to the appraisal of landscape and visual effects:

CDP13.3 Development Plan Objective: Western Corridor Working Landscape

The Development Plan designates the landscape within which the site is located as a *Working Landscape*. These are …*areas within Settled Landscapes that contain pockets of concentrated development or a unique natural resource*. The following *Development Plan Objective* is of relevance to development within the area of this landscape designation:

It is an objective of the Development Plan:

A. To permit development in these areas that will sustain economic activity, and enhance social well-being and quality of life - subject to conformity with all other relevant provisions of the Plan and the availability and protection of resources;

B. That selection of appropriate sites in the first instance within this landscape, together with consideration of the details of siting and design, are directed towards minimising visual impact;

C. That particular regard should be given to avoiding intrusions on scenic routes and on ridges or shorelines. Developments in these areas will be required to demonstrate:

i. That the site has been selected to avoid visually prominent locations;

ii. That site layouts avail of existing topography and vegetation to reduce visibility from scenic routes, walking trails, public amenities and roads;

iii. That design for buildings and structures reduce visual impact through careful choice of form, finishes and colours and that any site works seek to reduce visual impact of the development.

CDP14.17 Development Plan Objective: Woodlands, Trees and Hedgerows

It is an objective of Clare County Council:

A. To preserve and conserve individual or groups of trees identified in Volume 2 of this Plan as 'Trees for Preservation' which will enhance the character and appearance of an area;

B. To carry out tree survey work during the lifetime of this Plan to identify future trees of importance in the County and facilitate their future protection;

C. To protect individual or groups of trees within the Plan area which are important for environmental, recreational, historical, biodiversity and/or aesthetic reasons or by reason of contribution to sense of place, including groups of trees which correspond with protected habitats, or which support protected species, under the Habitats Directive;

D. To work with landowners, local communities and other relevant groups to promote the retention and conservation of existing trees and hedgerows and encourage development proposals that enhance the landscape through positive management and additional planting/ sensitive replanting of native tree species;

E. To protect woodlands and hedgerows from damage and/or degradation and to prevent disruption of the connectivity of woodlands and hedgerows of the County;

F. To ensure, where required, applications for development include proposals for planting / leave a suitable ecological buffer zone, between the development works and areas/ features of ecological importance;

G. Where hedgerows are required to be removed in the interests of traffic safety or where breaches to hedgerows occur due to river drainage/maintenance works and flood repair, to require the applicant/developer to replace the hedgerows with suitable native species to the satisfaction of the Council;

H. To require each large green space in new residential developments to have at least one native oak tree, or other naturalised tree species of similar stature and lifespan, integrated into the agreed planting/ landscaping scheme;

I. To require, where possible, that all trees felled as a result of development proposals be replaced at a minimum ratio of 10 new native species per 1 tree felled.

CDP14.27 Development Plan Objective: Green Infrastructure

It is an objective of Clare County Council:

A. To create an integrated and coherent green infrastructure network to enhance biodiversity and quality of life, provide sustainable water management and a green setting for urban areas;

B. To facilitate the on-going development and improvement of green infrastructure in the Plan area, including green networks, green amenities and linked green corridors which ensure the provision of recreational amenities, natural areas for the growth of wildlife and biodiversity, and a network of infrastructure which results in a better quality of life for visitors and inhabitants alike;

C. To implement the adopted green infrastructure plan for Shannon town and its environs;

D. To prepare green infrastructure plans for Ennis and Kilrush during the lifetime of this Plan;

E. To work with community groups to access funding for appropriate and beneficial green infrastructure projects including parks, woodlands, sports facilities, green areas, playground/play facilities, river corridors, walkways, cemeteries, churchyards, paths, seating and amenities;

F. To require the preparation and assessment of all planning applications associated with amenity and/or recreational uses under the heading of green infrastructure to have regard to the information, data and requirements of the Natura Impact Report, SEA Environmental Report and Strategic Flood Risk Assessment Report contained in Volume 10 of this Development Plan;

G. To require projects to be fully informed by ecological and environmental constraints at the earliest stage of project planning and any necessary assessment to be undertaken, including assessments of disturbance to species, where required;

H. To ensure compliance with all relevant legislation as outlined in Objective CDP2.1.

10.3.3 Planning Context Summary

Compliance with the above policies needs to be assessed at the time of determination of the Application. However, the development principles and criteria within these policies, are of relevance in assessing the landscape and visual impact of the proposal.

The level of design detail presented in this Application reflects the status of the proposal. It is adequate to assess the landscape and visual impacts arising from the proposal.

The development process, particularly in relation to greenfield development, will inevitably result in a change to the site resulting from the transformation in land use, with a consequential alteration to the character of the site.

Evaluating the proposal in terms of how well green infrastructure and green networks are incorporated, allows an assessment to be made of how appropriate the proposed design solution is within its landscape and visual context.

The consideration of green infrastructure considers the key elements of landscape setting; habitat and biodiversity; flooding and drainage; and contribution to the existing green network.

10.4 LANDSCAPE BASELINE

10.4.1 Landscape Fabric of the Site

The landscape fabric comprises the physical elements which make up the landscape, such as location, landform, and land cover. These physical elements are described below. The existing landscape context of the site is shown in Figure 10.1.

10.4.1.1 Location

The site is located to the northeast of the settlement of Ennis, on the opposite side of the M18 motorway. The R352, Tulla Road abounds the southern boundary of the site. An electricity substation is located to the southwest of the site, at the junction between the M18 and the R352 (M18, Junction 13). Pastoral farmland generally abounds the boundary to the north, with woodland to the east.

The main existing access to the site is a track the enters the site off the R352 Tulla Road along the eastern section of the southern boundary. This track provides access to a couple of houses and a farmyard within the site as well as a second farmyard beyond the site to the north.

A second access is located off the R352 to the south of Tooreen Lough. This entrance provides access to two further houses and associated farmyards. A further third access is located in the southwest of the site and provides access to the more southern of the two motorway SuDS ponds.

10.4.1.2 Landform and Hydrology

The landform is undulating in nature as a result of the drumlins that cover the site. Over and above the drumlins the landform is generally falls from the east to the west. The most elevated location is the summit of a larger hill in the southeast of the site, at an elevation of approximately 47.5m AOD. The lowest point, in the west of the site, is adjacent to the motorway SuDS ponds at an elevation of approximately 7m AOD.

A number of small seasonal waterbodies are located towards the northern and eastern boundaries with the larger permanent mesotrophic lake of Tooreen Lough located towards the southern boundary. A development exclusion buffer is required around Tooreen Lough incorporating the dense clump of trees to the west of the lake.

A small watercourse runs along the northern half of the western site boundary before heading westwards through a culvert under the M18 motorway. The watercourse passes between two motorway SuDS ponds before passing under the motorway. These SuDS ponds feed into the watercourse. The southern of the two SuDS ponds is located within the site boundary.

10.4.1.3 Land Use and Land Cover

The existing land use of the site essentially comprises average quality drumlin farmland, characterised by the undulating landform associated with the drumlins. This rolling landform has also resulted in an irregular agricultural field pattern defined by mature hedgerows. As this is a farming landscape, the well-defined hedgerow system is one of its main characteristics.

To the east and west, larger blocks of woodland form bookends to the site. The western woodland and surrounding area extending to 10ha has been zoned as Buffer Space by the Council in the Variation.

The landscape structure within the site is complemented by a wooded ring fort in the north of the site which is recorded as a Recorded Monument (CL-034-007). A development exclusion buffer of 30m is required by the Council from the outer edge of the ringfort.

Several buildings are located within the site, including three houses and associated farmyards and farm buildings as well as fourth house with an associated large shed. A further farmyard, and associated buildings, is located just outside the site to the north. Access to this farmyard is through the site, using the access road to the house with the shed. Beyond the house the access road continues outside the site following the site boundary along the northern edge for a stretch before reaching the farm buildings.

The wider landscape adjoining the site to the north, east and south is namely pastoral farmland with some blocks of woodland and forestry. The R352 Tulla Road also passes along the southern boundary. To the west the site is cut off from the surrounding landscape by the M18 motorway and the associated landforms. Beyond the motorway is some pastoral farmland before transitioning into the built forms of the settlement of Ennis that extends out along the northern side of the Tulla Road.

A number of three cable electricity lines pass through the site, mounted on both large twin wood poles and lattice work pylons.

The following factors have been taken into determination in considering the sensitivity to change of the landscape fabric of the site:

- The well-established hedgerow network, the large woodland areas, and the waterbodies such as Tooreen Lough,
- The presence of the Recorded Monument within the site,
- The generally pastoral grassland nature of the remainder of the site,
- The four houses and three farmyards located within the site,
- The presence of electrical infrastructure passing through the site, and
- The undulating nature of the site.

The sensitivity to change of the landscape fabric of the site is therefore considered to be **Medium**, as the landscape is relatively intact with a distinct character. There are high quality parts of the landscape within the site, but there are also areas of existing development and high voltage electricity lines crossing the site.

10.4.2 Landscape Character

10.4.2.1 Landscape Character Assessment of County Clare

The *Landscape Character Assessment of County Clare* (Character Assessment) was carried out in 2004 by ERM Ireland Ltd[2]. This Character Assessment identified the area within which the site is located as being located the *Ennis Drumlin Farmland Landscape Character Area* (LCA). The 5km Study Area is also covered by a number of other LCAs, the locations of which are all visible on Figure 10.4. However, as identified on the ZTVs the Tulla Drumlin Farmland LCA, will experience very little theoretical visibility of the proposed development. As such, this LCA is highly unlikely to experience levels of significance over and above Slight as result of the proposal. Furthermore, the Slieve Aughty Uplands LCA, as identified by the ZTV, will experience very little theoretical visibility at almost 5km away, resulting in a likely level of significance of Not Significant or lower. Therefore, in the interests of providing a focused assessment the Tulla Drumlin Farmland LCA and the Slieve Aughty Uplands LCA are not considered further in this LVIA.

10.4.2.2 Ennis Drumlin Farmland LCA

The *Ennis Drumlin Farmland LCA* radiates out from the settlement of Ennis at its centre. The LCA is composed of numerous drumlins orientated in the direction of the former ice flow. The predominant landcover is agricultural grassland with a number of broadleaf forests and transitional woodland and scrub.

The key characteristics of the *Ennis Drumlin Farmland LCA* are:

- *Settlement of Ennis is the focal point of the area where both historical and modern development is apparent.*
- *Ennis situated within drumlin farmland, drumlins oriented northeast to southwest punctuated by small loughs.*
- *Area can be disorientating due to many small winding roads and limited views.*
- *Communication centre for the region with Ennis as county town, with Fergus River running through the town.*

The condition of this LCA is variable, poor development has degraded landscape quality in some areas. Linear development along the roads near to Ennis frequently detracts from the landscape and reflects the housing pressures within this area. Largescale electrical infrastructure is also visible along the skyline northeast of Ennis. However, the more remote drumlin hinterland, away from the main roads, remains quite rural and intact. The County Development Plan designates the banks of the Fergus as a feature of high amenity.

The sensitivity to change of the Ennis Drumlin Farmland LCA is considered to be **Medium**. This is due to the contrast between the more developed areas and the more intact hinterlands and the presence of la locally designated landscape.

10.4.2.3 Fergus Loughlands LCA

This LCA is highly diverse and rich in terms of ecology with numerous loughs and woodlands.

2 https://www.clarecoco.ie/services/planning/publications/landscape-character-assessment-of-co-clare-2004-26526.pdf

The key characteristics of the *Fergus Loughlands LCA* are:

- *Undulating lowland mosaic of loughs, farmland and wooded limestone pavements.*
- *Loughs and rivers are oriented predominantly northeast to southwest reflecting historical glacial movements.*
- *Characteristic lowland limestone pavement in parts are vegetated with hazel scrub and is of high ecological value, e.g. Dromore Lough nature reserve.*
- *Important historical features include Dysert O'Dea.*
- *Area is largely rural in character dissected by quiet minor roads.*
- *Scattered settlement aside from the villages of Crusheen and Ruan.*

The Character Assessment describes the *Fergus Loughlands LCA* as a …*highly attractive and well-maintained landscape. The natural vegetation affords significant screening and can create an intimate landscape in many areas. This contrasts with the more open exposed character around larger loughs and limestone pavement. It is a highly distinctive landscape with the variety of landscape forms, specifically loughs, low drumlins and limestone pavement combining to create an intact landscape area.*

The sensitivity to change of the *Fergus Loughlands LCA* is considered to be **High**. This is due to the high quality of the landscape. The character assessment also describes it as being …*very sensitive to large scale and unsympathetic development and changes*.

10.4.2.4 <u>Fergus Estuary LCA</u>

This LCA is a low lying, distinctive, estuarine landscape situated on either side of the Fergus Estuary.

The key characteristics of the *Fergus Estuary LCA* are:

- *Flat estuarine farmland divided by drainage ditches, post and wire fences and degraded thorny hedgerows.*
- *Open expansive views are afforded across the estuary to the River Shannon, though these are limited in places due to flood defence embankments.*
- *Settlement is sparse reflecting the areas past tendency to flood, some settlement on higher ground. On eastern boundary, increased settlement due to proximity to Shannon Airport and town.*
- *Scattered holy wells with a number of graveyards and standing stones.*
- *Newmarket-on-Fergus and Killadysert are both designated ACA (Architectural Conservation Area).*

The Character Assessment describes the *Fergus Estuary LCA* as being …*generally of variable condition. The degradation of hedgerows and low quality barbed wire and post and wire fencing gives the hinterland a slightly degraded quality. Increased residential development on the eastern side can be highly visible and newer houses are not always appropriate to this estuarine setting. On the western side of the estuary, it is generally undeveloped with a strong remote sense. This is punctuated by the villages of Killadysert and Ballynacally.*

The sensitivity to change of the *Fergus Estuary LCA* is considered to be **Medium**. This is due to the variable condition of the landscape as described by the Character Assessment.

10.4.2.5 Local Landscape Character

The undulating drumlin farmland nature of the site and surrounding area is in keeping with the *Ennis Drumlin Farmland LCA* key characteristics for the area.

The local landscape character of the site and surrounding area is influenced by its rural context on the edge of the settlement of Ennis and adjacent to the M18 motorway and a substation. The character is strongly influenced by the industrial infrastructure, such as the pylons, associated with the substation. The motorway along the western boundary, as well as the road bounding the southern boundary of the site further diminish from the rural character of the area.

Established hedgerows from a well-defined field pattern which is influenced by the rolling landform, whilst blocks of woodland and scrub are interspersed across the landscape. Three farmyards are located within the site area whilst a fourth is located just to the north of the site.

The judgement of sensitivity to change is influenced by the following factors:

- the semi-rural / suburban context,
- the existing water features and the drumlin style landscape,
- the farmyards located within the landscape,
- the manmade infrastructure such as the surrounding road network, the substation, and the pylon lines,
- the hedgerows forming the agricultural field pattern, and
- the large woodlands.

The sensitivity to change of the local landscape character to the type of development proposed is therefore considered to be **Medium**. Although there are elements of the landscape that are of good quality, the proximity to the settlement and key infrastructure take away from this.

10.4.3 Landscape Designations and Classifications

10.4.3.1 Living Landscapes - Working Landscapes’ Designation

The Clare County Development Plan states that …*County Clare comprises a number of areas that have similar characteristics for which similar planning policies are applicable.* As such it divides the county into three different landscape types:

I. *Settled landscapes – areas where people live and work;*

II. *Working Landscapes – intensively settled and developed areas within Settled Landscapes or areas with a unique natural resource;*

III. *Heritage Landscapes – areas where natural and cultural heritage are given priority and where development is not precluded but happens more slowly and carefully.*

The site is located within the Western Corridor Working Landscape designation as illustrated on Figure 10.5. The County Development Plan provides the following description of the Western Corridor Working Landscape:

This part of the County contains the highest concentrations of population and employment and the strongest transport links and connectivity. It includes the Linked Gateway of Shannon and the County Town/Hub Town of Ennis. It is the economic driver of County Clare and an important area of the Mid-West Region.

The County Development Plan Objective *CPD13.4*, as set out in section 10.3.2.2 of this report, relates to this designation.

The sensitivity to change of the Western Corridor Working Landscape to the type of development proposed is considered to be **Low** due to the nature of this designated area.

10.4.3.2 Buffer Space Woodland

The Clare County Council's Zoning Map PLP-18-0001-2 (12/03/2019) designates two areas of woodland within the site as 'Buffer Space'. The extents of these Buffer Spaces is illustrated in Figure 10.1. These areas have been considered as part of the design and have been kept free of development. As the extents of these Buffer Spaces is not altered the effect upon them is not assessed further.

10.4.3.3 Natural Heritage Areas

There are no *Natural Heritage Areas* (NHA) located within the site or within the 5km LVIA Study Area.

10.4.3.4 Proposed Natural Heritage Areas

There are no *proposed Natural Heritage Areas* (pNHA) located within the site. There are a number of blocks of pNHAs located within the wider Study Area. The proposal will not impact upon these pNHAs due to their distance from the site at over 1km away. Therefore, these are not considered further in this LVIA.

10.4.3.5 Ancient Woodland

There are no areas of Ancient Woodland located within the site or within the 5km LVIA Study Area.

10.4.3.6 Protected Landscapes

There are no other Protected Landscapes of relevance within the LVIA Study Area.

10.5 VISUAL BASELINE

10.5.1 Roads

The M18 motorway passes north to south through the LVIA Study Area. There are also a number of national, regional, and local class roads within the LVIA Study Area. These are shown in Figure 10.6 *Key Routes*.

The sensitivity to change of roads is considered to be **Medium** (in accordance with the methodology set out in Section 10.1).

10.5.2 Railway Lines

The *Limerick to Galway Railway Line* runs roughly south to north through the LVIA Study Area. This is shown on Figure 10.6.

The sensitivity to change of railway lines is considered to be **Medium** (in accordance with the methodology set out in Section 10.2).

10.5.3 Scenic Routes and Protected Views or Prospects

County Clare contains a number of views and prospects, many of which are located along Scenic Routes. These Scenic Routes are designated within the Clare County Development Plan. However, there are no designated scenic routes located within the LVIA Study Area.

10.5.4 Viewpoints

Six representative viewpoints were identified. The locations of the ten representative viewpoints are shown in Figure 10.9 *Zone of Theoretical Visibility with Viewpoint Locations*. The sensitivity to change of each viewpoint is summarised in *Table 10.7 Summary of Viewpoint Sensitivity* below and the existing views are described in *Table 10.8 Representative Viewpoints – Baseline*.

A field survey was carried out on 3rd March 2021 and again on 15th April 2021. The purpose was as follows:

- to walk over and understand the components, characteristics and context of the site;
- appraise the landscape character and visual amenity of the Study Area;
- consider viewpoint locations; and
- to confirm the theoretical visibility and confirm likely actual visibility of the proposal.

The viewpoints are illustrated in Figures 10.11a to 10.16b. Table 10.7 lists the selected representative viewpoints used to inform the assessment of the landscape and visual impacts of the proposal:

Table 10.7 Summary of Viewpoint Sensitivity

VP	Name	Representative of	**Sensitivity**
1	R352 South of Site	Users of the regional road, Residential dwellings, ‘Ennis Drumlin Farmland’ LCA, ‘Working Landscape’ designation, Views from the South	**High**
2	West of R352-M18 roundabout	Users of the regional road, ‘Ennis Drumlin Farmland’ LCA, ‘Working Landscape’ designation, Views from the Southwest	**Medium**
3	M18 (Adjacent service track) West of Site	Users of the motorway, ‘Ennis Drumlin Farmland’ LCA, ‘Working Landscape’ designation, Views from the West	**Medium**
4	L4608 North of Site at Cappagh More	Users of the local road, Residential dwellings, ‘Ennis Drumlin Farmland’ LCA, ‘Working Landscape’ designation, Views from the North	**High**

5	L4608 at Ballymacahill	Users of the local road, 'Ennis Drumlin Farmland' LCA, 'Working Landscape' designation, Views from the Northwest	**High**
6	R352 at TII Depot to west of M18	Users of the regional road, Settlement, 'Ennis Drumlin Farmland' LCA, 'Working Landscape' designation, Views from the Southwest	**Medium**

Table 10.8 describes the context of the existing views and justifies the sensitivity assigned to each of the representative viewpoints.

Table 10.8 Representative Viewpoints – Baseline

Viewpoint	Sensitivity
Viewpoint 1 R352 South of Site (Figure 10.11a)	This view looks northwards across the R352, Tulla Road, towards the site form the entrance to a property on the southern side of the road. The farm buildings located behind the two properties on the other side of the road are visible on the left hand (west) edge of the view. The two properties themselves are just out of view. The western hedgerow of the existing main access to the site is visible in the right-hand edge of the view. The properties this access services are just visible behind intervening vegetation in the middle to far distance. This view helps to demonstrate how the existing hedgerows and rolling landform absorb the existing built elements within the landscape. The farm buildings in the north of the site, like the two properties are just visible behind intervening vegetation. This view also demonstrates how the landscape slopes from the high ground in the right (east) to the lower ground in the left of the view (west). Three separate sets of twin pole electricity lines are visible running across the view at varying distances. The sensitivity to change is considered to be **High,** as per the methodology, as the view is representative of residents.
Viewpoint 2 West of R352-M18 roundabout (Figure 10.12a)	This view looks northeast across the roundabout for the Junction 13 slip road of the M18 southbound. It is representative of views that would be experienced by road users on the R352, Tulla Road, heading east as they approach the roundabout. The road infrastructure including all the signage makes up much of the foreground of the view. Mature hedgerows beyond the roundabout screen much of the wider landscape from view. With just the hill in the southeast of the site rising up above the vegetation. Pylons and twin wood pole electricity lines are visible scattered across the view as they approach the electricity substation which is just out of view to the left (northwest). The sensitivity to change is considered to be **Medium,** as per the methodology, as the view is representative of road users.
Viewpoint 3 M18 (Adjacent service track) West of Site (Figure 10.13a)	This view is representative of users of the M18 motorway heading southbound. The view is taken from the service track on the eastern edge of the motorway at a point where it is at a similar elevation to that of the motorway and where views are available through the adjacent hedgerow. The view looks southeast across rolling pastoral farmland. Visible beyond the fields is the woodland in the west of the site, designated 'Buffer Space' on Clare County Council's Zoning Map PLP-18-0001-2 (12/03/2019). The lands of the site are hidden from view behind this block of woodland.

	Three sets of twin wood pole supports for electricity lines are visible in the centre of the view at varying distances. The sensitivity to change is considered to be **Medium**, as per the methodology, as the view is representative of road users.
Viewpoint 4 L4608 North of Site at Cappagh More (Figure 10.14a)	This view looks south towards the site from a field gate access on the L4608. It looks out across a rolling landscape covered by a mix of pastoral farmland and woodland. Hedgerows tend to follow the ridgelines shaping the horizon. The roof of an existing farm building is just visible in the distance to the left of centre of the view. A twin wood pole electricity line is visible running through the view with poles and pylons of other lines also visible in the distance. The sensitivity to change is considered to be **High**, as per the methodology, as the view is representative of residents of the properties on the northern side of the L4608.
Viewpoint 5 L4608 at Ballymacahill (Figure 10.15a)	This view looks southeast towards the site from a field gate access on the L4608 at Ballymacahill. The foreground is largely occupied by a pastoral field, whilst woodland occupies much of the far distance. Two twin wood pole electricity lines are visible passing through the view whilst the electricity substation to the southwest of the site is also just visible in the distance above the right-hand wall in the foreground. The sensitivity to change is considered to be **High** as per the methodology as the view is representative of a residential dwelling as well as users of the L4608. This view was also chosen to demonstrate the type of view from the eastern edge of the settlement of Ennis as there were no reasonably open views available from publicly accessible areas.
Viewpoint 6 R352 at TII Depot to west of M18 (Figure 10.16a)	This view looks eastwards from the R352, close to the entrance to the TII depot, on the eastern edge of the settlement of Ennis. It looks along the road to the roundabout for the Junction 13 slip road of the M18 northbound. The rising form of the road up to the motorway overpass foreshortens the overall view. A mast associated with electricity substation is clearly visible beyond the roundabout whilst the tops of pylons, also associated with the substation, are just visible on the horizon. The sensitivity to change is considered to be **Medium**, as per the methodology, as the view is representative of users of the R352.

10.6 DESCRIPTION OF PROPOSAL

The proposal is illustrated in Figure 10.7 Proposed Development. It is described in detail in Chapter 2 of this EIAR, and as such the description is not repeated here. In summary the key components of the proposal in relation to the preparation of a Landscape and Visual Impact Assessment are as follows;

- 6 no. two storey data centre buildings, each measuring 86x105m by 18m high, accompanied by 84 no. back-up generators with associated stacks of 8m high;
- An Energy Centre on a plot measuring 110x100m with buildings of 12m high and flues of 25m high;

- An Above Ground Installation (AGI) for a gas supply;
- An Electrical Substation Compound measuring c. 15m high;
- A two storey Vertical Farm Building measuring c. 50x50m by 12m high;
- Undergrounding of two of the existing overhead 110kV circuits and associated drop-down lattice work pylons; and
- Associated landscaping, including bunds, woodlands, hedgerows and meadows.

The proposed development includes the removal of 30 trees, approximately 2,715 linear metres of hedgerow and approximately 1,525m² of scrub/woodlands. However, the proposed landscape proposals include for the introduction of 57 new specimen trees, approximately 4,860 linear metres of hedgerow and approximately 58,565m² of woodlands. This greatly increases the hedgerow and woodland extents onsite, over and above what will be removed.

This additional structure planting (hedgerows and woodlands) strengthens the landscape framework and habitat connectivity of the site as well as providing an aesthetic setting to the built form and screening it from view from the wider landscape. Approximately 54,810m² of land will also be turned into meadow grasslands, thereby improving the biodiversity of the existing grasslands.

As set out in the Landscape Design Strategy report, accompanying this EIAR as part of the planning application, perimeter vegetation for the most part has been retained. Woodland belts of approximately 30m depth are proposed around the edges of the site where woodlands do not exist. In some sections in the north and south of the site, these woodland belts are located on top of landscape berms, increasing the level of screening provided by the planting. This comprehensive landscaping strategy around the peripheral environs of the site will provide a visual foil for those receptors on close proximity to the site.

The six Data Centre buildings have been located centrally to the site in order to reduce visibility from the Tulla road and the residences located there. As such, the buildings are located in the generally lower elevations of the site. The buildings have been carefully situated to avoid ecological and archaeological buffer zones around the site. This siting also ensures the peripheral vegetation is retained.

The ancillary buildings of the Energy Centre, Substation and Vertical Farm are located in the east of the site at the base of the larger hill, from which the ground level increases significantly. This siting ensures that there will be no potential for views of these buildings from the east and limits the visual impact on views of the horizon from the north and west.

The Data Centre buildings have been orientated so that the mechanical and electrical equipment -such as flue stacks, water and fuel storage, and generators are all located centrally between buildings. This allows building frontages to address key locations such as the roundabout to the southwest of the site, losing the mechanical equipment behind the more aesthetic office elevations.

The building elevational treatments consist of architectural metallic wall panels that graduate from dark blue to light blue as the façade rises. This effect helps to lose the building into the sky, reducing the massing of the building. External mechanical plant areas are treated with louvres which provide required airflow while screening equipment. The office elevation combines the graduated façade with large areas of curtain walling, providing natural daylight and visual relief.

The site will be a dark sky site, with night-time lighting restricted. This ensures that there is no potential for the proposed development to result in a negative visual impact at night.

The following sections assess the potential impacts as a result of these components upon the landscape visual receptors of the 5km LVIA Study Area.

Following the finalisation of the layout, for the proposal, a final ZTV was generated (Figure 10.9). This updated ZTV is a more accurate representation of the extent of theoretical visibility within the Study Area as it is based on the finalised layout. However, as with the Preliminary ZTV, actual visibility of the proposal is still likely to be less than the theoretical visibility illustrated. This is due to the further filtering and screening effects of localised landforms, built form and intervening vegetation such as hedgerows and tree belts, including proposed bunds and vegetation.

10.6.1 Do-Nothing Scenario

The site is currently predominantly greenfield agricultural land. The ‘do nothing scenario’ would result in the lands continuing to be farmed as they are. Any potential changes to the site would likely be limited to new farm buildings relating to the evolution of the existing farmyards and the continued growth of existing trees and hedgerows. This would result in a likely **Negligible** effect upon the landscape and visual receptors of the LVIA Study Area and an **Imperceptible** level of significance.

However, given the site is located in lands zoned for enterprise with a specific use for a Data Centre Campus, it is likely that the lands would be similarly developed as proposed rather than remaining greenfield. Consequently, given the zoned nature of the lands, the do-nothing scenario would result in a similar level of landscape and visual effect as that resulting from the proposed development.

10.7 ASSESSMENT OF CONSTRUCTION EFFECTS

The proposed development will be constructed in a phased manner over a period of approximately 7 years, and as described in Chapter 3 of this EIAR. Figure 10.8 illustrates the different construction phases of the proposed development.

Potential landscape and visual effects will arise from:

- Site establishment and preparation works;
- Formation of the proposed site access onto the R352;
- Establishment of construction compound and construction staff facilities;
- Erection of site hoarding and permanent security fencing;
- Site clearance;
- Site levelling, and excavation for foundations and underground utilities;
- Formation of landscape berms and attenuation areas;

- Provision of landscaping and planting etc.;
- Access and egress of construction traffic for material import and export;
- Erection and operation of tower cranes;
- Construction traffic movement on site;
- General construction activity, including construction and security personnel, and construction machinery;
- Gradual emergence of the proposed buildings on the site; and
- Completion and commissioning of the development.

It is proposed that the woodland belts, and some hedgerows, will be implemented prior to the construction of the buildings. This will be carried out in two stages as part of pre-construction works and the post cut and fill groundworks. This ensures that the bunds and key structure planting are in place prior to the commencement of any building construction. This will provide early establishment of landscape screening around the site as demonstrated by the Viewpoint photomontages (Figures 10.11a to 10.16b). As such the two elements of the construction that will the greatest potential for landscape or visual effects are the tower cranes and the gradual emergence of the buildings.

The landscape and visual effect during the initial ground works stage (Pre-Phase 1c) is assessed to be **Moderate, temporary/short term (approx. 1 year)** and the significance is **Moderate**. These works will be readily visible along the R352, and potentially from the L4608 to the north until the bunds area created and as the proposed early landscaping establishes. These works will generally be limited to earth moving and shaping equipment.

The landscape and visual effect during the main remaining phases of the construction (Post-Phase 1b) is generally assessed to be **Minor, short term (approx. 7 years)** and the significance is **Slight** given the current landscape planning context and policy and the screening capability of the existing vegetation and proposed early establishment planting. These elements of vegetation will both combine to screen the majority of construction activity in views from the surrounding landscape, leaving only the cranes and emerging buildings visible above the tops of the vegetation.

Construction works will not have longer-term landscape or visual effects.

10.8 LANDSCAPE ASSESSMENT

10.8.1 Approach

In accordance with the methodology for assessing landscape and visual impacts, this assessment reviews the magnitude of change of the operational proposal against the baseline characteristics to establish the level of the effect and the corresponding significance. Reference is made to viewpoints as required to inform the assessment. As stated previously, the effects are considered to be negative unless stated otherwise.

In assessing the updated SID design of the substation compound and the associated addition of the lattice work drop-down pylons in place of the twin wood poles it was identified that the revised ZTV differed very little from the original ZTV. In terms of Viewpoints, it was identified and confirmed that the only Viewpoint to experience an alteration to the proposed views is that of Viewpoint 4, L4608 North of Site at Cappagh More (Figures 10.14a & 10.14b). Consequently, the only part of this assessment to be updated resulting from the revised built form elements is the assessment of Viewpoint 4 and the L4608 along which Viewpoint 4 is located. The remainder of the assessment remains relevant and unaltered.

10.8.2 Potential Effects on the Landscape Fabric of the Site

Development of the site will result in the loss of pastoral agricultural farmland, including hedgerows. This will be replaced with a mix of hard surfaces (roofs, driveways, roads, footways) and greenspace (amenity greenspace, meadow grasslands and SuDS measures).

There will be re-grading of the site to create development platforms for the proposed built forms and suitable gradients for roads, footways, and services. Although large flat platforms will be created for the development these work with the overall slope of the landscape reducing in elevation form east to west. The proposed development is located in the centre of the site with the majority of the existing landscape around the edges of the site retained. Once completed, there will not be a readily perceivable change in landform across the majority of the site.

The proposal results in the loss of existing pastoral grassland habitat of low ecological value, along with approximately 2,716 linear metres of hedgerow, 1,525m² of scrub/woodland and 30 trees. However, the proposal includes the addition of approximately 4,859 linear metres of new hedgerow, 58,567m² of new woodland and 57 new amenity trees. This not just replaces the extents removed, but considerably increases them. Further to this approximately 54,813m² of meadow grassland is also proposed. These elements provide the opportunity to greatly enhance the diversity and connectivity of the habitats within the site. These habitat improvements will increase and result in a positive improvement to the biodiversity of the overall site as a consequence of the proposed development.

Two of the high voltage power lines crossing the site will be undergrounded as part of the works.

The following key landscape feature within the site will remain unaltered and will be integrated into the new landscape proposals:

- The western block of woodland, designated as ‘Buffer Space’ on Clare County Council's Zoning Map PLP-18-0001-2 (12/03/2019);
- Tooreen Lough and surrounding planting; and
- The wooded ring fort in the north of the site which is a Recorded Monument (CL-034-007).

All the waterbodies within the site will also be retained.

The magnitude of change to the landscape fabric of the site is assessed to be **Medium** as although the proposed development will alter the landscape fabric, this will be restricted to the centre such that much of the area will appear the same from outside of the site, the key features will remain unaltered and the proposed landscaping will greatly increase the extents of the woodland, hedgerows and meadow grassland on site, thereby improving the habitats and biodiversity of the site.

The effect of the proposal on the landscape fabric of the site is therefore assessed to be **Moderate** and the significance is **Moderate**. Although the proposal will alter a large area of the existing fabric of the site, it will create a greater range of habitats and biodiversity across the site and retains the key landscape features, whilst also being consistent with the land use zoning for the area.

10.8.3 Potential Effects on the Landscape Character

10.8.3.1 <u>Ennis Drumlin Farmland LCA</u>

The ZTV (Figure 10.10) illustrates that the LCA will experience relatively extensive theoretical visibility of the proposed development. However, intervening vegetation, the built form of the settlement of Ennis and the proposed landscaping will greatly reduce the actual extents of visibility as evidenced by the photomontages from the six viewpoints (Figures 10.11a-10.16b).

The proposed development is located in the context of existing development in terms of the adjacent substation and associated infrastructure, the M18 motorway and the nearby settlement of Ennis. Ennis is acknowledged as a focal point of development within this LCA, so the proposed development's location is in keeping with this characteristic.

Although, the central landform of the site will be platformed for development the drumlin nature to the edges will be retained, whilst the proposed bunding will blend in with this rolling landform character. As such the proposed development will barely alter the drumlin character of the LCA. A large part of the site will also be retained as pastoral farmland in keeping with the farmland nature of this LCA. As demonstrated by the photomontages the visible character of the LCA will largely be retained.

The magnitude of change experienced by the Ennis Drumlin Farmland LCA, as a result of the proposed development is assessed to be **Low** as the proposed development result is largely in keeping with the characteristic of the LCA and will only result in a slight alteration.

The effect of the proposal on the Ennis Drumlin Farmland LCA is therefore assessed to be **Minor** and the significance is **Slight** as the character of the overall LCA will remain largely as it is.

10.8.3.2 <u>Fergus Loughlands LCA</u>

The ZTVs (Figures 10.2 & 10.10) indicate that this LCA will experience broken patches of theoretical visibility at distances of over 3km away. Actual visibility will be further reduced by intervening vegetation, built forms and the proposed landscaping. This is further backed up by Character Assessment for this LCA which states …*the natural vegetation affords significant screening and can create an intimate landscape in many areas*.

The proposed development will not affect any of the key characteristics for this LCA.

The magnitude of change experienced by the Fergus Loughlands LCA, as a result of the proposed development is assessed to be **Negligible** for the following reasons:

- The proposed development will not affect any of the key characteristics of the LCA;

- The distance from the development; and
- The limited potential for actual visibility of the proposed development from within this LCA.

The effect of the proposed development on the Fergus Loughlands LCA is therefore assessed to be **Negligible** and the significance is **Not Significant**.

10.8.3.3 Fergus Estuary LCA

The ZTVs (Figures 10.2 & 10.10) indicate that this LCA will experience larger blocks of theoretical visibility at distances of over 3.5km away. Actual visibility will be further reduced by intervening vegetation, built forms and the proposed landscaping with the motorway located between the site and much of this LCA.

The proposed development will not affect any of the key characteristics of this LCA with the focus of views within the LCA out over the estuary away from the location of the proposed development.

The magnitude of change experienced by the Fergus Estuary LCA, as a result of the proposed development is assessed to be **Negligible** as the proposed development will not affect any of the key characteristics of the LCA and the distance from the proposed development.

The effect of the proposed development on the Fergus Estuary LCA is therefore assessed to be **Negligible** and the significance is **Not Significant**.

10.8.3.4 Local Landscape Character

The location of the site relates to the infrastructure of the adjacent electricity substation and M18 motorway as well as the nearby built form of the settlement of Ennis. Given this relationship and that the proposed development is set within a landscaped setting it is in keeping with semi-rural / suburban context of the local landscape character.

The proposed landscape planting increases the extent of hedgerows and woodland on the site and introduces new habitats such as permanent meadow grassland.

The undulating landform of the local landscape provides a sense of enclosure to much of the local area, foreshortening views much of the time, with the potential for longer range views limited to the higher elevations of the taller drumlins. Furthermore, the landform generally dips in the centre of the site restricting visibility into the site from the wider landscape. Views into the site from the east are obstructed due to the topography of the larger hill in the east of the site and the area of woodland located below the hill on its eastern side.

The existing woodland in the northwest of the site, combined with the proposed bunds and structural landscaping contribute to reduce views of the proposed development from much of the surrounding landscape to the east and north. Where views are available from wider landscape these are often restricted to glimpse views of parts of the site with visibility of the full site area from one view limited.

Although the landform in the centre of the site will be platformed and altered to suit the building and road layouts, this change will not be noticeable from the surrounding landscape. The appearance of a drumlin landscape is thereby retained from the surrounding context.

This generally restricted visibility of the proposed development is evidenced in the photomontages for the representative viewpoints (Figures 10.11a – 10.16b).

The magnitude of change experienced by the local landscape character, as a result of the proposed development is assessed to be **Low** as the overall local landscape character will remain largely unaltered with the proposed development in keeping with the man-made influence of the surrounding area.

The effect of the proposed development on the local landscape character is therefore assessed to be **Minor** and the significance is **Slight**.

10.8.4 Potential Effects on Landscape Designations and Classifications

10.8.4.1 <u>County Development Plan - Living Landscapes</u>

10.8.4.2 <u>*Working Landscapes*</u>

The location of the proposed development within this designation is in keeping with the description of this designation as …*intensively settled and developed areas within Settled Landscapes…* and *…the highest concentrations of population and employment and the strongest transport links and connectivity*. As such the site being located within the extents of this designation contributed to the zoning of the site for a Data Centre in *Variation No.1* to the *Clare County Development Plan 2017-2023*.

The Development Plan Objectives for this designation are as follows:

A. To permit development in these areas that will sustain economic activity, and enhance social well-being and quality of life - subject to conformity with all other relevant provisions of the Plan and the availability and protection of resources;

B. That selection of appropriate sites in the first instance within this landscape, together with consideration of the details of siting and design, are directed towards minimising visual impact;

C. That particular regard should be given to avoiding intrusions on scenic routes and on ridges or shorelines. Developments in these areas will be required to demonstrate:

iv. That the site has been selected to avoid visually prominent locations;

v. That site layouts avail of existing topography and vegetation to reduce visibility from scenic routes, walking trails, public amenities and roads;

vi. That design for buildings and structures reduce visual impact through careful choice of form, finishes and colours and that any site works seek to reduce visual impact of the development.

The proposed development will contribute to sustaining economic activity. This LVIA assesses the visual impact arising from the proposed development and demonstrates that the visual impact will be minimal given the scale of the proposed development. The site location does not relate to any scenic routes or shorelines. The site layout makes use of the existing landscape to set the proposed development into the lower central part of the site, whilst relating to the overall east-west slope. This setting combined with the proposed bunds and planting ensure visibility from the wider landscape is minimal. The colour scheme of the data centres has been selected so that where the upper parts of the buildings are visible these will partially blend with sky.

The magnitude of change, experienced by the Working Landscape designation, as a result of the proposal is assessed to be **Negligible** as the proposed development takes account of the Development Plan objectives for the designation and is also in keeping with the overall designation description.

The effect of the proposal on the Working Landscape designation is therefore assessed to be **Negligible** and the significance is **Not Significant**.

10.9 VISUAL ASSESSMENT

This section addresses the likely effects of the proposal on the visual resource of the Study Area. The ZTV (Figures 10.9 and 10.10) has been used to illustrate the parts of the Study Area that have the potential to experience visual effects of the proposal. The potential for visibility has also been verified through field studies and the representative viewpoints.

10.9.1 Roads

The locations of the roads are illustrated in Figure 10.6 Key Routes. The effects and impacts upon all motorways, national roads, and regional roads within the LVIA Study Area have been assessed. However, in order to provide a focussed assessment, in terms of local roads, only those within approximately 1km of the site have been assessed. Local roads are generally lined by mature hedgerows and tree lines which prevent longer distance views. This is evidenced in the assessment of the local roads in the paragraphs below and the viewpoints which demonstrate that views to the site are generally only available from occasional field gates.

10.9.1.1 <u>M18</u>

The ZTV illustrates that users of the M18 will experience theoretical visibility of the proposal mainly for a 5km stretch to the west of the site. There are also some smaller areas further to the south. Actual views from the motorway will be restricted by localised roadside embankments and associated vegetation as well as intervening vegetation and built forms.

The majority of views will be experienced by users heading southbound along the motorway. As such Viewpoint 6 (Figures 10.13a & 10.13b) is representative of views for southbound users of the motorway. This view is taken from the service track adjacent to the motorway where it is at a similar location. It is also located where there is a break in the hedgerow that allows more open views to the site that are not so readily visible elsewhere.

The photomontages for this view demonstrate that visibility of the development will be limited to part of the proposal and will be a glimpse view whilst receptors are travelling at speed along the motorway.

Viewpoints J and K in Appendix 10.1 are also representative from location further northwards of users heading southbound on the motorway. These views demonstrate that the intervening woodland will screen much of the proposed development. Although Viewpoint J is in proximity to Viewpoint 4 (Figures 10.14a & 10.14b), the difference in angle will result in a greater level of screening by both existing and proposed intervening woodlands.

The magnitude of change experienced by users of the M18, as a result of the proposed development is assessed to be **Low to Medium**. Actual visibility will be limited and where views will be experienced these will mostly be partial and glimpsed views in nature due to the speed of travel.

The effect of the proposed development on the M18 is therefore assessed to be **Minor** and the significance is **Slight**.

10.9.1.2 <u>N85</u>

The ZTV illustrates that users of the N85 will experience theoretical visibility of the proposal for two stretches of approximately 3km and 1km at distances of over 3.5km distance from the site. Actual visibility from these stretches is actually unlikely due to the intervening built form of the settlement of Ennis and associated vegetation. Viewpoint M in Appendix 10.1 demonstrates that actual views are generally not feasible.

The magnitude of change experienced by users of the N85, as a result of the proposed development is assessed to be **Negligible**.

The effect of the proposed development on the N85 is therefore assessed to be **Negligible** and the significance is **Not Significant**.

10.9.1.3 <u>R352</u>

The ZTV illustrates that users of the R352 will experience extensive extents of theoretical visibility of the proposed development. However, to the west of the M18 motorway, the intervening built form of the settlement of Ennis and intervening vegetation along with the embankments and associated vegetation of the motorway screen actual views of the proposed development. This is demonstrated by Viewpoint 6 (Figures 10.16a & 10.16b) and in Appendix 1, Viewpoints B & C.

Viewpoint A in Appendix 10.1 demonstrates views from the R352 to the east of the proposed development. This view demonstrates that intervening vegetation and landform largely screen views towards the site. Views may be visible of the southern part of the site. However, there are no proposed buildings in this part of the site.

Viewpoints 1 and 2 in Appendix 10.2 (Figures 10.11a to 10.12b), illustrate the views from along the R352 to the south of the site. Viewpoint 1 demonstrates that due to the placement of the proposed buildings set back over 100m from the road along with the proposed bunds and associated woodland planting only filtered views will be available initially (Figure 10.11b). As the proposed structure planting establishes the proposed development will become completely screened from view as per the montage for the view after 15 years establishment of the structure planting on Figure 10.11a.

The photomontages for Viewpoint 2 show that the part of the proposed development will be clearly visible from this motorway junction roundabout. In discussion with the Council, they requested that the proposed development actually address the motorway junction and that it be visible in order to acknowledge its presence in some form. As such the proposal has been designed so that the front of one of the data halls is visible from the roundabout with other halls either screened behind the front most building or by vegetation to either side of it. The proposed development will also be viewed in the context of existing electricity infrastructure such as a lattice work pylon, with the existing electricity substation visible outside the illustrated views to the left.

The magnitude of change experienced by users of the R352, as a result of the proposed development is assessed to be **Low to Medium**. For the most part the visibility of the proposed development will be filtered or screened for road users. Where readily available views are available these address the road.

The effect of the proposed development on the R352 is therefore assessed to be **Minor** and the significance is **Slight**.

10.9.1.4 R458

The ZTV illustrates that users of the R458 will experience continuous theoretical visibility of the proposal for part of the length in the south of the LVIA Study Area. However, as the road passes through the settlement of Ennis for all of this stretch, actual views of the proposal will be screened by the intervening built form of the settlement. Further north, users of the R458 will only experience small stretches of theoretical visibility with the majority of actuals views highly likely to be completely screened in reality due to intervening vegetation.

The magnitude of change experienced by users of the R458, as a result of the proposed development is assessed to be **Negligible** due to the low potential for actual views of the proposed development.

The effect of the proposed development on the R458 is therefore assessed to be **Negligible** and the significance is **Not Significant**.

10.9.1.5 R469

The ZTV illustrates that to the west of the motorway users of the R469 will experience extensive theoretical visibility of the proposal. To the east of the motorway only small stretches of theoretical visibility will be available and these will largely be limited to potential views of the Energy Centre and/or the Vertical Farm, most likely only the flues of the Energy Centre which extend above the buildings.

Viewpoint L (Appendix 10.1) demonstrates the view experience from along this road and was selected due the absence of roadside vegetation. As can be seen any potential for views towards the site are screened by intervening vegetation beyond the viewpoint location.

The magnitude of change experienced by users of the R469, as a result of the proposed development is assessed to be **Negligible** as the potential for actual views is limited.

The effect of the proposed development on the R469 is therefore assessed to be **Negligible** and the significance is **Not Significant**.

10.9.1.6 R474

The ZTV illustrates that users of the R474 will experience continuous theoretical visibility of the proposal for most of its length within the LVIA Study Area. However, as the road passes through the settlement of Ennis for all of this stretch, actual views of the proposal will be screened by the intervening built form of the settlement. Furthermore, the road, at its closest, is located over 4km for the proposed development.

The magnitude of change experienced by users of the R474, as a result of the proposed development is assessed to be **Negligible** as the potential for actual visibility is very limited.

The effect of the proposed development on the R474 is therefore assessed to be **Negligible** and the significance is **Not Significant**.

10.9.1.7 R475

The ZTV illustrates that users of the R475 will experience theoretical visibility of the proposed development over two stretches for approximately two thirds of its length within the LVIA Study Area. However, as the road passes through the settlement of Ennis for all of this stretch, actual views of the proposal will be screened by the intervening built form of the settlement. Furthermore, the road, at its closest, is located over 4km for the proposed development.

The magnitude of change experienced by users of the R475, as a result of the proposed development is assessed to be **Negligible** as the potential for actual visibility is very limited.

The effect of the proposed development on the R475 is therefore assessed to be **Negligible** and the significance is **Not Significant**.

10.9.1.8 R871

The ZTV illustrates that users of the R871 will experience theoretical visibility of the proposed development for approximately half its length at a distance of almost 3km from the proposed built forms. The road for its length is located within the settlement of Ennis and as such the associated built forms and vegetation will more than likely screen any actual views.

The magnitude of change experienced by users of the R871, as a result of the proposed development is assessed to be **Negligible/None** as the potential for actual views is unlikely.

The effect of the proposed development on the R871 is therefore assessed to be **Negligible/None** and the significance is **Not Significant**.

10.9.1.9 L4076

The ZTV illustrates that users of the L4076 will experience theoretical visibility of the proposed development for much of the route. Viewpoint I in Appendix 10.1 was taken form a location with an open outward view from the road and demonstrates that actual views towards the site are screened by intervening vegetation. For much of the route views outwards are screened by roadside planting or properties located along the road.

The magnitude of change experienced by users of the L4076, as a result of the proposed development is assessed to be **Negligible** as the potential for actual views of the proposed development is limited.

The effect of the proposed development on the L4076 is therefore assessed to be **Negligible** and the significance is **Not Significant**.

10.9.1.10 L4608

The ZTV illustrates that users of the L4608 will experience theoretical visibility of the proposed development for its entire length. Viewpoints 4 and 5 (Figures 10.14a to 10.15b) and Viewpoint F demonstrate the type of views that will actually be experienced along this road. All three viewpoints are taken from field gateways off the road providing open views whereas much of the rest of the route is lined by roadside hedgerows screening views outwards.

As evidenced by Viewpoints 5 and F intervening landform and vegetation will screen much of the proposed development only the upper parts of the proposed data halls likely to be visible on the horizon. The colouring of the buildings will help to blend the buildings with the skyscape, and they will also be seen in the context of the electricity substation and associated infrastructure such as pylons and twin wood poles.

Viewpoint 4 is representative of the closest most open views of the proposed development form this road. Although the data halls will be visible, the Vertical Farm, the Energy Centre and the majority of the associated new substation will all be screened from view with the exception of the Energy Centre flues following establishment of the structure planting. Although the flues break the horizon they are similar in vertical scale to existing trees on the nearby ridgeline.

Following 15 years establishment of the structure planting (approximately 10 years post completion of the proposed development), visibility of the proposed development will mainly be limited to two data halls with only the top of one of these visible.

The magnitude of change experienced by users of the L4608, as a result of the proposed development is assessed to be **Low to Medium** as actual views of the proposed development will be relatively limited overall along this route, with more open views only experienced by the stretch closets to the site.

The effect of the proposed development on the L4608 is therefore assessed to be **Minor** and the significance is **Slight**.

10.9.1.11 L4100

The ZTV illustrates that users of the L4100 will experience broken stretches of theoretical visibility of the proposed development along this route. Actual views will be filtered/screened by roadside hedges, and intervening built forms and vegetation, especially the block of woodland on the opposite side of the L4068 road at the southern end of this route. Viewpoint F illustrates a view from the L4608 in proximity to the southern end of the L4100. It demonstrates that intervening vegetation will screen/filter the majority of the proposed development if views are available from the road.

The magnitude of change experienced by users of the L4100, as a result of the proposed development is assessed to be **Negligible** as the potential for actual views is unlikely due to roadside and intervening vegetation.

The effect of the proposed development on the L4100 is therefore assessed to be **Negligible** and the significance is **Not Significant**.

10.9.1.12 L8168 (Kilfielim Road)

The ZTV illustrates that users of the L8168 will experience theoretical visibility of the proposed development along the northern stretch of this road. However due to a combination of roadside vegetation, intervening hedgerows, and the proposed landscaping along the R352 actual visibility of the proposed development is unlikely.

The magnitude of change experienced by users of the L8168, as a result of the proposed development is assessed to be **Negligible** as actual views are unlikely.

The effect of the proposed development on the L8168 is therefore assessed to be **Negligible** and the significance is **Not Significant**.

10.9.1.13 L8172

The ZTV illustrates that users of the L8172 will experience theoretical visibility of the proposed development from much of the route with only a couple of broken stretches along its length. However, roadside hedgerows, the built form of the houses along the eastern side of the northern end of the road and intervening vegetation will likely screen any actual views of the proposed development.

The magnitude of change experienced by users of the L8172, as a result of the proposed development is assessed to be **Negligible** as actual views are unlikely.

The effect of the proposed development on the L8172 is therefore assessed to be **Negligible** and the significance is **Not Significant**.

10.9.1.14 Knockanean Road

The ZTV illustrates that theoretical visibility of the proposed development experienced by users of the Knockanean Road will largely be limited to the stretch of road west of Knockanean National School where Viewpoint H is located. For the stretch on the eastern side of the motorway, mature roadside hedgerows combined with the woodland block situated between the road and the R352 will screen any actual views of the proposed development. West of the motorway, mature hedgerows combined with the built forms of Knockanean and Ennis, will once again screen any potential views.

The magnitude of change experienced by users of the Knockanean Road, as a result of the proposed development is assessed to be **Negligible** as actual views are unlikely.

The effect of the proposed development on the Knockanean Road is therefore assessed to be **Negligible** and the significance is **Not Significant**.

10.9.2 Rail

The location of the railway line is illustrated in Figure 10.6 Key Routes.

10.9.2.1 Limerick to Galway Railway Line

The ZTV illustrates that users of the Limerick to Galway Railway Line will experience theoretical visibility of the proposed development for two long, largely unbroken stretches, one in the north and one in the south of the LVIA Study Area.

For the stretch in the south, views to the proposed development are likely screened by the large blocks of vegetation located between the railway and the motorway and also in places by the built form of the settlement of Ennis.

In the north, actual views will be screened by localised cuttings through which the railway line passes and intervening vegetation.

Although Viewpoints K and M are located along these two stretches respectively they are raised up on the road over passes and as such the visibility experienced by users of the railway line will be even more restricted than that demonstrated by these two views.

The magnitude of change experienced by users of the Limerick to Galway Railway Line, as a result of the proposed development is assessed to be **Negligible** as actual visibility of the proposed development will be relatively limited and if seen will be likely to appear as part of the settlement of Ennis.

The effect of the proposed development on the Limerick to Galway Railway Line is therefore assessed to be **Negligible** and the significance is **Not Significant**.

10.9.3 Viewpoints

The baseline description and assessment of sensitivity of the viewpoints is presented in Table 10.8. The visual assessment of the viewpoints is described in Table 10.9 below. The viewpoints are illustrated in Figures 10.11a to 10.16b.

Table 10.9 Representative Viewpoints – Assessment

Viewpoint	Viewpoint Assessment
Viewpoint 1 R352 South of Site (Figures 10.11a & 10.11b)	The photomontages demonstrate that even after the completion of Phase 1 (Figure 10.11b), views of the proposed development will be strongly filtered by the proposed woodland planting and associated bund along the roadside. Upon completion of the entire development at Phase 3, the planting will have grown to such a level that the majority of the development will be screened from view, and it will be barely noticeable. After 15 years establishment of the structure planting (Figure 10.11a), approximately 10 years after completion of the proposed development (Phase 3), the proposed development will be screened from view, even in the winter months when the trees are bare of leaves. The proposed hedgerow provides an appropriate, aesthetically pleasant boundary between the proposed footpath along the R352 and the site boundary and woodland bund beyond. **Magnitude of Change** The magnitude of change, as a result of the proposed development, is assessed to be **Low** for the following reasons: • The proposed woodland planting and bund will heavily filter views of the proposed development from the outset; • The hedgerow and woodland planting are in keeping with the existing landscape character of the area and as such are not uncharacteristic elements; and • Although the introduction of the landscaping is a noticeable change to the viewpoint, the actual built forms will not be visible. **Effect** The effect is therefore assessed to be **Minor,** and the significance is **Slight**.
Viewpoint 2 West of R352-M18 roundabout (Figures 10.12a & 10.12b)	The photomontage illustrating the proposed development upon completion of Phase 1 (Figure 10.12b) shows that the proposed development will occupy a small proportion of the view with the lower part of the building screened from view by the existing intervening hedgerow. Upon completion of the entire proposed development (Phase 3), the photomontage (Figure 10.12b) demonstrates that the proposed development will occupy approximately a third of the horizontal extents of view with the existing planting screening the lower parts of the buildings. After 15 years establishment of the structure planting (Figure 10.12a), approximately 10 years after completion of the proposed development (Phase 3), the proposed structure planting will have grown such that it frames the main building in the view on either side and screening the other buildings from view. In all views the frontages of the buildings positively address the view, facing directly onto the receptor. It should be noted that in discussion with the Council during the design phase the Council requested that the proposed development address this motorway junction in some form in order to acknowledge the presence of the Data Centre.

	Magnitude of Change The magnitude of change, as a result of the proposed development, is assessed to be **Medium** for the following reasons: • The proposed built form will be a noticeable change to the existing view whilst also being an uncharacteristic element in the view; • The proposed buildings will ultimately occupy less than a third of the horizontal extents of view and due to the setback and the intervening hedgerow will not be dominant; and • The proposed buildings positively address the viewpoint. **Effect** The effect is therefore assessed to be **Moderate/Minor** and the significance is **Moderate**. The viewpoint is generally transient in nature and seen in the wider context of the electricity substation and the motorway junction and associated signage. Although there are residences in proximity to the roundabout, their windows are not orientated towards the proposed development.
Viewpoint 3 M18 (Adjacent service track) West of Site (Figures 10.13a & 10.13b)	Upon completion of Phase 1, the photomontage (Figure 10.13b) demonstrates that the proposed development will occupy less than a sixth of the horizontal extents of the view, visible in a dip in the landform and existing vegetation. Two existing twin wood pole electricity structures are removed from the view as a result of the undergrounding of the two high voltage electricity lines within the site. Upon completion of the entire proposed development, the photomontage (Figure 10.13b) illustrates that the built forms will have expanded to occupy just under a third of the horizontal view, but still contained to the dip in the landscape. After 15 years establishment of the structure planting (Figure 10.13a), approximately 10 years after completion of the proposed development (Phase 3), the proposed woodland planting will have established to such a point that it will screen/heavily filter the two righthand buildings that were partially visible. As a result, open visibility is restricted to the one more readily visible building. Much of this building that is visible is the frontage of the building, providing a more positive appearance. The proposed development is seen in the portion of the view containing existing electricity infrastructure, containing development to the one part of the view. It should also be noted that this view is representative of users of the motorway consequently travelling at high speeds. As such, given the proposed development occupies a small proportion of the view and is located in a dip in the landscape this will be limited to a glimpsed view. **Magnitude of Change** The magnitude of change, as a result of the proposed development, is assessed to be **Low to Medium** for the following reasons: • The proposed development occupies a small proportion of the view, visible through a break in the existing hedgerow planting, located in a dip in the landscape and at an oblique angle to the motorway; • Although the proposed buildings, given their scale are uncharacteristic elements within the view, they occupy the same proportion of the view as other man-made electricity infrastructure; and • Given the proportion of the view occupied and the high-speed nature of the receptor, the proposed development will be apparent rather than conspicuous in nature. **Effect** The effect is therefore assessed to be **Minor/Moderate,** and the significance is **Slight**.

Viewpoint 4 L4608 North of Site at Cappagh More (Figures 10.14a & 10.14b)	Upon completion of Phase 1, the photomontage (Figure 10.14b) illustrates that the upper sections of two data halls and the substation will be visible with the lower sections screened by a mix of the existing vegetation and the proposed landscaping. The substation will for the most part be backclothed by the existing landform. The two drop-down pylons will also be visible behind one another on the horizon, in place of the two existing twin wood poles currently visible on the horizon. The photomontage for the completion of Phase 3 and the entire development (Figure 10.14b) illustrates that although the Vertical Farm and Energy Centre have now also been constructed, the only elements of these built forms that will be readily visible will be the flues of the Energy Centre. These will be viewed at a similar vertical scale and in the context of existing mature trees on the horizon. A third data hall will now also be visible, with the two previously visible data halls replaced by two new halls which are closer in the view than in the Phase 1 photomontage. The photomontage after 15 years establishment of the structure planting (Figure 10.13a), approximately 10 years after completion of the proposed development (Phase 3), illustrates that the proposed woodland planting will almost completely screen the right-hand data hall from view and the majority of the substation. The remaining visible data halls will occupy less than a third of the horizontal extents of the view, with the elements visible limited to the frontages and the upper halves of the sides. The top of the drop-down towers will be visible above the planting but due to their lattice work formation will not be readily visible elements within the view at this distance. The proposed landscaping is in keeping with the character of this landscape and easily blends into the view. Despite the addition of large scale, built form, only a proportion of the development will be visible, and the characteristic undulating nature of the drumlin farmland will not be affected. **Magnitude of Change** The magnitude of change, as a result of the proposed development, is assessed to be **Medium** for the following reasons: • The built form will be conspicuous but not dominant, being a partial change to a proportion of the landscape affecting some but not all of the key characteristics of the landscape; • The built forms will be uncharacteristic; and • The key undulating characteristic of this landscape will be retained within the view. **Effect** The effect is therefore assessed to be **Moderate,** and the significance is **Moderate.** Although the proposed development will be noticeable change within the view, a large proportion of the built forms will be screened from view due to the combination of the layout and placement of the buildings and the proposed landscaping. This is despite the viewpoint being located within 500m of the site boundary. The level of assessment for this viewpoint remains unchanged for the following reasons: • The revised substation and the drop-down towers result in a minimal alteration to the proposed view and would be for the most part backclothed by the existing landform; • The substation is contained within the extents of the already proposed built elements and would be largely screened from view after 15 years; • The drop-down towers will be visible in place of the existing wood twin poles and due to their lattice work nature will not be readily visible elements within the view.
Viewpoint 5 L4608 at Ballymacahill (Figures 10.15a & 10.15b)	The photomontage illustrating the proposed development upon completion of Phase 1 (Figure 10.15b) shows that the very top of one building of the proposed development will be just visible above the horizon. However, the building will be lower in height than the taller elements of the hedgerow running along the horizon. As a result of this minimal visibility and the proposed building colour scheme the proposed development will be a n inconspicuous element within the wider view.

	Upon completion of the entire development, Phase 3, the photomontage (Figure 10.15b) demonstrates that the tops of four of the proposed buildings will now be visible. However, the heights of these will still be lower than the higher parts of the hedgerow and when combined with the proposed colour scheme helps the proposed development to be absorbed into the landscape. After 15 years establishment of the structure planting (Figure 10.15a), approximately 10 years after completion of the proposed development (Phase 3), the proposed structure planting will have grown to such a point that it will have further screened parts of the proposed development. The proposed planting will blend with the hedgerow along the horizon. **Magnitude of Change** The magnitude of change, as a result of the proposed development, is assessed to be **Low to Negligible** for the following reasons: • Visibility of the proposed development is limited to just the upper parts of the buildings; • The proposed colour scheme helps to blend the development with the sky, reducing how noticeable the built forms are; and • Consequently, the proposed development, despite being visible, is a barely noticeable element amongst the existing vegetation along the horizon. **Effect** The effect is therefore assessed to be **Negligible,** and the significance is **Not Significant**.
Viewpoint 6 R352 at TII Depot to west of M18 (Figures 10.16a & 10.16b)	All three photomontages for this view illustrate that visibility of the proposed development will be limited to a very small horizontal and vertical proportion of the view farmed between a lamppost, roadside planting, and roadside barrier. The built forms are also viewed behind existing pylons and do not extend vertically above the adjacent existing gateway walls to the Knockanean Halting Site. **Magnitude of Change** The magnitude of change, as a result of the proposed development, is assessed to be **Negligible** for the following reasons: • The proposed development is barely noticeable, occupying a very small proportion of the view; • The proposed development is seen in the context of the other man-made elements; and • The proposed development does not extend above other built elements in the same proportion of the view. **Effect** The effect is therefore assessed to be **Negligible,** and the significance is **Not Significant**.

10.10 Cumulative Impact Assessment

In terms of potential cumulative landscape and visual impacts, the only other proposed development with the potential to contribute to cumulative effects is the consented Motorway Service Station at Junction 12, southbound off the M18. The scheme is currently the subject of an appeal to An Bord Pleanála. A list of all cumulative developments considered is contained within Appendices 3.1 and 3.2 of Chapter 3 of the EIAR.

The ZTV for the proposed development (Figure 10.9) shows that there will be some theoretical visibility of the proposed development from the location of the proposed Junction 12 Motorway Services Station. However, actual visibility is highly unlikely due to the combination of the proposed landscaping and intervening vegetation as demonstrated by the Viewpoints in Appendix 10.1 and Annex 10.1 and as assessed in Table 10.9. Furthermore, existing mature hedgerows and woodland to the north of the proposed motorway service station will foreshorten wider visibility of the service station.

The potential for cumulative impacts upon the LVIA Study Area resulting from the proposed development in combination with the proposed service station is therefore limited, given the restriction of actual visibility in the area between the two schemes. Consequently, the cumulative effects are assessed to be **Negligible,** and the significance is **Not Significant**.

10.11 SUMMARY

Table 10.10 summarises the findings of this LVIA.

Table 10.10 Summary Table

Receptor	Sensitivity	Magnitude of Change	Effect	Significance
Construction – Pre-Phase 1c	-	-	Moderate, temporary/ short term (approx. 1 year)	Moderate
Construction – Post-Phase 1b	-	-	Minor, short term (approx. 1 year)	Slight
Landscape Fabric	Medium	Medium	Moderate	Moderate
Ennis Drumlin Farmlands LCA	Medium	Low	Minor	Slight
Fergus Loughlands LCA	High	Negligible	Negligible	Not Significant
Fergus Estuary LCA	Medium	Negligible	Negligible	Not Significant
Local Landscape Character	Medium	Low	Minor	Slight
Working Landscapes	Low	Negligible	Negligible	Not Significant
M18	Medium	Low to Medium	Minor	Slight
N85	Medium	Negligible	Negligible	Not Significant
R352	Medium	Low to Medium	Minor	Slight
R458	Medium	Negligible	Negligible	Not Significant
R469	Medium	Negligible	Negligible	Not Significant
R474	Medium	Negligible	Negligible	Not Significant
R475	Medium	Negligible	Negligible	Not Significant
R871	Medium	Negligible/ None	Negligible/ None	Not Significant
L4076	Medium	Negligible	Negligible	Not Significant
L4608	Medium	Low to Medium	Minor	Slight
L4100	Medium	Negligible	Negligible	Not Significant
L8168 (Kilfielim Road)	Medium	Negligible	Negligible	Not Significant
L8172	Medium	Negligible	Negligible	Not Significant
Knockanean Road	Medium	Negligible	Negligible	Not Significant
Limerick to Galway Railway Line	Medium	Negligible	Negligible	Not Significant

VP1 R352 South of Site	High	Low	Minor	Slight
VP2 West of R352-M18 roundabout	Medium	Medium	Moderate/ Minor	Moderate
VP3 M18 (Adjacent service track) West of Site	Medium	Low to Medium	Minor/ Moderate	Slight
VP4 L4608 North of Site at Cappagh More	High	Medium	Moderate	Moderate
VP5 L4608 at Ballymacahill	High	Low to Negligible	Negligible	Not Significant
VP6 R352 at TII Depot to west of M18	Medium	Negligible	Negligible	Not Significant
Cumulative	-	-	Negligible	Not Significant

It is notable that the LVIA has identified that no landscape or visual receptors will experience levels of significance greater than 'Moderate as a result of the proposed development.

10.11.1 Summary of Residual Impacts

This Landscape and Visual Impact Assessment has been carried out to identify potential landscape and visual impacts arising from the proposed Data Centre development at Tulla Road, Spancilhill. The findings of this LVIA will inform the Council's consideration of the proposed development.

The impact of the proposed development has been considered and presented in this LVIA. A series of design measures, which were inherent to the design of the proposal, have ensured that the proposal fits with the surrounding character and context. The LVIA takes cognisance not only of the proposed built development, but also of the proposed landscaping.

The proposed woodland planting along the boundary to the R352, Tulla Road screens the proposed development from the adjacent properties and the road users. The woodland planting elsewhere across the site also aide in reducing actual visibility of the proposed development and provides an attractive setting to the development. The woodlands also enhance the biodiversity of the site.

The proposed meadow grasslands across the site provide a landscaped area of transition between the proposed building layout and the surrounding countryside and pastoral farmland.

The relationship with the existing landform has been considered. The proposed built forms have been located within the centre of the site where the ground is less elevated. They have also been orientated to correspond with the overall slope of the landform from east to west. This ensures that the key undulating characteristic and overall landform is maintained in views from the wider landscape.

The key features of the site, namely the woodland designated as 'Buffer Space' on Clare County Council's Zoning Map PLP-18-0001-2 (12/03/2019), Tooreen Lough and the ring fort Recorded Monument have been respected and incorporated into the design. All the existing waterbodies have also been retained.

The LVIA, by reference to field surveys and viewpoint analysis, has identified that the site is relatively visually discrete from the wider landscape despite its large scale. Views of the proposed development are not available from the east due to the existing topography. Views of the proposal from the R352 and the wider landscape to the south are contained by a combination of the existing and proposed woodland planting in the south of the site.

Viewpoint A from the east (Appendix 10.1) demonstrates the restricted visibility of the proposal due to the existing topography. Viewpoints 5 and 6 (Annex 10.1, Figures 10.15a to 10.16b), along with Viewpoints C to G (Appendix 10.1), also demonstrate the restricted visibility in views from the west.

To the north, although the built form will be visible, Viewpoint 4 (Annex 10.1, Figures 10.14a & b) demonstrates how the combination of the proposed bunds and woodland planting will reduce the visible extents of the proposed development.

As a result of the landscape and visual impact assessment, it is concluded that the site has the landscape capacity to accommodate the proposed development, taking account of the existing and proposed landscape framework and the following reasons:

- The LVIA has identified that there will be no 'Significant' or higher impacts on the landscape and visual receptors as a result of the proposed development;
- The proposal is in keeping with the zoning and designation in Variation No.1 to the Clare County Development Plan 2017-2023;
- The proposal responds to the existing landscape context and landform, ensuring that the woodland designated as 'Buffer Space' on Clare County Council's Zoning Map PLP-18-0001-2 (12/03/2019), Tooreen Lough and the ring fort Recorded Monument are not altered as part of the development; and
- The proposal improves and increases the habitats and biodiversity through the addition of the bunds, the additional woodland and the new meadow grasslands.

The adoption of the design measures (described in this report, the Landscape Design Strategy report and the Landscape and Biodiversity Management Plan) will integrate the proposal into the surrounding context. This is evidenced by the absence of any significant landscape and visual impacts, the limited extents of potential visibility and the broader findings of the LVIA.

11.0 ARCHAEOLOGICAL, ARCHITECTURAL AND CULTURAL HERITAGE

11.1 INTRODUCTION

11.1.1 General

This chapter assesses the potential impacts, if any, on the archaeological, architectural and cultural heritage resource of a proposed data centre development at Tooreen and Cahernalough, Ennis, County Clare (ITM 537485/679651; Figure 11.1).

This study determines, as far as reasonably possible from existing records, the nature of the archaeological, architectural, and cultural heritage resource in and within the vicinity of the proposed development using appropriate methods of study. Desk-based assessment is defined as a programme of study of the historic environment within a specified area or site that addresses agreed research and/or conservation objectives. It consists of an analysis of existing written, graphic, photographic, and electronic information in order to identify the likely heritage assets, their interests and significance and the character of the study area, including appropriate consideration of the settings of heritage assets (CIfA 2014). This leads to the following:

- determining the presence of known archaeological and architectural assets that may be affected by the proposed development;
- assessment of the likelihood of finding previously unrecorded archaeological and architectural remains during the construction programme;
- determining the impact upon the setting of known cultural heritage sites in the surrounding area; and
- suggested mitigation measures based upon the results of the above research.

The study involved detailed interrogation of the archaeological, architectural and historical background of the proposed development area. This included information from the Record of Monuments and Places of County Clare, the Record of Protected Structures, National Inventory of Architectural Heritage, the Clare County Development Plan (2017-2023), the topographical files of the National Museum of Ireland, and cartographic and documentary records. A field inspection has been carried out in an attempt to identify any known archaeological, architectural and cultural heritage sites and previously unrecorded features, structures, and portable finds within the proposed development area.

An impact assessment and a mitigation strategy have been prepared. The impact assessment is undertaken to outline potential adverse impacts that the proposed development may have on the cultural heritage resource, while the mitigation strategy is designed to avoid, reduce, or offset such adverse impacts.

11.1.2 Legislation and Guidelines

The following legislation, standards and guidelines were consulted as part of the assessment.

- National Monuments Act, 1930 to 2014;
- The Planning and Development Acts, 2000 (as amended) ;
- Heritage Act, 1995, as amended;

- Draft Advice Notes on Current Practice (in the preparation of Environmental Impact Statements), 2015, EPA;
- Draft Guidelines on the Information to be Contained in Environmental Impact Statements. Dublin. Government Publications Office, 2017, EPA;
- Frameworks and Principles for the Protection of the Archaeological Heritage, 1999, (formerly) Department of Arts, Heritage, Gaeltacht, and Islands; and
- Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act, 1999

11.1.3 Consultation

During scoping and research for the assessment and EIAR, a number of statutory and voluntary bodies were consulted to gain further insight into the cultural background of the receiving environment and study area, as follows:

- Department of Housing, Local Government and Heritage – the Heritage Service and Policy Unit, National Monuments and Historic Properties Section: Record of Monuments and Places; Sites and Monuments Record; Monuments in State Care Database; Preservation Orders; Register of Historic Monuments;
- National Museum of Ireland, Irish Antiquities Division: topographical files of Ireland;
- National Inventory of Architectural Heritage: County Clare; and
- Clare County Council: Planning Section.

11.1.4 Definitions

In order to assess, distil and present the findings of this study, the following definitions apply:

'Cultural Heritage' where used generically, is an over-arching term applied to describe any combination of archaeological, architectural, and cultural heritage features, where:

- the term 'archaeological heritage' is applied to objects, monuments, buildings or landscapes of an (assumed) age typically older than AD 1700 (and recorded as archaeological sites within the Record of Monuments and Places);
- the term 'architectural heritage' is applied to structures, buildings, their contents and settings of an (assumed) age typically younger than AD 1700; and
- the term 'cultural heritage', where used specifically, is applied to other (often less tangible) aspects of the landscape such as historical events, folklore memories and cultural associations.

The quality, magnitude and duration of potential effects are defined in accordance with the criteria provided in the EPA Draft *'Guidelines on the information to be contained in Environmental Impact Assessment Reports'* (2017) as outlined in Table 1.2 of Chapter 1 (introduction).

11.2 METHODOLOGY

Research for this report was undertaken in two phases. The first phase comprised a paper survey of all available archaeological, architectural, historical, and cartographic sources. The second phase involved a field inspection of the site.

11.2.1 Paper Survey

This is a document search. The following sources were examined and a list of areas of archaeological, architectural and cultural heritage potential was compiled:

- Record of Monuments and Places for County Clare;
- Sites and Monuments Record for County Clare;
- National Monuments in State Care Database;
- Preservation Orders List;
- Register of Historic Monuments;
- Topographical files of the National Museum of Ireland;
- Cartographic and written sources relating to the study area;
- Clare County Development Plan, 2017-2023;
- Aerial photographs;
- Excavations Bulletin (1970–2019);
- Place Names; and
- National Inventory of Architectural Heritage.

Record of Monuments and Places (RMP) is a list of archaeological sites known to the National Monuments Section, which are afforded legal protection under Section 12 of the 1994 National Monuments Act and are published as a record.

Sites and Monuments Record (SMR) holds documentary evidence and field inspections of all known archaeological sites and monuments. Some information is also held about archaeological sites and monuments whose precise location is not known e.g. only a site type and townland are recorded. These are known to the National Monuments Section as 'un-located sites' and cannot be afforded legal protection due to lack of locational information. As a result, these are omitted from the Record of Monuments and Places. SMR sites are also listed on a website maintained by the Department of Housing, Local Government, and Heritage (DoHLGH) – www.archaeology.ie.

National Monuments in State Care Database is a list of all the National Monuments in State guardianship or ownership. Each is assigned a National Monument number whether in guardianship or ownership and has a brief description of the remains of each Monument.

The Minister for the DoHLGH may acquire national monuments by agreement or by compulsory order. The state or local authority may assume guardianship of any national monument (other than dwellings). The owners of national monuments (other than dwellings) may also appoint the Minister or the local authority as guardian of that monument if the state or local authority agrees. Once the site is in ownership or guardianship of the state, it may not be interfered with without the written consent of the Minister.

Preservation Orders List contains information on Preservation Orders and/or Temporary Preservation Orders, which have been assigned to a site or sites. Sites deemed to be in danger of injury or destruction can be allocated Preservation Orders under the 1930 Act. Preservation Orders make any interference with the site illegal. Temporary Preservation Orders can be attached under the 1954 Act. These perform the same function as a Preservation Order but have a time limit of six months, after which the situation must be reviewed. Work may only be undertaken on or in the vicinity of sites under Preservation Orders with the written consent, and at the discretion, of the Minister.

Register of Historic Monuments was established under Section 5 of the 1987 National Monuments Act, which requires the Minister to establish and maintain such a record. Historic monuments and archaeological areas present on the register are afforded statutory protection under the 1987 Act. All registered monuments are included in the Record of Monuments and Places.

The topographical files of the National Museum of Ireland are the national archive of all known finds recorded by the National Museum. This archive relates primarily to artefacts but also includes references to monuments and unique records of previous excavations. The find spots of artefacts are important sources of information on the discovery of sites of archaeological significance.

Cartographic sources are important in tracing land use development within the development area as well as providing important topographical information on areas of archaeological potential and the development of buildings. Cartographic analysis of all relevant maps has been made to identify any topographical anomalies or structures that no longer remain within the landscape.

- William Petty, Down Survey, Barony of Bunratty, c. 1655;
- Henry Pelham, The County of Clare, 1787; and
- Ordnance Survey maps of County Clare, 1840-2, 1893-1907 and 1913-8.

Documentary sources were consulted to gain background information on the archaeological, architectural and cultural heritage landscape of the proposed development area.

Development Plans contain a catalogue of all the Protected Structures and archaeological sites within the county. The Clare County Development Plan (2017–2023) was consulted to obtain information on cultural heritage sites in and within the immediate vicinity of the proposed development area.

Aerial photographic coverage is an important source of information regarding the precise location of sites and their extent. It also provides initial information on the terrain and its likely potential for archaeology. A number of sources were consulted including aerial photographs held by the Ordnance Survey, Google Earth and Bing Maps.

Excavations Bulletin is a summary publication that has been produced every year since 1970. This summarises every archaeological excavation that has taken place in Ireland during that year up until 2010 and since 1987 has been edited by Isabel Bennett. This information is vital when examining the archaeological content of any area, which may not have been recorded under the SMR and RMP files. This information is also available online (www.excavations.ie) from 1970–2020.

Place Names are an important part in understanding both the archaeology, history, and cultural heritage of an area. Place names can be used for generations and in some cases have been found to have their root deep in the historical past. The main references used for the place name analysis is *Irish Local Names Explained* by P.W Joyce (1870) and the Place Names Database of Ireland.

The National Inventory of Architectural Heritage (NIAH) is a state initiative established under the provisions of the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act 1999 tasked with making a nationwide record of significant local, regional, national and international structures, which in turn provides county councils with a guide as to what structures to list within the Record of

Protected Structures. The NIAH have also carried out a nationwide desk-based survey of historic gardens, including demesnes that surround large houses.

11.2.2 Field Inspection

Field inspection is necessary to determine the extent and nature of archaeological, architectural, and historical remains and can also lead to the identification of previously unrecorded or suspected sites and portable finds through topographical observation and local information.

The archaeological and architectural field inspection entailed:

- Walking the proposed development and its immediate environs;
- Noting and recording the terrain type and land usage;
- Noting and recording the presence of features of archaeological or historical significance;
- Verifying the extent and condition of any recorded sites; and
- Visually investigating any suspect landscape anomalies to determine the possibility of their being anthropogenic in origin.

During the baseline analysis and field inspection, a number of sites of heritage merit have been identified, which do not have statutory protection, but represent sites that require assessment as part of the overall cultural heritage resource. Cultural Heritage (CH) has been applied to sites or structures that possess archaeological and/or architectural heritage significance. Area of Archaeological Potential (AAP) has been applied to areas of the landscape, such as loughs or watercourses, that whilst are not specifically archaeological in nature, are landscape features that have proven throughout the prehistoric and historic period to attract human habitation and settlement.

11.3 RECEIVING ENVIRONMENT

11.3.1 Archaeological and Historical Background

The proposed development area is situated within a number of open fields primarily in the townlands of Cahernalough and Tooreen with small sections extending west into the townlands of Ballymacahill and Knockanean, which are located in the parishes of Kilraghtis and Doora and barony of Bunratty Upper, County Clare. The landscape is currently under agricultural use, which would likely continue without the proposed development. The site is bordered to the south by the R352 and to the west by the M18. There is one recorded monument within the northern half of the proposed development, a cashel (RMP CL034-007) with a further six recorded sites located within the study area (250m) (Figure 11.1). There are no protected structures or structures listed in the NIAH located within the study area of the proposed development.

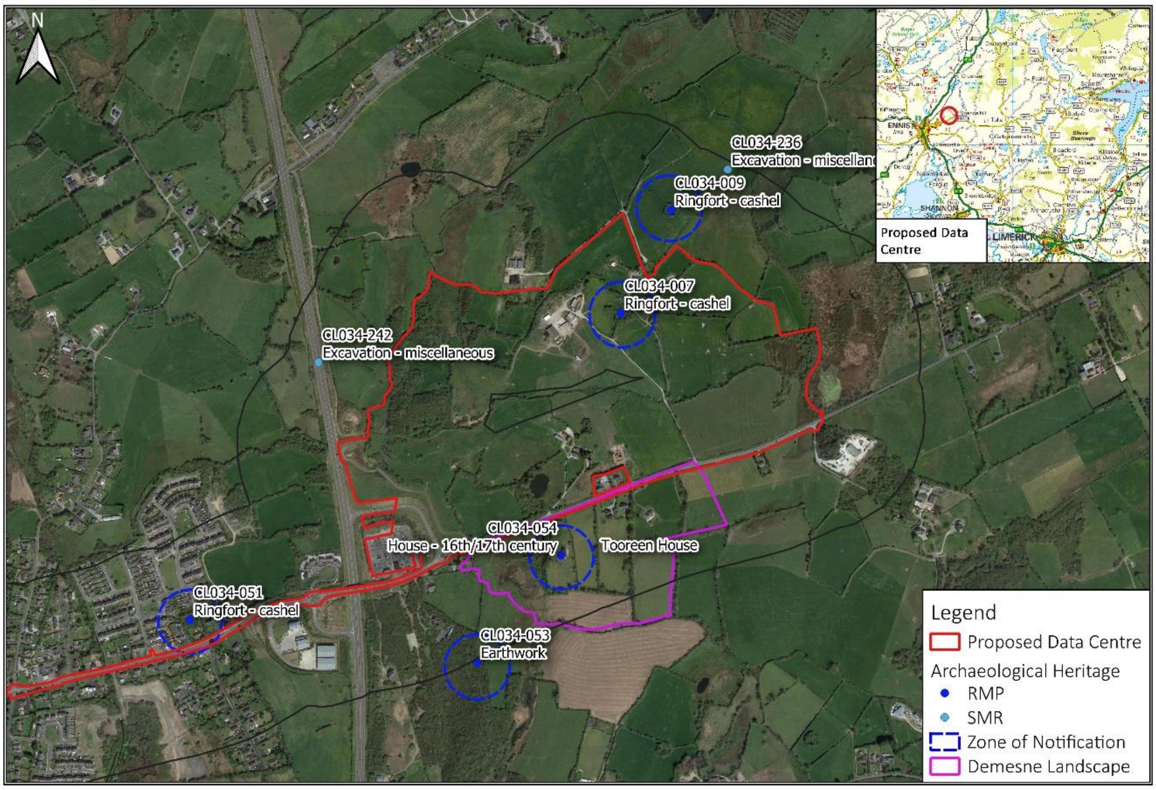


Figure 11.1 *Location of proposed development and surrounding recorded monuments and demesne landscapes*

11.3.1.1 Prehistoric Period

Mesolithic Period (6000-4000 BC)

Although very recent discoveries may push back the date of human activity by a number of millennia (Dowd and Carden 2016), the Mesolithic period is the earliest time for which there is clear evidence for prehistoric activity in Ireland. During this period people hunted, foraged, and gathered food and appear to have had a mobile lifestyle. The most common evidence found to show the presence of Mesolithic communities at a site consists of scatters of worked flint material, a by-product from the production of flint implements. There are no known Mesolithic sites located within the vicinity of the proposed development; however, the River Fergus, with its range of materials and resources, c. 2.4km to the west-southwest, would have been an attractive location for early hunter gatherers, providing access to the Shannon estuary to the south and deep into the Irish Midlands.

Neolithic Period (4000-2500 BC)

In the Neolithic period communities became less mobile and their economy became based on the rearing of stock and cereal cultivation. The transition to the Neolithic was marked by major social change. Communities had expanded and moved further inland to more permanent settlements. This afforded the development of agriculture which demanded an altering of the physical landscape. Forests were rapidly cleared, and field boundaries constructed. Pottery was also being produced, possibly for the first time.

While recent years have seen a large increase in the number of identified Neolithic settlement and habitation sites, the period is most commonly characterised by its impressive megalithic tombs. There are four types of tomb; court cairn, portal, passage, and wedge. The court, portal, and passage style tombs are of pure Neolithic date, while the wedge tomb straddles the Neolithic to Bronze Age transition. Evidence of Neolithic activity in the county is represented by the presence of court tombs and portal tombs in the Burren and stray artefacts typical of this period. A wedge tomb (RMP CL026-091) is recorded c. 2.1km to the northeast of the proposed data centre.

Bronze Age (2500-800 BC)

During the Bronze Age settlement within the wider landscape continued and intensified and there is a range of evidence for activity in the surrounding wetlands and drylands of the Shannon estuary and Fergus valley (O' Sullivan 2001). Evidence for a possible late Bronze Age wooden trackway crossing the upper Fergus estuary, providing access between dryland islands, was recorded c. 8km south-southwest of the site (O' Sullivan 2001, 109; RMP CL042-149). This has been interpreted as evidence for the herding of cattle or sheep on the saltmarshes by the local farming community (ibid. 261).

The Bronze Age was marked by the widespread use of metal for the first time in Ireland. As with the transition from Mesolithic to Neolithic, the transition into the early Bronze Age was accompanied by changes in society. The construction of megalithic tombs went into decline and the burial of the individual became typical. Cremated or inhumed bodies were often placed in a cist, which is a stone-lined grave, usually built of slabs set upright to form a box-like construction and capped by a large slab or several smaller lintels (Buckley and Sweetman 1991). Barrows and pit burials are also funerary monuments associated with this period. A Bronze Age palstave was recovered during testing for the Ennis Bypass, c. 910m to the north-northwest (Licence 03E1293).

Another site type thought to reveal of glimpse of domestic life at this time is the burnt mound and fulacht fiadh. A common site within the archaeological record, they are normally interpreted as temporary cooking sites but may have been used for other industrial or even recreational functions. They survive as low mounds of charcoal-enriched soil mixed with an abundance of heat-shattered stones. They are usually horseshoe shaped and located in low-lying areas near a water source and are often found in clusters. Even when levelled by an activity such as ploughing, they are identifiable as burnt spreads in the landscape (Brindley and Lanting 1990).

Iron Age (800 BC-AD 500)

The Iron Age was traditionally seen as a period for which there was little evidence in comparison to the preceding Bronze Age and the succeeding early medieval period. However, development-led excavation in recent decades and projects such as the 'Late Iron Age and Roman Project' have added significantly to our knowledge of the Irish Iron Age. In Europe, there are two stages to the Iron Age, the earlier Hallstatt and followed by the La Tene phase. It is clear there was significant contact and interaction between the Continental Europe, Britain and Ireland at this time. There are no recorded sites of Iron Age date in the vicinity of the proposed development area.

11.3.1.2 Early Medieval Period (AD 500–1100)

County Clare formed from a very early period as a native principality, designated *Tuath Mumhan* (North Munster), or Thomond and contained the six cantrels of *Hy Lochlean, Corcumruadh*, *Ibh Caisin*, *Hy Garman*, *Clan Cuilean* and *Dal Gaes*. Archaeological evidence for settlement at this time is characterised in the landscape by ringforts, cashels, souterrains and early ecclesiastical sites.

The early medieval period is depicted in the surviving sources as largely rural characterised by the basic territorial unit known as *túath*. Byrne (2001) estimates that there were likely to have been at least 150 kings in Ireland at any given time during this period, each ruling over his own *túath*. Enclosures comprise the greatest number of sites recorded in the County Clare Sites and Monuments Record (SMR). Cashels are the stone equivalent of ringforts and are normally found in the west of the country. These together with the ringfort or rath are considered to be the most common indicator of settlement during the early medieval period. Ringforts were often constructed to protect rural farmsteads and are usually defined as a broadly circular enclosure. One of the most recent studies of the ringfort (Stout 2017) has suggested that there is a total of 47,000 potential ringforts or enclosure sites throughout Ireland. They are typically enclosed by an earthen bank and exterior ditch and range from 25m to 50m in diameter. Ringforts can be divided into three broad categories – univallate sites, with one bank or ditch; multivallate sites with as many as four levels of enclosing features and platform or raised ringforts, where the interior of the ringfort has been built up. These enclosed farmsteads were intimately connected to the division of land and the status of the occupant. There is one ringfort recorded within the site containing the proposed data centre (CL034-007), where the enclosure is define as a cashel. There is a further two ringforts located within 250m of the site (CL034-051, 009).

11.3.1.3 Medieval Period (AD 1100–1600)

It was shortly after the arrival of the Anglo-Normans that Donncadh Cairbreach O' Brien, King of Thomond, moved the O' Brien royal residence from Limerick City to the newly constructed earthen fort at *Clonroad or Cluain Ráda,* c. 2.7km to the southwest of the development area (Ó' Dálaigh 2012, 1; RMP CL033-085005). The new stronghold was located at a fording point on the River Fergus in the northeast of modern Ennis town. Following his death, his son and successor Conor Ruadh, transferred the stronghold and settlement from the northern banks of the River Fergus to the southern bank (RMP CL033-085006).

A Franciscan Abbey (RMP CL033-082001) was founded, by King *Donncadh Cairbreach* O' Brien' in the 1240s at a place known as *Inish Mac nInil,* c. 3.4km to the southwest of the development area. The friary was suppressed in 1543 and was leased to James Naylande in 1569 after which it became an effective centre for English government in Thomond. Courts were held in the abbey – possibly in the sacristy. At the time of dissolution the friary property included a church, belfry, graveyard, a mill on the Fergus, an eel weir, two messuages with stone walls and twelve houses in the town of *Innishe* (Ó' Dálaigh 2012, 3). In 1589 the friary was leased to *Donnchad* O' Brien 4th Earl of Thomond who was credited with ensuring the preservation of the building. The monastery was the principal burial place of the Kings (and later Earls) of Thomond. The remaining ruins comprise of a church and parts of a cloister.

In 1543, the last recognised King of Thomond, Murrough the Tanist, travelled to London to become the first Earl of Thomond as part of the Surrender and Regrant scheme (Ó' Dálaigh 2012, 17). The account of a raid on Clonroad in 1553 indicates that a substantial settlement was associated with the castle and in 1581 Clonroad was superseded by Bunratty as the Earls' principal residence. The volume of commercial traffic on the River Fergus in the late 1500s appears to have been considerable and the town traded corn, furs, hides, and wool for manufactured goods such as cloth, iron, salt and wine.

The Annals of the Four Masters record that in 1559 a battle was fought at Spancil Hill (RMP CL034-017/20) between the forces of the Earl of Desmond and the joint forces of the Earl of Thomond and the Earl of Clanrickard, c. 1.1-1.5km to the east-northeast of the proposed development. The battle was the culmination of a cross-country skirmish extending over 6km before the forces of the Earl of Desmond gained the summit of the hill and routed the army of the Earl of Thomond and the Earl of Clanrickard.

In 1565 Connaught was divided into six counties by Sir Henry Sidney (the lord-deputy). Thomond, which was sometimes called O' Brien's country, was made shire ground and called Clare, after its chief town and its Anglo-Norman possessors. In accordance with its natural position, the county was subsequently re-annexed to Munster in 1602, on petition of the Earl of Thomond. The medieval town of Ennis had developed at the convergence of three route ways leading to Limerick, Galway, and the Burren (Spellissy 2003, 40). The town was granted a market in 1609 and in 1613 Ennis was incorporated and the abbey was adopted as a parish church for Doora and Dromcliff.

11.3.1.4 Post-Medieval Period (AD 1600–1900)

In 1641 Barnabas O'Brien, Earl of Thomond owned a large portion of the lands in the Baronies of Islands and Bunratty. Following the rebellion of the same year many of the English families were forced out of Ennis and Clare (now Clarecastle); however it was at this time that a number of displaced wealthy Catholic merchant families settled here.

In the late 17th century Ennis is thought to have contained c. 120 houses and 12 English families. The 18th century saw an increase in leases taken and the town sprawled south and north of the river. In 1741 the O'Brien estates passed to Percy Wyndham and the markets and tolls expanded in the following decades. In 1733 the main trade road to Limerick was made a tolled turnpike (Ó' Dálaigh 2012, 6). By the late 18th century the market at Ennis had grown to the point where the market square failed to provide sufficient space. As such the sale of 'milk, potatoes and other gross goods' was moved to Cloghaneagour (*Clochán na nGabhal* or Stepping stones of the forked stream) at the western end of town (Spellissy 2003, 42). By the 19th century, encouraged by trade and commerce, the town had expanded well into Lifford, north of the river.

The 18th century witnessed a more pacified Ireland and the political climate settled; this saw a dramatic rise in the establishment of large residential houses around the country. This was largely due to the fact that after the turbulence of the preceding centuries, the success of the Protestant cause and effective removal of any political opposition, the country was at peace. The large country house was only a small part of the overall estate of a large landowner and provided a base to manage often large areas of land that could be dispersed nationally. During the latter part of the 18th century, the establishment of a parkland context (or demesnes) for large houses was the fashion. Although the creation of a parkland landscape involved working with nature, rather than against it, considerable construction effort went into their creation. Major topographical features like rivers and mountains were desirable features for inclusion into, and as a setting, for the large house and parkland. The demesne of Tooreen House, was established to the immediate south of the proposed data centre; however, by the late 19th century the house and demesne had fallen into ruin.

Toureen House itself is a recorded monument (CL034-054), located c. 76m south-southeast of the proposed development area. Today the house has been restored and renovated and comprises a three-bay, three-storey, over basement house dating to the 17th century. Prior to renovation the structure was completely ruinous and had lost its roof and internal floors.

Vernacular architecture is defined in James Steven Curl's Encyclopedia of Architectural Terms as 'a term used to describe the local regional traditional building forms and types using indigenous materials, and without grand architectural pretensions', i.e. the homes and workplaces of the ordinary people built by local people using local materials. This is in contrast to formal architecture, such as the grand estate houses of the gentry, churches, and public buildings, which were often designed by architects or engineers. The majority of vernacular buildings are domestic dwellings. Examples of other structures that may fall into this category include shops, outbuildings, mills, lime kilns, farmsteads, forges, gates and gate piers.

The ruins of a vernacular farmstead are located within the proposed development area, which are marked on the first edition OS map (CH 1). A later 19th century modified cottage, which is now derelict, is also located within the site (CH 2) (Figure 11.2). The first edition OS map also marks the site of a lime kiln within the site (CH 3) and the further site of a structure is also recorded, as marked on the first edition OS map (CH 4).

11.3.2 Summary of Previous Archaeological Fieldwork

A review of the Excavations Bulletin (1970–2020) revealed that no previous archaeological investigations have been carried out within the confines of the proposed data centre; however, there have been four investigations carried out within the study area, which are summarised below.

A single oval pit, measuring 1.9m by 1.4m and 0.28m deep, was excavated in advance of a gas pipeline c. 223m to the northeast (Licence 02E1187, Bennett 2002:0113). The single fill of the pit was a fine silt that darkened from a mid-brown at the surface to black at the base. The lowest 0.08m of the deposit was pure charcoal, suggesting in situ burning. The site has since been added to the SMR as CL034-236.

Testing for the northern section of the N18 Ennis Bypass identified one site of archaeological interest within the study area of the proposed development in Ballymacahill. This comprised three small fire pits, potentially of modern date that were identified at the base of a natural slope, c. 170m to the west (Licence 04E0054, Bennett 2004:0135). This site has since been added to the SMR as CL034-242.

A programme of investigation was carried out c. 200m to the west (Licence 02E1495, Bennett 2002:0091), but nothing of significance was identified. Similarly, all renovations associated with works at Toureen House (CL034-054), were archaeologically monitored c. 76m to the south-southeast, but nothing of significance was identified (Licence 00E0753, Bennett 2001:102).

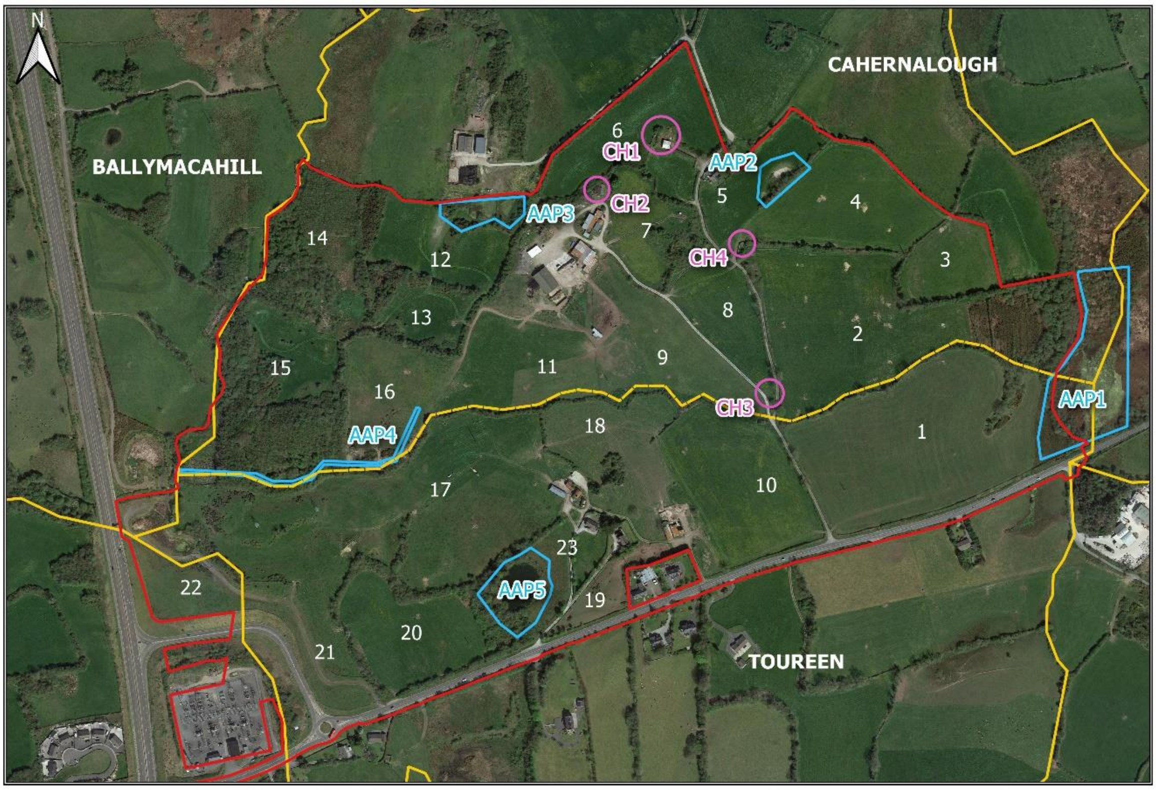


Figure 11.2 *Location of proposed development showing townland boundaries, CH sites, AAPs and field numbers*

11.3.3 Cartographic Analysis

William Petty, Down Survey, Barony of Bunratty, c. 1655

The Down Survey depicts the area of the proposed data centre in the southern limit of the parish of Kilraghtis in the townlands of 'Lehanagh North' and 'South'. No features are depicted within these townlands.

Henry Pelham, The County of Clare, 1787

The route of the modern R352 to the immediate south of the proposed data centre is marked on this map. Tooreen House (CL034-054) is marked to the south of the site and Castletown House and castle are depicted further to the east. This map shows Tooreen Lough within the site with Lough Ardnamurry to the east.

First Edition Ordnance Survey Map, 1840-2, scale 1:10,560

This is the first map to depict the proposed data centre in detail (Figure 11.3). The site consists of a number of open fields and the two loughs. A small number of houses are marked along a trackway extending north-northwest from the road to the south (CH 1). A circular feature marks the location of the recorded ringfort (CL034-007) on the west side of the trackway in the north of the site. A lime kiln is also marked in the eastern part of the site (CH 3). A watercourse, a tributary of the River Fergus, is depicted along the western limit of the site. The demesne of Tooreen House is depicted to the south and the small demesne of Castletown House is depicted to the east.

Ordnance Survey Map, 1893-1907, scale 1:2,500

There have been some minor changes to the layout of the fields by the time of this OS map and some alterations are shown to the vernacular structures depicted within the north of the site along the trackway (CH 1) (Figure 11.4). A footpath is marked extending south-southwest from these structures to the road to the south. Lough Ardnamurry is depicted as covered in furze to the east of the site. Tooreen House (CL034-007) is marked in ruins to the south and its demesne has fallen into disrepair. The lime kiln (CH 3) is no longer depicted.

Third Edition Ordnance Survey Map, 1913-8, scale 1:10,560

The only major change to note within this is that a small house is now shown at the location of CH 2 within the northern part of the development area.

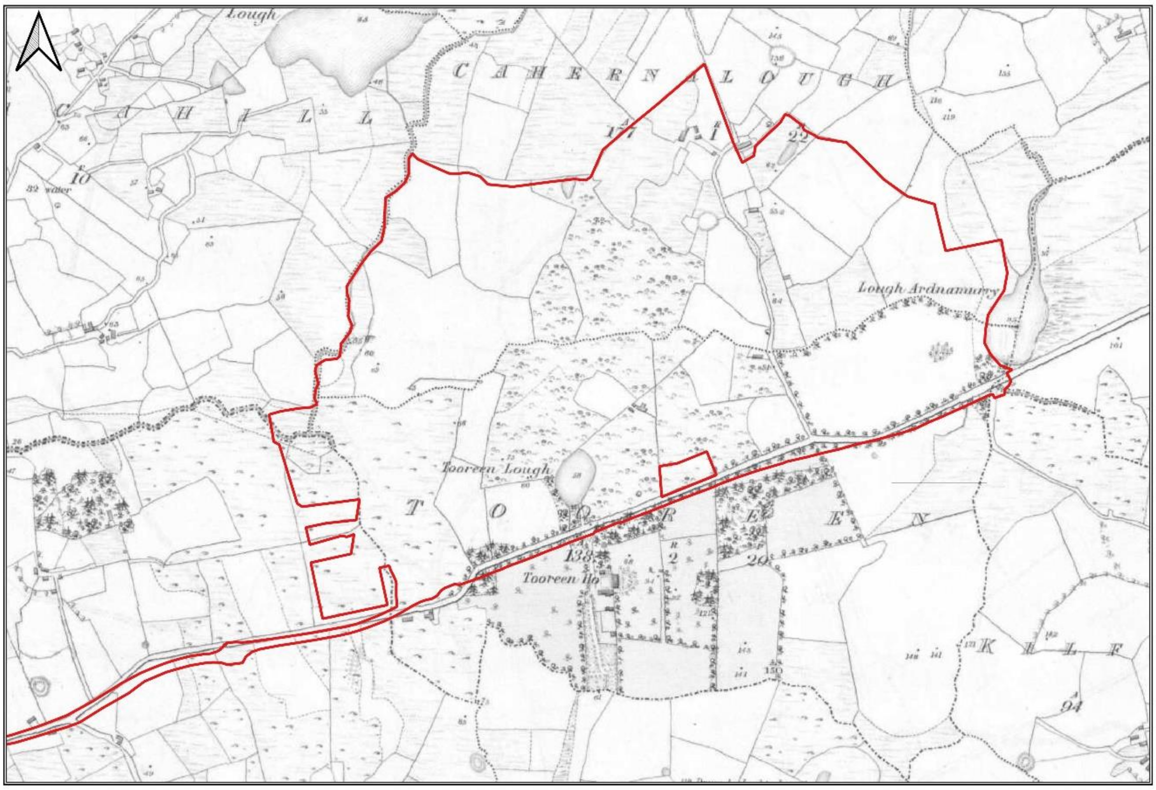


Figure 11.3 *Extract from the 1840-2 OS map showing the site location*

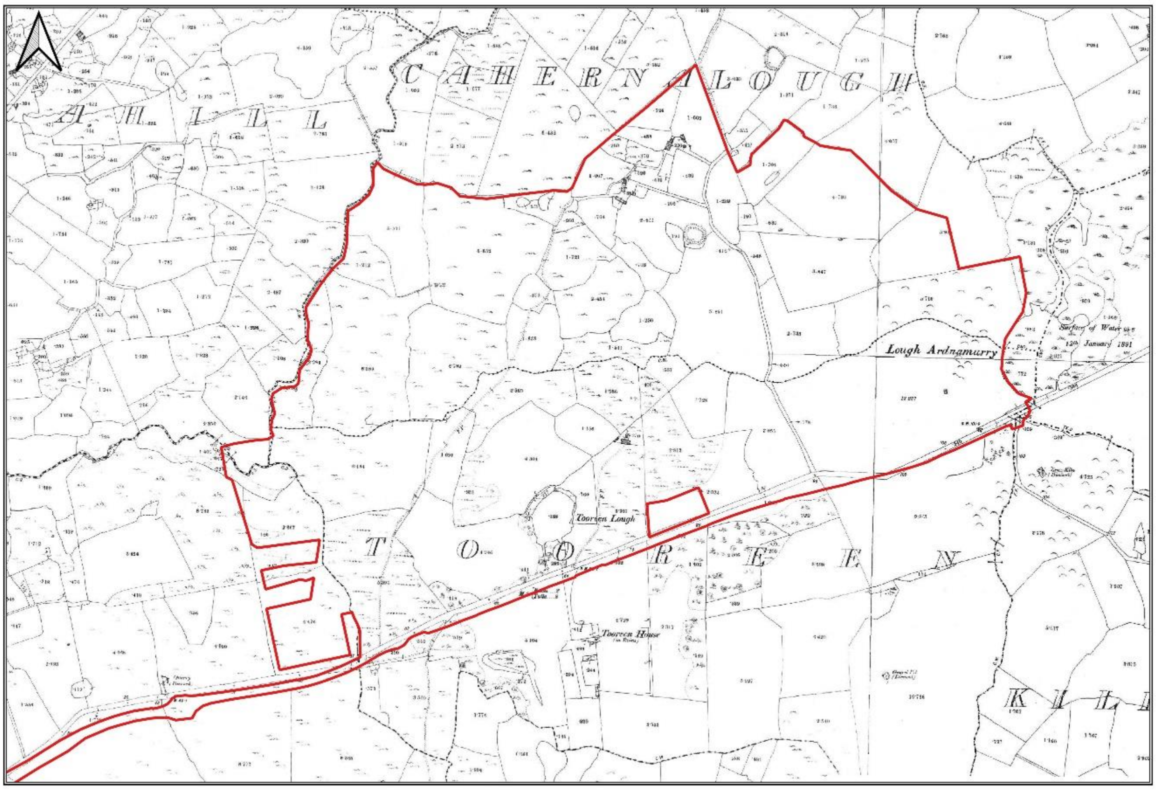


Figure 11.4 *Extract from the 1893-1907 OS map showing the site location*

11.3.4 Clare County Development Plan, 2017-2023

11.3.4.1 Record of Monuments and Places

The Clare County Development Plan, 2017-2023 recognises the statutory protection afforded to all Record of Monuments and Places (RMP) sites under the National Monuments Legislation (1930–2014). The development plan lists a number of aims and objectives in relation to archaeological heritage (Appendix 11.1). It is an objective of the plan to secure the preservation of all archaeological monuments included in the Record of Monuments and Places as established under Section 12 of the National Monuments (Amendment) Act, 1994, and of sites, features and objects of archaeological and historical interest generally, with the preference to preserve in situ and only in exceptional cases preserve by record.

There are seven recorded archaeological sites within 250m of the proposed development, one of which, a cashel (RMP CL034-007) is situated within the northern portion of the site (Table 11.1; Figure 11.1). Of the seven sites, five represent recorded monuments, whereas two are included in the SMR only as records of previous archaeological investigations. SMRs are not subject to statutory protection.

None of the archaeological sites are further protected as National Monuments, or are subject to Preservation Orders.

Table 11.1 *Recorded Archaeological Sites*

SMR No.	Location	Classification	Distance to Site	Statutory Protection
CL034-007	Cahernalough	Ringfort - cashel	0m	Yes
CL034-051	Knockanean	Ringfort - cashel	c. 56m north	Yes
CL034-009	Cahernalough	Ringfort - cashel	c. 71m north	Yes
CL034-054	Tooreen	House - 16th/17th century	c. 76m south	Yes
CL034-242	Ballymacahill	Excavation - miscellaneous	c. 170m west	No
CL034-236	Cahernalough	Excavation - miscellaneous	c. 223m north-northeast	No
CL034-053	Knockanean	Earthwork	c. 250m south-southeast	Yes

11.3.4.2 Record of Protected Structures

The Clare County Development Plan, 2017-2023 recognises the value of the built heritage to the county and is committed to the protection and enhancement of this heritage by providing measures for the protection of architectural heritage. These include the establishment of a Record of Protected Structures (RPS) and the designation of Architectural Conservation Areas (ACAs).

There are no structures included on the RPS within 250m of the proposed development. The nearest protected structure comprises Castletown tower house (RPS 266), situated c. 765m to the east in the townland of Muckinish. The tower house is also included on the Record of Monuments and Places (RMP CL034-014002).

11.3.4.3 ACAs

There are 35 ACAs designated within the Clare County Development Plan, 2017-2023, none of which are situated within the proposed development. The nearest ACA is Our Lady's Hospital Complex, Gort Road, which is situated c. 2.6km to the west.

11.3.5 National Inventory of Architectural Heritage

11.3.5.1 Building Survey

The National Inventory of Architectural Heritage survey of Clare was published in 2009. A review of the architectural survey was undertaken as part of this assessment and included buildings within 250m of the study area. There are no structures listed on the NIAH building survey within the study area, the nearest comprises Knockanoura Castle (NIAH 20003065), c. 2.2km to the west-southwest in the townland of Knockanoura.

11.3.5.2 Garden Survey

The National Inventory of Architectural Heritage has also carried out a garden survey of the demesne landscapes in County Clare. The first edition Ordnance Survey map of County Clare (1840-2) shows the extent of demesne landscapes as shaded portions of land within the study area. These were established as a naturalised landscaped setting for the large houses of the landed gentry.

There are no demesnes within the study area listed on the NIAH Garden Survey; however, there is one demesne depicted on the first edition OS map within the study area, which comprises Tooreen House, located to the immediate south of the road that borders the development area to the south (Figure 11.1).

The demesne of Tooreen House is depicted to the immediate south of the development area on the first edition OS map. By the time of the 1893-1907 OS map the principal structure (RMP CL034-054) is annotated 'in ruins' and the demesne is denuded. Today elements of the demesne's footprint are still visible and the main house has been restored with a modern annex constructed to the east.

11.3.6 Cultural Heritage

The term 'cultural heritage' can be used as an over-arching term that can be applied to both archaeology and architectural. However, it also refers to more ephemeral aspects of the environment, which are often recorded in folk law or tradition or possibly date to a more recent period. Cultural Heritage sites can also include elements of the landscape, such as placenames or townlands (and their associated boundaries). Sites and areas identified as possessing cultural heritage significance are included below.

11.3.6.1 Townlands

The townland is an Irish land unit of considerable longevity as many of the units are likely to represent much earlier land divisions. However, the term townland was not used to denote a unit of land until the Civil Survey of 1654. It bears no relation to the modern word 'town' but like the Irish word *baile* refers to a place. It is possible that the word is derived from the Old English *tun land* and meant 'the land forming an estate or manor' (Culleton 1999, 174).

Gaelic land ownership required a clear definition of the territories held by each sept and a need for strong, permanent fences around their territories. It is possible that boundaries following ridge tops, streams or bog are more likely to be older in date than those composed of straight lines (*ibid.* 179).

The vast majority of townlands are referred to in the 17th century, when land documentation records begin. Many of the townlands are mapped within the Down Survey of the 1650s, so called as all measurements were carefully 'laid downe' on paper at a scale of forty perches to one inch. Therefore, most are in the context of pre-17th century landscape organisation (McErlean 1983, 315).

In the 19th century, some demesnes, deer parks or large farms were given townland status during the Ordnance Survey and some imprecise townland boundaries in areas such as bogs or lakes, were given more precise definition (*ibid.*). Larger tracks of land were divided into a number of townlands, and named Upper, Middle or Lower, as well as Beg and More (small and large) and north, east, south, and west (Culleton 1999, 179). By the time the first Ordnance Survey had been completed a total of 62,000 townlands were recorded in Ireland.

The majority of the proposed development area is located within the townlands of Cahernalough and Tooreen with small sections extending west into the townlands of Ballymacahill and Knockanean. The surrounding townlands consist of Cappagh More, Muckinish, Kilfeilim, Tullyvoghan, Creggaun, and Drumdoolaghty. These are townlands are located within the parishes of Kilraghtis, Clooney, and Doora, within the Barony of Bunratty Upper, County Clare.

There are eight townland boundaries and two parish boundaries within and bordering the proposed development. The townland boundary between Cahernalough and Tooreen winds east-west through the centre of the proposed data centre. Much of this boundary is formed by a mature hedge line. The western section contains a small stream, where it runs through a valley.

11.3.6.2 Place name Analysis

Townland and topographic names are an invaluable source of information on topography, land ownership and land use within the landscape. They also provide information on history; archaeological monuments and folklore of an area. A place name may refer to a long-forgotten site and may indicate the possibility that the remains of certain sites may still survive below the ground surface. The Ordnance Survey surveyors wrote down townland names in the 1830's and 1840's, when the entire country was mapped for the first time. Some of the townland names in the study area are of Irish origin and through time have been anglicised. The main references used for the place name analysis are *Irish Local Names Explained* by P.W Joyce (1870) and logainm.ie. A description and possible explanation of each townland name in the environs of the proposed development is provided in the below table.

Table 11.2 *Place names*

Name	Derivation	Possible Meaning
Tooreen	*An Tuairín*	Little bleach green/ little paddock/ little (cultivated) field/ little pasture
Cahernalough	*Cathair na lough*	Caher (circular stone fort) of the lake
Ballymacahill	*Baile Mhic Cathail*	Town/place of Mhic Cathail
Knockanean	*Cnoc an Éin*	Bird hill
Cappagh More	*An Cheapach Mhór*	Great tillage-plot
Muckinish	*Mucrois*	Pig island
Kilfeilim	*Cill Feidhlime*	Church of Feidhlim
Tullyvoghan	*Tulach Uí Bhuacháin*	Hillock of Ó Buacháin
Creggaun	*An Creagán*	Little rock/ rocky ground
Drumdoolaghty	*Drom Dubhlachna*	Ridge of the black duck
Kilraghtis	*Cill Reachtais*	Church of Reachtais
Clooney	*Cluaine*	Meadow land
Doora	*Dubh dúire*	Black oak-wood
Bunratty Upper	*Bun Raite Uachtarach*	The mouth of the River Ratty, now called the Owen O'Garney
Clare	*Clar*	A level piece of land

11.3.6.3 Cultural Heritage sites

Four cultural heritage sites have been identified during the course of this study. CH 1 relates to the site of a ruined vernacular farmstead, located in the northern part of the proposed development area, which is marked on the first edition OS map. CH 2 consists of a late 19th century modified vernacular cottage (now derelict), also located in the northern part of the site. CH 3 represents the site of a lime kiln, located in the eastern part of the site, which is marked on the first edition OS map. CH 4 consists of the site of a probably vernacular building located to the southeast of CH 1. The sites are shown on Figure 11.2.

11.3.7 Stray Finds within the Surrounding Area

Information on artefact finds from the study area in County Clare has been recorded by the National Museum of Ireland since the late 18th century. Location information relating to these finds is important in establishing prehistoric and historic activity in the study area.

A review of the topographical files revealed that no stray finds have been recovered from in or within the study area of the proposed development.

11.3.8 Aerial Photographic Analysis

Inspection of the aerial photographic coverage of the proposed development area held by the Ordnance Survey (1995-2013), Google Earth (2009-2020) and Bing Maps (2020) revealed that the M18 to the west of the proposed data centre was built between 2005 and 2009 resulting in landscaping in the western corner of the site. The remainder of the site has remained has open pasture fields and no previously unrecorded sites of archaeological potential were noted within the proposed development area.

11.3.9 Field Inspection

The field inspection sought to assess the site, its previous and current land use, the topography, and any additional information relevant to the report. During the course of the field investigation the proposed data centre and its immediate surrounding environs were inspected. The 23 fields that form the development area are described below and marked on Figure 11.2.

Field 1

Sub-rectangular in plan, this field of pasture is located in the southeast corner of the development area and is bounded by the R352 to the south; Lough Ardnamurry to the east; an access lane to the west and the townland boundary between Toureen and Cahernalough to the north (Plate 11.1). Lough Ardnamurry, and its immediate environs, are considered to be of archaeological potential (AAP 1) due to the fact that water bodies were often utilised during prehistoric and historic periods for ritual and settlement (Plate 11.2). The eastern part of the field contains a drumlin that slopes on all sides, with a plateau in the field to the north (Field 2). The eastern side of the slope slopes steeply down towards the lough and contains possible evidence of localised quarrying, although this section is heavily overgrown. The western part of the field is relatively level. The townland boundary that runs through the development area is primarily formed by a denuded stone wall of rough masonry with mature trees (Plate 11.3). Only the very western and south-western portion of the field will be affected by the proposed development.

Plate 11.1: Field 1, facing northeast

Plate 11.2: Lough Ardnamurry (AAP 1), facing east

Plate 11.3: Townland boundary, facing southwest

Field 2

This is a sub-rectangular field of pasture, located to the north of Field 1 and south of Fields 3 and 4. The field is bordered to the south by the townland boundary between Toureen and Cahernalough; by Lough Ardnamurry to the east; an access lane to the west and mature field boundaries to the north. The centre of the field is formed by the plateau of a drumlin that slopes in a western direction through much of field (Plate 11.4). The ground level slopes steeply down towards to the lough to the east, and this portion of the field is planted with trees. Only the western section of this field will be affected by the proposed development.

Plate 11.4: Field 2, facing east

Field 3

This field of pasture is roughly triangular in plan and is located to the north of Field 2 and southeast of Field 4. It is bounded on all sides by mature field boundaries and slopes to the north and northwest away from the drumlin plateau in Field 2. This field will remain unaffected by the proposed development.

Field 4

An irregular field in plan, this field of pasture is located to the north of Field 2 and 3 and is east of Field 5. It is bounded on all sides by mature field boundaries. The field slopes to the west and northwest. The proposed development will be located in the western part of this field.

Field 5

This is a small sub-rectangular field with Fields 6, 7 and 8 to the north, west and south and Fields 4 and 2 to the east and southeast. The field contains a large pond, which is also marked on the historic mapping and has been designated as AAP 2. The first edition OS map shows that a building formerly occupied the southeast corner of the field (CH 4). No remains associated with the structure were noted during the inspection. The field is relatively level, with a modern residence to the northwest and access lane running along the western boundary (Plate 11.5). The proposed development will not extend into this field.

Plate 11.5: Field 5, facing northeast

Field 6

This field is located in the northern most point of the proposed development area, with a modern farmyard complex and Field 7 to the south and a modern residence and Field 5 to the southeast. The field contains natural undulations and slopes gently to the south and southwest (Plates 11.6). A modern shed in located in the field, with the ruins of a vernacular farmstead to the immediate west, which is marked within the historic OS mapping (CH 1). The ruins are heavily denuded and represents the remains of single storey vernacular structures with walls of roughly coursed masonry (Plate 11.7). This field will remain unaffected by the proposed development.

Field 7

This field is located to the south of Field 6 and is bounded to the east and south by Fields 5, 8 and 9. A modern farmyard is located to the immediate west. The field is under pasture and contains natural undulations and a gentle westerly slope. A recorded ringfort (CL034-007), in the form of an overgrown cashel, is located in the southeast corner of the field (Plate 11.8). The site is heavily overgrown (Plate 11.9) and barely accessible, although the denuded cashel wall was visible along the south-eastern side with an apparent width of c. 5m. No features potentially associated with the ringfort were noted within any of the surrounding fields. Very little development will occur within this field, with a potential attenuation pond proposed in part of the western section of the field. The ringfort will be preserved in-situ with only minor intrusions into the zone of archaeological potential, associated with the proposed development road layout.

Plate 11.6: Northern part of Field 6, facing southwest

Plate 11.7: Remains of vernacular farmstead (CH 1), facing east-northeast

Plate 11.8: Ringfort (CL034-007), within Field 7, facing east

Plate 11.9: Interior of ringfort (CL034-007)

Modern Farmyard

The modern farmyard comprises a roughly oval area of modern agricultural sheds and areas of disturbance, which is bordered to the north and east by Fields 6, 7 and 9 and to the west and south by Fields 12 and 11. The extent of the disturbance is visible in the aerial photographic coverage of the landscape. The only feature of merit is a semi-derelict single storey cottage with dormer level located to the immediate northeast of the farmyard (CH 2). This structure (Plate 11.10) has been modified in the past and dates to the late 19th century. It possess three bays, with an entrance porch on the main east facing elevation. The door and window fittings have been replaced and the structure has been rendered. The structure will be located to the immediate west of a proposed attenuation pond and northeast of the main distribution road network.

Plate 11.10: Vernacular cottage (CH 2), facing north

<u>Field 8</u>

This field is roughly triangular in plan and comprises level pasture with occasional undulations, located to the immediate southeast of the recorded ringfort (CL034-007) (Plate 11.11). The field is bordered to the east by an access lane and to the southwest by a more recent drive accessing the modern farmyard. In the very southern tip of the field is the site of a lime kiln (CH 3), which is marked on the first edition OS map. No evidence of this site remains today and it may have been affected by the installation of the more recent access track (Plate 11.12). Whilst much of this field will remain unaffected by the proposed development, the site of the lime kiln will be impacted by the distribution network.

Plate 11.11: Field 8, facing south

Plate 11.12: Site of lime kiln (CH 3), facing northwest

Field 9

This field is located at the centre of the proposed development area and comprises a level field of pasture with Fields 7 and 8 to the east and Fields 10, 18 and 11 to the south and southwest. The modern farmyard is located to the immediate northwest. The modern access track to the farm forms the eastern boundary of the field and the townland boundary between Toureen and Cathernalough forms the southern boundary. The field will be included in the main layout of the data centre development.

Field 10

This is another field of level pasture, which is sub-rectangular in plan (Plate 11.13). The R352 forms the southern boundary, with recent scattered residential development to the west; Fields 18 and 9 to the north and Field 1 and the access lane to the east. The northern boundary is formed by the townland boundary between Toureen and Cathernalough. This portion of the site will contain a portion of the proposed data centre, a realigned access road and some attenuation ponds.

Plate 11.13: Field 10, facing west

Field 11

This field is located to the immediate south of the modern farmyard and bounded to the south by Fields 17 and 18, along with the townland boundary between Toureen and Cathernalough. Field 9 is located to the east and Field 13 and 16 to the west. The field is formed by level pasture with some natural shallow undulations (Plate 11.14). The majority of this field will be affected by the development that is proposed.

Plate 11.14: Field 11, facing east

Field 12

This area comprises an area of pasture containing small drumlins, which are present within this north-western corner of the development area (Fields 12-16) (Plate 11.15). The northern part of the field is heavily overgrown and slopes sharply to the north, where a large pond is present (Plate 11.16). This water body is marked on the historic OS map and has been designated as AAP 3. A modern farm and pasture is located to the north, whereas Field 14 is located to the west and Field 13 to the south. The modern farmyard is located to the immediate east. At the time of the inspection, there was evidence of flooding in the western part of the field. A portion of this field will be used as attenuation for the proposed development.

Plate 11.15: Field 12, facing southwest

Plate 11.16: Pond (AAP 3), facing north

Field 13

This field consists of a rectangular area of pasture containing natural drumlins. The field is bounded to the to the north and east by Fields 12 and 11 and to the west and south by Fields 14, 15 and 16. Much of the field will be occupied by the proposed data centre and associated attenuation.

Fields 14 and 15

These fields form the northwest portion of the proposed development area and will not be affected by the proposed development. They comprise a mixture of small drumlins under rough pasture, boggy areas of ground and heavily planted area, such as the southern parts of Field 14 and Field 15.

Field 16

This is a roughly triangular field of rough pasture containing small drumlins and undulations. It is bounded by Fields 15, 13, 11 and 17. The southern part of the field slopes steeply down towards a stream that runs along the path of the townland boundary, separating Toureen from Cahernalough (Plate 11.17). The stream is only evident in this part of the site, and it remains unclear where the watercourse commences. This section of the stream to the south of Field 16 (and 17 to the west) is heavily overgrown and has been designated as AAP 4. Only a small section of the eastern part of the field will be affected by the development. The stream does not follow the townland boundary along the southern side of Field 11 and as such it will not be affected by the development.

Plate 11.17: Stream (AAP 4), facing southwest

Field 17

This is a large field in the south-western part of the proposed development area. It comprises a field of pasture that is irregular in plan and bounded to the north by the townland boundary between Toureen and Cathernalough. As described in Field 16, a portion of this boundary is formed by a stream. Fields 20-23 are located to the south, with Field 18 to the east and Fields 16, 16 and 11 to the north. The field is characterised by small drumlins, similar in form to those located in the north-western part of the site. The eastern part of this field only will be affected by the proposed development.

Field 18

This is an irregular field of rough pasture located in between Field 17 to the west and Field 10 to the east. The field is relatively level and the southern section of the field contains a number of modern houses and outbuildings. Only the northern section of the field will be affected by the proposed development.

Field 19

This is a small area of level pasture surrounding some modern houses (outside the development area) fronting onto the R352. This area will not be affected by the proposed development.

Field 20

This is an irregular field of pasture located in the southwest section of the proposed development area. It is bounded to the south by the R352, with Fields 17, 23 and 19 to the north and east and Field 21 to the west. A small drumlin occupies the western part of the field, which slopes gently to the east (Plate 11.18). The eastern part of the field will be affect by the construction of an access road.

Plate 11.18: Field 20, facing northeast

Fields 21 and 22

These are two small fields of pasture located to the east and north of a link road onto the M18. There is a modern attenuation pond located to the immediate north of Field 22. A modern access track runs through both of the fields, which provides access to the ponds. Both areas appear to have been disturbed due to the presence of the M18 and the construction of the access track.

Field 23

This area consists of a small rectangular field of rough pasture, which is also the grounds of a modern house, located at the eastern end of the field. Toureen Lough is located within this field and has been designated as AAP 5. This field will remain undisturbed by the proposed development.

With the exception of AAPs 1-5 and CH 1-4, no other previously unrecorded sites of archaeological, architectural or cultural heritage significance were noted during the course of the field inspection.

11.3.10 Summary of Receiving Environment

The proposed data centre is located within 23 fields bordered to the west by the M18 and to the south by the R352. The site is situated within the townlands of Cahernalough, Tooreen, Ballymacahill and Knockanean in the parishes of Kilraghtis and Doora and barony of Bunratty Upper, County Clare. There are seven recorded archaeological sites within 250m of the proposed development, one of which, a cashel (RMP CL034-007) is situated within the northern portion of the site. Of the seven sites, five represent recorded monuments, whereas two are included in the SMR only as records of previous archaeological investigations. SMRs are not subject to statutory protection.

There are no buildings included on the Record of Protected Structures for Clare or the NIAH Building Survey in or within 250m of the proposed development area. Similarly, no Architectural Conservation Areas are located within the study area. One demesne landscape has been identified within the study area, which comprises Tooreen House, located to the immediate south.

A review of the Excavations Bulletin (1970–2020) revealed that no previous archaeological investigations have been carried out within the confines of the proposed data centre; although four investigations have been undertaken within the study area. Two of the sites revealed archaeological remains of minor significance, whereas the remaining two failed to identify any features of significance.

A review of the aerial photographic coverage and historic mapping, along with the field inspection, has resulted in the identification of a number of Cultural Heritage Sites and Areas of Archaeological Potential. CH 1-4 comprise the site of vernacular structures and the site of a lime kiln, all of which are marked within the historic mapping. Today only CH 1 and 2 possess upstanding remains. AAPs 1-5 relate to small loughs/ponds within the area (which are a characteristic of drumlin landscapes) along with a stream in the western part of the site, which follows the path of the townland boundary between Toureen and Cathernalough. A large portion of this townland boundary is located within the proposed development area, but much of it is defined by a denuded stone wall and mature trees. No other features or structures of archaeological, architectural or cultural heritage significance were identified.

11.4 CHARACTERISTICS OF THE DEVELOPMENT

11.4.1 Construction Phase

The proposed development will comprise construction of a six data storage facilities, a gas powered energy centre and associated ancillary development. The key civil engineering works which will have a potential impact on archaeology during construction are summarised below:

- Significant cut and fill will be required for site levelling, construction of roads, car parking areas, foundations, installation of drainage services and ancillary infrastructure;
- Piling for foundations (where required)

11.4.2 Operational Phase

During operation there will be no ground disturbance required.

11.5 POTENTIAL IMPACTS OF THE DEVELOPMENT

11.5.1 Construction Phase

Ringfort CL034-007 will be preserved in-situ as part of the development with any potential direct impacts screened out as part of the design process. Works associated with the access roads will impinge within c. 27m of the ringfort, but the site will not be directly impacted by construction activities.

AAPs 1-5 will not be affected by the construction of the proposed development. Similarly CH 1, 2 and 4 remain outside of the footprint of the proposed works. CH 3 (site of lime kiln) will be subject to a direct, negative impact. Assuming buried remains survive beneath the current ground level, the impact (prior to mitigation) may be significant in nature.

Although no other previously unrecorded sites of archaeological, architectural and cultural heritage significance were identified during the assessment, it remains possible that previously unrecorded archaeological remains survive beneath the current ground level with no surface expression. Prior to the application of mitigation, it is possible that construction activities may result in a direct negative impact on same. Impacts may vary in scale from moderate to profound.

The construction of the proposed development will result in the removal of a section of townland boundary in between Toureen and Cathernaboy. Prior to the application of mitigation, this represents a direct negative moderative impact upon the cultural heritage resource.

11.5.2 Operational Phase

Whilst the recorded ringfort (CL034-007) will be preserved in-situ, the operation of the proposed development will result in an indirect negative impact on the setting of the monument, due to the proximity of the data centre and distribution roads. The impact is moderate negative.

No other impacts have been identified during the operation of the proposed development, which relate to the archaeological, architectural or cultural heritage resource.

11.6 REMEDIAL AND MITIGATION MEASURES

11.6.1 Construction Phase

A full geophysical survey and programme of archaeological testing will be carried out prior to the commencement of construction. The works will be carried out under licence to the DoHLGH. This work will be carried out in order to identify any remains associated with CH 3, along with any buried archaeological remains within the landscape that may be affected by the proposed development. Further mitigation may be required, dependant on the results of the assessment, such as preservation in-situ/by record and/or archaeological monitoring. Any further mitigation will require the approval of the National Monuments Service of the DoHLGH.

A full written and photographic record will be made of the section of townland boundary to be impacted upon by the development. This will be carried out at the same time as the archaeological testing assessment.

11.6.2 Operational Phase

A full photographic record of the landscape setting of ringfort CL043-007 will be made prior to the commencement of construction.

11.7 PREDICTED IMPACTS OF THE DEVELOPMENT

11.7.1 Construction Phase

Following the completion of mitigation measures detailed in section 11.6.1, there will be no predicted impacts on the archaeological, architectural and cultural heritage resource as a result of the construction of the development.

11.7.2 Operational Phase

Following the completion of mitigation measures detailed in section 11.6.2, there will be a slight negative indirect impact on ringfort CL034-007, due to the proximity of the operating development.

11.8 CUMULATIVE IMPACTS

No other existing or approved developments have been identified that would give rise to any cumulative impacts upon the archaeological, architectural and cultural heritage resource.

11.9 RESIDUAL IMPACTS

Following the completion of the mitigation measures described in this chapter, there will be no significant negative residual impacts upon the archaeological, architectural or cultural heritage resource. A slight negative indirect impact on ringfort CL034-007, will remain due to the proximity of the operating development.

11.10 INTERACTIONS

Potential impacts detailed in Chapter 10 Landscape and Visual have been reviewed as part of this assessment.

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12.0 TRAFFIC AND TRANSPORTATION

12.1 INTRODUCTION

12.1.1 Purpose of section

The purpose of this section is to assess the traffic impacts of the additional traffic movements that will be generated during the construction, operational and decommissioning phases of a proposed Art Data Centre, Substation and Grid Connection project, proposed in the townland of Tooreen and Cahernalough. The proposed development, referred to as the Art Data Centre – Ennis Campus, County Clare, is located on the northern side of the R352 Tulla Road approximately 1 km to the east of the M18 Motorway, which bypasses the Town of Ennis to the east.

The magnitude of the increase in traffic volumes experienced on the surrounding network and the forecast effects are identified during the construction, operational and decommissioning stages of the Proposed Development.

12.2 METHODOLOGY

The report adopts the guidance for such assessments set out by Transport Infrastructure Ireland (TII), in the document PE-PDV=02045-01 *'Traffic and Transport Assessment Guidelines, May 2014'* and also makes reference to the following;

- Rural Road Link Design, DN-GEO-03031, TII Publications, June 2017,
- Project Appraisal Guidelines for National Roads (Unit 5.3), PE-PAG-02017, TII Publications, May 2019,
- County Clare Development Plan 2017 to 2023 (as varied),
- Design Manual for Urban Roads and Streets, DoTTS, May 2019,
- National Cycle Manual, National Transport Authority, June 2011

The Traffic and Transport Section of this report is set out as follows:

- A review of the existing transport infrastructure in the vicinity of the proposed Art Data Centre, including existing and forecast traffic flows (Section 12.3 - Receiving Environment),
- A description of the nature of the proposed Art Data Centre and the traffic volumes that will be generated during the construction stage and when it is operational (Section 12.4 – Characteristics of Development,
- An assessment of the impacts of traffic generated by the proposed Art Data Centre on the surrounding road network (Section 12.5 –Potential Impacts of Development),
- Proposed mitigation measures (Section 12.6 – Remedial and Mitigation Measures),
- An assessment of the likely impacts of the Proposed Development (Section 12.7 – Predicted Impacts of the Proposed Development),
- An assessment of potential cumulative impacts with neighbouring developments (Section 12.8 – Cumulative Impacts), and,
- An assessment of residual impacts of traffic generated by the proposed Art Data Centre (Section 12.9 – Residual Impacts).

12.3 RECEIVING ENVIRONMENT

12.3.1 Site location and network summary

The location of the proposed Art Data Centre is located in the townland of Tooreen and Cahernalough, County Clare, and is shown in the context of the local road network in Figure 12.1 at the end of this chapter.

The site is located approximately 4.5 kms to the east of Ennis Town Centre and is accessed from the Regional R352 Tulla Road, which is a key commuter route, radiating from the town.

Adjacent to the site the R352 Tulla Road is a Type 2 single carriageway with a width of 7.0m and has a designated speed limit of 80 km/h.

Bordering the site to the west is the M18 motorway, which travels north to south and underpasses the R352 Tulla Road. Roundabout junctions are located either side of the M18 motorway. Access is provided to / from the M18 southbound lanes via the eastern roundabout (East Clare Roundabout) and to /from the M18 northbound lanes via the roundabout to the west (Tulla Road West Roundabout).

Travelling west of the Motorway in the direction of Ennis the R352 Tulla Road is accessed by residential development, both single accesses and estates, and by various other uses including retail, a service station and childcare facilities.

12.3.2 Base year traffic flows – years 2015 and 2019

Due to travel restrictions in place for the Covid-19 virus during the preparation of this EIAR, the collection of current year 2021 traffic counts was not possible. For this reason the following historic traffic count data was used as the base year 2015 traffic data set for the purpose of the traffic assessment;

Year 2015 data

- Classified turning count surveys undertaken at the East Clare Roundabout and the Tulla Road West Roundabout – These surveys were undertaken by ABACUS Ltd for the purpose of preliminary assessment of the subject site, and were collated for the AM (07:00 – 10:00) and PM (16:00 – 19:00) peak periods on a typical weekday in the month of July (Tuesday 21st July, 2015).
- Automatic Traffic Count Data (ATC) from the M18 between Junction 13 Tulla Road and Junction 14 Barefield Road – This data site is maintained by Transport Infrastructure Ireland (TII) with traffic count data available from 2015 to the present.

The classified turning count data provided all link flows and turning movements observed in the year 2015 at the 2 roundabouts during the AM and PM peak hours. A full listing of the traffic count for the roundabouts is included as Appendix 12.1.

Year 2015 to 2019

The M18 ATC data was used to;

- Provide link flows on the M18 main carriageway,
- To provide an indication of seasonal variation in traffic flows on the local road network. The observed counts were undertaken in the month of July, which

was recorded to be the second busiest month of the year. It was therefore determined that no seasonal adjustment of the observed counts was required.
- To determine a factor to convert the observed AM and PM peak hour traffic count data available from the 2015 surveys to all day traffic flows.
- To provide an indication of traffic growth between the observed survey year of 2015 and 2019, the year prior to the introduction of Covid-19 travel restrictions. From 2019 onward traffic growth rates issued by TII were used, as discussed subsequently in this report.

The M18 ATC Data referred to is included as Appendix 12.2.

The link count locations refer to in the assessment are shown in Figure 12.2 at the end of this chapter and are the following;

- Link 1 – The R352 Tulla Road to the east of the proposed Art Data Centre access junction
- Link 2 – The R352 Tulla Road to the west of the proposed Art Data Centre access junction
- Link 3 – The access road serving the proposed Art Data Centre
- Link 4 – The R352 Tulla Road between the M18 slip roundabouts
- Link 5 – The M18 slip road linking into the East Clare Roundabout
- Link 6 – The R352 Ennis Road
- Link 7 – Local access road from the Knockanean halting site linking into the Tulla Road West Roundabout
- Link 8 – The M18 slip road linking into the Tulla Road West Roundabout
- Link 9 – The M18 northbound carriageway to the north of the R352 Tulla Road
- Link 10 – The M18 southbound carriageway to the north of the R352 Tulla Road
- Link 11 – The M18 northbound carriageway to the south of the R352 Tulla Road
- Link 12 – The M18 southbound carriageway to the south of the R352 Tulla Road

The observed AM and PM peak turning counts for the year 2015 are shown by vehicle category in Figures A12.3.1 to A12.3.3 of Appendix 12.3. It should be noted that all turning count figures referred to in Section 12 of this EIAR are provided in Appendix 12.3.

Observed link flows are shown by time period for the observed year 2015 in Table 12.1, with the following key points to note:

- The AM and PM peak hours on the R352 Tulla Road and the M18 slip roads linking into both the East Clare and Tulla Road West Roundabouts were observed to be 08:00 to 09:00 and 17:00 to 18:00 respectively.
- From the M18 ATC data it was determined that all day traffic flows may be estimated from the following expression;

All day = 6.15 x (AM peak hour 08:00 – 09:00 flow + PM peak hour 17:00 – 18:00).

- On the R352 Tulla Road adjacent to the proposed Art Data Centre access junction (Link 1) 2-way traffic flows were observed to be relatively light during all periods, with flows observed as follows: AM peak hour = 272 vehicles, PM peak hour = 441 vehicles and All day = 4,385 vehicles.

- Traffic flows on the R352 Tulla Road increase significantly as the road approaches Ennis to the west of the M18 roundabouts with 2-way traffic flows at this location (Link 6) observed to be: AM peak hour = 623 vehicles, PM peak hour = 808 vehicles and All day = 8,801 vehicles.
- Of the 2 slip roads providing access to and from the M18 motorway, the one providing for southbound traffic movements linking into the East Clare Roundabout (Link 5) was observed to be the busier during the AM peak hour, providing for a 2-way flow of 352 vehicles, while the arm providing for northbound traffic linking into the Tulla Road West Roundabout (Link 8), was observed to be the busier during the PM peak hour, providing for a 2-way flow of 397 vehicles.
- The M18 just to the north of the R352 Tulla Road was recorded to have a daily 2-way traffic flow of 11,759 vehicles. It is noted that this is a relatively low volume of traffic for a motorway with a 2-way link capacity of 52,000 vehicles per day[1].

[1] Rural Road Link Design, DN-GEO-03031, June 2017, TII Publications

Table 12.1 *Observed link flows, by time period and vehicle type, year 2015 (2-way flows)*

Time period	Link	Observed Year 2015				
		cars / lgvs	HGVs	All vehs	% HGVs	PCUs
AM peak hour	1 Tulla Road east of site access	254	18	272	6.6%	282
	2 Tulla Road west of site access	254	18	272	6.6%	282
	3 Ste access	0	0	0	NA	0
	4 Tulla Road between roundabouts	515	19	534	3.6%	550
	5 M18 slip at East Clare roundabout	343	9	352	2.6%	362
	6 Ennis Road	601	22	623	3.5%	639
	7 Local access road	0	0	0	NA	0
	8 M18 slip at Tulla Road West roundabout	160	13	173	7.5%	185
	9 M18 motorway north of Tulla Road - n/b	334	20	354	5.6%	382
	10 M18 motorway north of Tulla Road - s/b	443	26	469	5.6%	506
	11 M18 motorway south of Tulla Road - n/b	334	20	354	5.6%	382
	12 M18 motorway south of Tulla Road - s/b	443	26	469	5.6%	506
PM peak hour	1 Tulla Road east of site access	422	19	441	4.3%	455
	2 Tulla Road west of site access	422	19	441	4.3%	455
	3 Ste access	0	0	0	NA	0
	4 Tulla Road between roundabouts	531	17	548	3.1%	562
	5 M18 slip at East Clare roundabout	197	8	205	3.9%	211
	6 Ennis Road	784	24	808	3.0%	825
	7 Local access road	7	0	7	0.0%	7
	8 M18 slip at Tulla Road West roundabout	386	11	397	2.8%	405
	9 M18 motorway north of Tulla Road - n/b	561	33	594	5.6%	641
	10 M18 motorway north of Tulla Road - s/b	467	28	495	5.6%	534
	11 M18 motorway south of Tulla Road - n/b	561	33	594	5.6%	641
	12 M18 motorway south of Tulla Road - s/b	467	28	495	5.6%	534
All Day	1 Tulla Road east of site access	4,157	228	4,385	5.2%	4,533
	2 Tulla Road west of site access	4,157	228	4,385	5.2%	4,533
	3 Ste access	0	0	0	NA	0
	4 Tulla Road between roundabouts	6,433	221	6,654	3.3%	6,839
	5 M18 slip at East Clare roundabout	3,321	105	3,426	3.1%	3,524
	6 Ennis Road	8,518	283	8,801	3.2%	9,004
	7 Local access road	43	0	43	0.0%	43
	8 M18 slip at Tulla Road West roundabout	3,358	148	3,506	4.2%	3,629
	9 M18 motorway north of Tulla Road - n/b	5,504	326	5,830	5.6%	6,287
	10 M18 motorway north of Tulla Road - s/b	5,597	332	5,929	5.6%	6,393
	11 M18 motorway south of Tulla Road - n/b	5,504	326	5,830	5.6%	6,287
	12 M18 motorway south of Tulla Road - s/b	5,597	332	5,929	5.6%	6,393

12.3.3 Future year traffic volumes – years 2027, 2029 and 2044

The key study years with respect to traffic impacts of the proposed Art Data Centre are as follows;

- Year 2027 – During construction and part operational. It is during this year that construction and operation traffic levels peak to generate the most traffic by the Art Data Centres during the lifetime of the proposed development.
- Year 2029 – First year fully operational, and,
- Year 2044 – First year operational + 15 years design year.

In order to produce forecast background traffic flows for these years from the observed 2015 traffic counts the following steps were undertaken.

Year 2015 to year 2019

Annual Average Daily Traffic (AADT) volumes on the M18 are available from the Automatic Traffic Count site maintained by TII located just to the north of the R352 Tulla Road. With AADTs of 9,802 and 13,215 recorded for the years 2015 and 2019, it may be derived that traffic growth during the interim was 34.8%. Year 2019 traffic flows were therefore determined by factoring 2015 traffic flows by 1.348.

As discussed previously, data from this count site will not be representative beyond 2019 due to Government travel restrictions in place for the Covid-19 pandemic.

Years 2019 +

For years of interest beyond the year 2019 traffic forecast produced by TII were referenced. Revised guidelines for forecasting annual growth in traffic volumes were produced by TII in May 2019[2]. The annual growth rates for light vehicles for County Clare, and factors for the years relevant to this study, are shown in Tables 12.2 and Table 12.3. The figures show that traffic volumes are forecast to increase during the period from 2019 to 2027 by 13.2%, from 2019 to 2029 by 16.7% and by 23.0% during the period from 2019 to 2044, based on a medium growth scenario.

Similarly, the cumulative growth rates from the observed year 2015 to the years of interest are shown in Table 12.4 taking account of the observed growth up to 2019, and the TII growth forecasts thereafter. Total medium growth rates from the survey year of 2015 are forecast to be as follows: 2027 = 52.6%, 2029 = 57.4% and 2044 = 65.8%.

Background traffic flows are included for assessment years 2027, 2029 and 2044 in Tables 12.14 to 12.17 included as Appendix 12.4.

It should be noted that while the assumed peak construction year of 2027 may vary slightly, this will not alter the forecast outcomes and effects presented in this section of the EIAR. This is due to the annual growth rate for background traffic being just 1.56% (as shown in Table 12.2) and that traffic volumes generated by the Art Data Centre will remain unchanged regardless of construction year and opening year, as presented subsequently in Section 12.4.

[2] Project Appraisal Guidelines for National Roads (Unit 5.3), PE-PAG-02017, May 2019, TII Publications

The forecast AM and PM peak hour counts for the years 2019, 2027, 2029 and 2044 are shown in Figures A12.3.4 to A12.3.7 included as Appendix 12.3.

Table 12.2 *TII traffic growth rates, light vehicles, County Clare*

Year	Lights - Annual factor			Lights - Cumulative index		
	low	Medium	High	low	Medium	High
2019	1.0139	1.0156	1.0191	1.000	1.000	1.000
2020	1.0139	1.0156	1.0191	1.014	1.016	1.019
2021	1.0139	1.0156	1.0191	1.028	1.031	1.039
2022	1.0139	1.0156	1.0191	1.042	1.048	1.058
2023	1.0139	1.0156	1.0191	1.057	1.064	1.079
2024	1.0139	1.0156	1.0191	1.071	1.080	1.099
2025	1.0139	1.0156	1.0191	1.086	1.097	1.120
2026	1.0139	1.0156	1.0191	1.101	1.114	1.142
2027	1.0139	1.0156	1.0191	1.117	1.132	1.163
2028	1.0139	1.0156	1.0191	1.132	1.149	1.186
2029	1.0139	1.0156	1.0191	1.148	1.167	1.208
2030	1.0019	1.0038	1.0075	1.150	1.172	1.217
2031	1.0019	1.0038	1.0075	1.152	1.176	1.226
2032	1.0019	1.0038	1.0075	1.155	1.181	1.236
2033	1.0019	1.0038	1.0075	1.157	1.185	1.245
2034	1.0019	1.0038	1.0075	1.159	1.190	1.254
2035	1.0019	1.0038	1.0075	1.161	1.194	1.264
2036	1.0019	1.0038	1.0075	1.163	1.199	1.273
2037	1.0019	1.0038	1.0075	1.166	1.203	1.283
2038	1.0019	1.0038	1.0075	1.168	1.208	1.292
2039	1.0019	1.0038	1.0075	1.170	1.213	1.302
2040	1.0011	1.0029	1.0105	1.171	1.216	1.316
2041	1.0011	1.0029	1.0105	1.173	1.220	1.330
2042	1.0011	1.0029	1.0105	1.174	1.223	1.343
2043	1.0011	1.0029	1.0105	1.175	1.227	1.358
2044	1.0011	1.0029	1.0105	1.176	1.230	1.372

Table 12.3 *TII derived traffic growth rates from 2019*

Period	Cumulative index		
	low	Medium	High
2019 to 2027	1.117	1.132	1.163
2019 to 2029	1.148	1.167	1.208
2019 to 2044	1.176	1.230	1.372

Table 12.4 *Combined traffic growth rates from 2015*

Period	Cumulative index		
	low	Medium	High
2015 to 2027	1.505	1.526	1.568
2019 to 2029	1.548	1.574	1.629
2019 to 2044	1.586	1.658	1.849

12.3.4 Future environment

A review of the TII and Clare County Council web sites suggests that there are no existing highway proposals that would significantly alter traffic patterns in the proximity of the Proposed Development site located on the R352 Tulla Road just to the east of the M18 motorway.

12.4 CHARACTERISTICS OF THE DEVELOPMENT

12.4.1 Development content

The proposed Art Data Centre comprises of 6 data centres, an energy centre, associated fibre and grid connection and associated site infrastructure. A full description of the proposed development is provided in Section 2.3 with the site layout shown in Figure 2.1.

12.4.2 Construction phases

It is estimated that the Art Data Centre will be constructed over a 6.5 year period (80 months), commencing in December 2022, with construction forecast to be complete in July 2029. Construction will be undertaken in 3 overlapping phases, with the start and completion dates, together with the forecast duration of each phase, shown in Table 12.5. The time line of the construction phases are shown in the summary chart included as Appendix 12.5.

Table 12.5 *Summary information for Art Data Centre by construction phase*

	Pre-start	Phase 1	Phase 2	Phase 3
Start date	Dec-22	Jun-23	Sep-25	Jun-27
End date	Mar-23	Sep-25	Jul-29	Jul-29
Phase duration	4 months	2 years, 4 months	3 years, 11 months	2 years, 2 months
Elements constructed during phase	Site preparation	Primary infrastructure Substation 1 2 x Data Centres (Nos 2 & 3)	Energy Centre Vertical Farm 2 x Data Centres (Nos 4 & 5)	2 x Energy Centre 2 x Data Centres (Nos 1 & 6)

12.4.3 Traffic generation during construction

The estimation of the volumes of traffic movements generated by deliveries to and from the site were provided by the study team. The estimates were calculated based on the preliminary estimates of materials that will be delivered to and from the site by month for the duration of the construction period.

The estimation of the volumes of traffic movements generated by construction staff to and from the proposed development site was estimated based on trip generation estimates for a similar scale development with a similar construction methodology.

The daily trip generations during each month of the 6.5 year construction period are set out in the chart included as Appendix 12.5 with the following key observations made from previous similar developments and applied to the proposed Art Data Centre as follows;

Construction Staff Trips

- For the peak construction month, which is forecast to occur in month 61 at the end of Year 2027 it is estimated that a maximum 1,200 construction staff will be on site each day. While in practice a significant percentage of the daily workforce will travel to the site by buses organised by the contractor, in order to test the worst case scenario it is assumed that all will travel by car. Based on a modest estimate that the average car occupancy will be 1.5, this will result in a maximum number of 800 cars to and from the site generated by construction staff on site on one day.
- For each of the 3 phases it is determined that there will be a maximum of 474 staff car trips to / from the site per day, as shown in Table 12.6.
- For construction staff it is estimated that 40% and 5% of the daily total will arrive at, and leave from the site during the AM peak hour from 08:00 to 09:00, with the reverse applying to the PM peak hour from 17:00 to 18:00.

Construction HGV Trips

- HGV deliveries will be concentrated at the beginning of the construction phase with a maximum of 115 trips to / from the site during Phase 1, reducing to a maximum of 46 HGVs during Phase 2 and 39 HGVs during Phase 3. The forecast daily average for each phase is 46 trips per day for Phase 1, 13 trips for Phase 2 and 23 trips for Phase 3, as set out in Table 12.6.
- It is estimated that a total of 23,279 HGV trips to and from the site will be generated during Phase 1, with 13,217 during Phase 2 and 12,603 during Phase 3. Including a further 200 deliveries to and from the site during the site preparation stage, it is estimated that a total of 53,396 HGV movements to and from the site will be generated during the construction of the Art Data Centre within the 6.5 year construction period.

Table 12.6 *Summary of Art Data Centre trip generation during construction, by phase and vehicle type (trips to and from site)*

Trip category		Pre-start (4 months)	Phase 1 (2 years, 4 months)	Phase 2 (3 years, 11 months)	Phase 3 (2 years, 2 months)	Total
Staff car trips	Maximum / day	50	474	474	474	NA
	Average / day	50	340	276	352	NA
HGV trips	Maximum / day	3	115	46	39	NA
	Average / day	2	46	13	23	NA
	Total HGV trips in Phase	200	27,376	13,217	12,603	53,396

12.4.4 Traffic generation during operation

Estimates of the number of employees that will be employed on the completion of each of the 3 individual phases, together with an estimate of the number of staff employed when the proposed Art Data Centre (6 Data Centres plus Vertical Farm) is fully operational, is set out in Table 12.7. It is estimated that a total of 151 staff will be employed on site on the completion of each phase, with an additional 40 staff included for phase 2 which includes the vertical farm. It is estimated that a total of 493 staff will be employed on site on the completion of the Art Data Centre.

The number of daily staff trips estimated to be generated to and from the site on the completion of each phase are shown distributed throughout the day in Tables 12.8 and 12.9.

For Phases 1 and 3 (Table 12.8) it is estimated that 50 staff will arrive at the Proposed Development and 11 will leave during the AM peak hour from 08:00 to 09:00. For the same phases it is estimated that 11 staff will both arrive at and leave the site during the PM peak hour between 17:00 to 18:00. For Phase 2 (Table 12.9), which includes the Vertical Farm, it is estimated that an additional 40 staff will travel to the site during the AM peak hour and from the site during the PM peak hour.

The total number of staff trips that are estimated to be generated traveling to and from the site during the peak hours and on a daily basis on the completion of the proposed Art Data Centre are shown in Table 12.10. During the AM peak hour it is estimated that a total of 190 staff members will arrive at the site, with 33 exiting the site. During the PM peak hour it is forecast that 33 staff will access the site with 73 exiting. It is forecast that a total of 493 staff members will travel to / from the site each day when the Art Data Centre is fully operational.

A Travel Plan will be implemented at the Art Data Centre when operational aimed at promoting sustainable modes of travel and car sharing for staff in preference to single occupancy car trips. In order to assess the worst case scenario, however, for the purpose of the traffic impact assessment presented in Section 12.5 of this EIAR, it is assumed that all staff trips will be made by cars with single occupancy vehicles.

It is noted that an Outline Travel Plan for the Proposed Art Data Centre is included as Appendix 12.6.

Table 12.7 *Trip generation for Art Data Centre during operation, number of staff per day*

No of Data Centre Buildings	Purpose	Day shift	Night shift	Total
Phase 1	Security staff	11	11	22
	General staff	82	8	90
	Maintenance staff and visitors	39	0	39
	Total	132	19	151
Phase 2 (includes Vertical Farm)	Security staff	11	11	22
	General staff	122	8	130
	Maintenance staff and visitors	39	0	39
	Total	172	19	191
Phase 3	Security staff	11	11	22
	General staff	82	8	90
	Maintenance staff and visitors	39	0	39
	Total	132	19	151
All phases	Security staff	33	33	66
	General staff	286	24	310
	Maintenance staff and visitors	117	0	117
	Total	436	57	493

Table 12.8 *Trip generation during operation for Art Data Centre Phase 1 and Phase 3, by time of arrival and departure, numbers of staff*

Hour commencing	Security staff		General staff		Maintenance staff + visitors		All person trips	
	In	**Out**	**In**	**Out**	**In**	**Out**	**In**	**Out**
7:00	0	0	41	8	0	0	41	8
8:00	11	11	0	0	39	0	50	11
9:00	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0
13:00	0	0	0	0	0	0	0	0
14:00	0	0	0	0	0	0	0	0
15:00	0	0	41	41	0	39	41	80
16:00	0	0	0	0	0	0	0	0
17:00	11	11	0	0	0	0	11	11
18:00	0	0	0	0	0	0	0	0
19:00	0	0	0	0	0	0	0	0
20:00	0	0	0	0	0	0	0	0
21:00	0	0	0	0	0	0	0	0
22:00	0	0	0	0	0	0	0	0
23:00	0	0	8	41	0	0	8	41
0:00	0	0	0	0	0	0	0	0
Total	22	22	90	90	39	39	151	151

Table 12.9 *Trip generation during operation for Art Data Centre Phase 2, by time of arrival and departure, number of staff*

Hour commencing	Security staff		General staff		Maintenance staff + visitors		All person trips	
	In	Out	In	Out	In	Out	In	Out
7:00	0	0	41	8	0	0	41	8
8:00	11	11	40	0	39	0	90	11
9:00	0	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0
13:00	0	0	0	0	0	0	0	0
14:00	0	0	0	0	0	0	0	0
15:00	0	0	41	41	0	39	41	80
16:00	0	0	0	0	0	0	0	0
17:00	11	11	0	40	0	0	11	51
18:00	0	0	0	0	0	0	0	0
19:00	0	0	0	0	0	0	0	0
20:00	0	0	0	0	0	0	0	0
21:00	0	0	0	0	0	0	0	0
22:00	0	0	0	0	0	0	0	0
23:00	0	0	8	41	0	0	8	41
0:00	0	0	0	0	0	0	0	0
Total	22	22	130	130	39	39	191	191

Table 12.10 *Summary of trip generation during operation for all Art Data Centre, AM and PM peak hours and all day, numbers of staff*

Hour commencing	**All operational staff**	
	In	**Out**
08:00	190	33
17:00	33	73
All day	493	493

Once operational it is estimated that each of 6 data centres will generate 5 HGV trips to and from the site with 2 HGV trips generated to and from the site by the vertical farm resulting in 32 HGV trips to and from the site per day. Of the 32 HGV trips 7 were allocated to each of the AM and PM peak hours.

12.4.5 Art Data Centre test scenarios

The points in the construction and operational life of the proposed Art Data Centre that are critical in terms of traffic generation, and are therefore selected for the traffic impact element of the assessment, are as follows;

- **Art Data Centre Peak Construction Month - Year 2027** - This is forecast to be the worst case scenario in terms of total traffic generated during the entire construction and operational life of the proposed development. For this scenario Phase 1 is constructed and operational, while Phases 2 and 3 are during the peak construction period. This is forecast to be month 61 of the 80 month construction period as shown in the chart included as Appendix 12.5.
- **Art Data Centre Peak HGV delivery days - Year 2027** - This is forecast to be the worst case scenario in terms of the numbers of HGV trips travelling to and from the site. It is forecast that a maximum of 115 HGVs will travel to and from the site in one day. This is forecast to occur in month 14 of the 80 month construction period as shown in the chart included as Appendix 12.5.
- **Art Data Centre Average Construction Month - Year 2027** - This represents the average month of the construction period with daily trip generation determined to be 59% of the traffic volumes generated during the peak construction month.
- **Art Data Centre Fully Operational - Year 2029** – By September 2029 it is forecast that construction of Phases 1, 2 and 3 will be complete and the proposed Art Data Centre will be fully operational.
- **Art Data Centre Fully Operational – Opening year + 15 - Year 2044** – The year 2044 is tested as the opening year + 15 time horizon in accordance with TII guidelines.

The daily number of trips that are determined to be generated for each of the above scenarios are shown by test scenario, vehicle type and year in Table 12.11, with these trips translated to time period during the day in Table 12.12. Note that the figures shown in Table 12.11 are extracted from the resource chart included as Appendix 12.5.

A summary of the information provided in Table 12.12 is provided in Table 12.13 with the following points to note;

- For the peak construction days the majority of traffic is generated by construction and Phase 1 operational staff cars, with 951 cars traveling to and from the site per day. During the days it is estimated that 39 HGVs with travel to and from the site. On these days it is estimated that 2,089 2-way pcus will be generated by the site per day.
- For the busiest days in terms of HGV, it is estimated that 474 staff cars and 115 HGVs will travel to and from the site per day, totalling 1,500 2-way pcus per day,
- Once operational it is estimated that 493 staff cars and 32 HGVs will travel to and from the site per day, with a total of 1,140 2-way pcus per day,

Table 12.11 *Traffic generation by test scenario, trip purpose and vehicle type*

Traffic category	Phase	Vehicle type	Development scenario			
			Peak construction day (2027 month 61)	Peak construction for HGV trips (2024 month 14)	Fully operational	
					Year 2029	2044
Construction Traffic	Phase 1	HGV trips (to / from)	0	115	0	0
		HGV pcus (to / from)	0	276	0	0
		Cars/lgvs (to / from)	0	474	0	0
		Total 2-way pcus	0	1500	0	0
	Phase 2	HGV trips (to / from)	1	0	0	0
		HGV pcus (to / from)	2	0	0	0
		Cars/lgvs (to / from)	326	0	0	0
		Total 2-way pcus	657	0	0	0
	Phase 3	HGV trips (to / from)	28	0	0	0
		HGV pcus (to / from)	67	0	0	0
		Cars/lgvs (to / from)	474	0	0	0
		Total 2-way pcus	1082	0	0	0
	All construction traffic	HGV trips (to / from)	29	115	0	0
		HGV pcus (to / from)	70	276	0	0
		Cars/lgvs (to / from)	800	474	0	0
		Total 2-way pcus	1739	1500	0	0
Operational Traffic	Phase 1	HGV trips (to / from)	10	0	10	10
		HGV pcus (to / from)	24	0	24	24
		Cars/lgvs (to / from)	151	0	151	151
		Total 2-way pcus	350	0	350	350
	Phase 2	HGV trips (to / from)	0	0	12	12
		HGV pcus (to / from)	0	0	29	29
		Cars/lgvs (to / from)	0	0	191	191
		Total 2-way pcus	0	0	440	440
	Phase 3	HGV trips (to / from)	0	0	10	10
		HGV pcus (to / from)	0	0	24	24
		Cars/lgvs (to / from)	0	0	151	151
		Total 2-way pcus	0	0	350	350
	All operational traffic	HGV trips (to / from)	10	0	32	32
		HGV pcus (to / from)	24	0	77	77
		Cars/lgvs (to / from)	151	0	493	493
		Total 2-way pcus	350	0	1140	1140
All traffic	All traffic	HGV trips (to / from)	39	115	32	32
		HGV pcus (to / from)	94	276	77	77
		Cars/lgvs (to / from)	951	474	493	493
		Total 2-way pcus	2089	1500	1140	1140

Note: The figures in Table 12.11 are extracted from the chart included as Appendix 12.3

Table 12.12 *Traffic generation by test scenario, trip purpose, time period and vehicle type*

Scenario	Trip category	All day		AM peak hour		PM peak hour	
		In	Out	In	Out	In	Out
Peak construction day Tested for year 2027	Construction HGVs	29	29	3	1	1	3
	Construction cars	800	800	320	40	40	320
	Operational HGVs	10	10	2	2	2	2
	Operational cars	151	151	50	11	11	11
	All HGVs	39	39	5	3	3	5
	All HGV pcus	94	94	12	8	8	12
	All cars	951	951	370	51	51	331
	All pcus	1,045	1,045	382	59	59	343
	All 2-way pcus	2,089		441		402	
Average construction day Tested for year 2027	Construction HGVs	17	17	2	1	1	2
	Construction cars	464	464	189	24	24	189
	Operational HGVs	6	6	1	1	1	1
	Operational cars	88	88	29	6	6	6
	All HGVs	23	23	3	2	2	3
	All HGV pcus	54	54	7	5	5	7
	All cars	552	552	215	30	30	192
	All pcus	606	606	221	34	34	199
	All 2-way pcus	1,212		256		233	
Worst case construction day for HGVs Tested for year 2027 (15% of HGVs in Peak hours)	Construction HGVs	115	115	17	17	17	17
	Construction cars	474	474	190	24	24	190
	Operational HGVs	0	0	0	0	0	0
	Operational cars	0	0	50	11	11	11
	All HGVs	115	115	17	17	17	17
	All HGV pcus	276	276	41	41	41	41
	All cars	474	474	240	35	35	201
	All pcus	750	750	281	76	76	242
	All 2-way pcus	1,500		357		318	
Year 2029 & 2044 Phase 1 - Operational Phase 2 - Operational Phase 3 - Operational	Construction HGVs	0	0	0	0	0	0
	Construction cars	0	0	0	0	0	0
	Operational HGVs	32	32	6	6	6	6
	Operational cars	463	463	161	42	42	42
	All HGVs	32	32	6	6	6	6
	All HGV pcus	77	77	15	15	15	15
	All cars	493	493	190	33	33	73
	All pcus	570	570	205	48	48	88
	All 2-way pcus	1,140		254		137	

Note: *The All-day figures in Table 12.12 are extracted from the chart included as Appendix 12.5*

Table 12.13 Summary of traffic generation by test scenario, time period and vehicle type

Scenario	**Vehicle type**	**All day**			**AM peak hour**			**PM peak hour**		
		In	**Out**	**2-way**	**In**	**Out**	**2-way**	**In**	**Out**	**2-way**
Peak construction day	All HGVs	39	39	78	5	3	8	3	5	8
	All cars	951	951	1,902	370	51	421	51	331	382
	All pcus	1,045	1,045	2,089	382	59	441	59	343	402
Average construction day	All HGVs	23	23	45	3	2	5	2	3	5
	All cars	552	552	1,103	215	30	244	30	192	222
	All pcus	606	606	1,212	221	34	256	34	199	233
Worst case for HGV deliveries	All HGVs	115	115	230	17	17	35	17	17	35
	All cars	474	474	948	240	35	274	35	201	235
	All pcus	750	750	1,500	281	76	357	76	242	318
Year 2029 & 2044 Phase 1, 2 & 3 operational	All HGVs	32	32	64	6	6	13	6	6	13
	All cars	493	493	986	190	33	223	33	73	106
	All pcus	570	570	1,140	205	48	254	48	88	137

12.4.6 Art Data Centre traffic distribution

The distribution of traffic generated by the proposed Art Data Centre was estimated separately for staff trips and for deliveries of materials to the site.

Distribution of generated staff trips

It is considered that the optimum source of information to determine likely travel patterns for staff trips to and from the proposed Art Data Centre is the existing traffic patterns travelling into and out of the local road network via the R352 Tulla Road (to and from the directions of Ennis and Tulla) and via the M18 southbound and northbound slip lanes, to and from the M18 motorway. The traffic flows travelling on these links during peak hours reflect existing traffic patterns through the local network, and will include a significant number of vehicles traveling for the purpose of work. Using this information, the results would also appear to be logical with almost half (47%) of staff travelling to the Art Data Centre forecast to travel to / from Ennis.

Traffic flows for 2019 are shown for these links by direction in Table 12.14, together with the estimated percentage distribution of staff trips through the local road network. Based on these flows it is estimated that during the AM peak hour 47% of all staff trips will originate from the direction of Ennis, 28% from the direction of Tulla, with the remaining 25% arriving via the M18 slip roads. For corresponding traffic leaving the Art Data Centre during the PM peak hour it is estimated that the same 47% will travel in the direction towards Ennis, 28% towards Tulla with the remaining 25% accessing the M18 motorway.

Table 12.14 *Trip distribution for staff / visitor trips based on 2019 link flows*

Arm	AM peak hour				PM peak hour				All Day	
	From		To		From		To			
	Flow	%	Flow	%	Flow	%	Flow	%	% from	% to
R352 Tulla	276	28%	104	11%	255	20%	359	28%	24%	19%
M18 s/b	104	11%	384	39%	112	9%	173	14%	10%	26%
M18 n/b	140	14%	109	11%	400	31%	146	11%	23%	11%
R352 Ennis	469	47%	392	40%	510	40%	603	47%	44%	43%
Total	989	100%	989	100%	1277	100%	1281	100%	100%	100%

Distribution of generated HGV trips

While the location of the potential quarries that will supply materials during the construction phase are known (as will be discussed in Section 12.7.2), the quantities that each will supply is not known at this stage. The location of the providers of all other materials required to construct the Art Data Centre is also not known. For the purpose of this assessment the distribution of HGV trips during both the construction and operational stages of the development were assumed to be as follows;

- To / from M18 north – 40%
- To / from M18 south – 40%
- To / from R352 east – 20%.

While the above could vary significantly in practice, it is considered that it represents a realistic trip distribution for HGV traffic based on the location of quarries that could potentially provide materials during the construction of the proposed development, as discussed in Section 12.6.2, and the potential for other deliveries to be made via the M18 from the north and the south. It is also considered to be a worst case scenario as it concentrates HGV movements on the M18 / R352 Tulla Road roundabouts, which are critical junctions on the local network.

The forecast AM and PM peak trip distributions and trip generations are shown by vehicle type in Figures A12.3.8 to A12.3.18 included in Appendix 12.3.

12.4.7 Walking and cycling

While there is an existing footpath on the southern side of the R352 Tulla Road, there is currently no footpath on the northern side adjacent to the proposed development. As part of the Art Data Centre development it is proposed to provide a shared footpath and cycle lane on the northern side of the road from the proposed Art Data Centre access junction, westwards to the Clare East Clare Roundabout. It is also proposed to upgrade the existing footpath on the southern side of the road to a share footpath and cycle lane. An informal uncontrolled pedestrian crossing facility, comprising dropped kerbs and tactile paving is proposed across the R352 Tulla Road, in order to provide a continuous pedestrian link between the Art Data Centre and Ennis Town Centre.

Distances from the proposed Art Data Centre are shown at 0.5km intervals in Figure 12.3 at the end of this chapter in order to provide an indication of walk distances and between Art Data Centre and various locations in Ennis. Based on a conservative walk speed of 7 minutes per km (or 8.64 km per hour, which equates to 2.4m per second as is adopted in the design of pedestrian crossing) the estimated walk times to a few locations in Ennis are listed in Table 12.21. The figures show that it is estimated that the “Woodside” and “The Lane” residential estates are within 14 and 21 minutes’ walk respectively, with Ennis Town centre, which is located approximately 4.5 kms from the Art Data Centre, just over half and hours walk away (31.5 minutes).

The same information is shown in Table 12.15 for cycle trips. Based on a modest cycle speed of 30 km/h the residential estates would be within a 4 minute (Woodside) and 6 minute (The Lane) cycle, while it is estimated that it will take 9 minutes to cycle between the Art Data Centre and Ennis Town Centre.

Pedestrian access into the site is provided by a footpath adjacent to the main proposed vehicle access junction, with continuous footpaths provided within the campus to element comprising the Art Data Centre. Dropped kerbs and tactile paving are provided at all crossing points.

Table 12.15 *Estimated walk and cycle times from the Art Data Centre*

Location	Distance from Art Data Centre (kms)	Walk time (minutes)	Cycle time (minutes)
Woodside Estate	2	14	4
The Lane Estate	3	21	6
Ennis Town Centre	4.5	31.5	9

Covered cycle parking is distributed at various locations throughout the site with a total number of 126 spaces provided. This equates to 1 cycle parking space for every 2 employees that may be on site at any one time (it is estimated that 256 of the total 493 employees may be on site at any particular time of the day due to shifts), which is in excess of the 1 space per 10% of employees as suggested in the NTA Cycle manual.

12.4.8 Public transport

There are currently no local bus services in Ennis so at present bus would not be a mode of transport available for staff or visitors to the proposed site. It is, however, noted that the provision of local bus services on key routes in Ennis is fundamental to the National Transport Authorities Smarter Travel program, which requires the availability and the promotion of sustainable alternative modes of travel to the private car, as adopted in the current Clare Development Plan 2017 to 2023. While the assessment of the viability of a local Ennis bus route on the R352 Tulla Road is outside the remit of this assessment, given the quantum of residential and other development along the route, it is considered that the Tulla Road route would be an ideal location to pilot a local bus service. Given the relatively high numbers of staff that will be expected to travel to the Art Data Centre from Ennis, the proposed development would serve to enhance the viability of such a service. The Applicant would fully support the introduction of a local bus service on the R352 Tulla Road and would also consider the potential for the future bus route to terminate at the Art Data Centre campus. An area for a future bus terminus is included in the campus layout.

12.5 POTENTIAL IMPACTS OF THE DEVELOPMENT

12.5.1 Impact on link flows

The impact that the proposed Art Data Centre is forecast to have on link flows on the local road network during the construction period and when fully operational was assessed during the AM peak and PM peak hours, and during the course of one day. The results are set out in Tables 12.16 to 12.20, which are included as Appendix 12.4, for the following scenarios;

- Background traffic compared to with Art Data Centre peak construction traffic, year 2027 (Table 12.16),
- Background traffic compared to with Art Data Centre peak construction HGV deliveries, year 2027 (Table 12.17),
- Background traffic compared to with Art Data Centre average construction traffic, year 2027 (Table 12.18),
- Background traffic compared to with Art Data Centre fully operational traffic, year 2029 (Table 12.19), and,
- Background traffic compared to with Art Data Centre fully operational traffic, year 2044 (Table 12.20).

The salient points to note from the tables are as follows (It is noted that all commentary provided in section 12.5.1 refers to 2-way traffic flows, with the exception of references made to the M18 main carriageway, which are one-way flows);

Years 2027 peak construction months

During the peak construction months the maximum increase in 2-way traffic volumes is forecast to be on the R352 Tulla Road just to the west of the proposed Art Data access junction (Link 2). At this location it is forecast that the increase in traffic levels will be +318 vehicles (+77%) during the AM peak hour, +285 vehicles (+42%) during the PM peak hour, with an increase of 23% forecast throughout the day.

Other links forecast to be impacted the greatest during the peak construction phase are;

- The section of the R352 Tulla Road between the roundabouts (Link 4), which is forecast to incur an increase of +255 vehicles (+31%) during the AM peak hour,
- The Tulla Road to the east of the development access (Link 1) forecast to have an increase of 111 vehicles (+27%),
- The M18 Slip onto the Tulla Road West roundabout (Link 8) with an increase of +60 vehicles (+23%), and,
- The R352 leading to Ennis (Link 6) which is forecast to increase by 194 vehicle during the AM peak hour (+20%).

With respect to the impacts on the M18 motorway, the forecast maximum increase during any time period is forecast to be +54 vehicles (+10%), which will occur during the AM peak hour on the northbound carriageway of the motorway to the south of the R352 Tulla Road (Link 11). Over the course of the day the increase on traffic flows on the M18 during the peak construction days is forecast to be between 1% and 3%. It is noted that the M18 has significant spare link capacity on these worst case days, with a maximum daily flow of 18,435 vehicles forecast compared to a link capacity of 52,000 vehicles).

In terms of magnitude the forecast increases in traffic volumes during the PM peak is forecast, in general, to be similar to those during the AM peak hour.

Years 2027 peak HGV delivery months

During the days when the maximum number of HGV deliveries will be made to the site (up to 115 trips to and from the site) the maximum number of additional HGVs that will travel on the network in any one hour will be +27 HGV 2-way movements which will be on the R352 Tulla Road to the west of the proposed access junction (Link 2). During the AM peak hour this will result in a 98% increase in HGVs on this link and a 56% increase in traffic flows,

In terms of the impacts on the M18 slip road approaches to the Tulla Road Roundabouts, it is forecast that they will incur a maximum increase in 2-way HGV movements of 14 HGVs during the AM and PM peak hours.

Years 2027 average construction months

The impacts on average construction days will be significantly less than the peak months with development traffic at 59% of the volumes estimated for the peak months. Some key comparisons are;

- The maximum increase in 2-way traffic volumes on the R352 Tulla Road to the west of the proposed access junction (Link 2) will increase by 45% compared to 77% during the peak construction months,
- The maximum percentage increase on the M18 during the PM peak hour will be +6% compared to +10%

Years 2029 and 2044 fully operational

As the impacts on link flows are similar for both 2029 and 2044 when the Art Data Centre will be fully operational, the following is based on the year 2044 forecasts when overall traffic volumes will be higher.

Once the proposed Data Art Centre is fully operational a maximum increase in 2-way traffic volumes on the R352 Tulla Road just to the west of the proposed access (Link 2) is forecast to be +164 vehicles (+37%) during the AM peak hour, +95 vehicles (+13%) during the PM peak hour, with an increase of 11% forecast throughout the day.

Other links forecast to be impacted the greatest are the section of the R352 Tulla Road between the roundabouts (Link 4) which is forecast to incur an increase of 14% in traffic volume (+126 vehicles) during the AM peak hour, followed by Tulla Road to the east of the development access (Link 1, +53 vehicles), and the M18 Slip onto the Tulla Road West roundabout (Link 8, +33 vehicles), which are both forecast to incur a 12% increase in traffic volumes during the AM peak hour.

It is noted that compared to the AM peak hour forecast impacts are significantly less during the PM peak hour, and for the rest of the day.

With respect to the impacts on the M18 motorway, the forecast maximum increase during any time period is 1% both northbound and southbound once the proposed Art Data Centre is operational.

TII guidelines state that a detailed capacity assessment should be undertaken for junctions where the proposed development is forecast to result in an increase in traffic volumes of +10%, or +5% in instances where the network is already congested. This would suggest that in addition to the proposed access junction, detailed capacity tests should be undertaken for both the East Clare and Tulla Road West roundabouts on the R352 Tulla

Road. Detailed capacity tests as set out in the remainder of this section were therefore undertaken at the following junctions;

- Proposed access junction on the R352 Tulla Road,
- The East Clare Roundabout, and,
- The Tulla Road West Roundabout.

The forecast AM and PM peak turning flows are shown in terms of PCUs for each development scenario in Figures A12.3.19 to A12.3.23 included in Appendix 12.3.

12.5.2 Impacts on junction capacity

Junction capacity assessment method

The traffic impact of the proposed Art Data Centre was assessed at the proposed access junction and on the surrounding network using a combination of the industry recognised junction analysis programmes PICADY for priority junctions, and ARCADY for roundabouts. The capacity for each movement possible at the junction being assessed is determined from geometric data with the output used in the assessment as follows:

- Queue – This is the average queue forecast for each movement and is useful to ensure that queues will not interfere with adjacent junctions.
- Ratio of flow to capacity (RFC) – As suggested, this offers a measure of the amount of available capacity being utilised for each movement. Ideally each movement should operate at a level of no greater than 0.85, or at 85% of capacity.
- Delay – Output in minutes, this gives an indication of the forecast average delay during the time period modelled for each movement.

Scenarios modelled

For the proposed Art Data Centre access junction on the R352 Tulla Road the following scenarios were assessed;

- AM and PM peak hours,
- For development scenarios;
  - Year 2027 Art Data Centre peak construction day,
  - Year 2027 Art Data Centre peak HGV delivery days
  - Year 2027 Art Data Centre average construction day,
  - Year 2029 Art Data Centre fully operational,
  - Year 2044 Art Data Centre fully operational.

For the R352 Tulla Road / M18 slip road roundabouts (East Clare Roundabout and Tulla Road West Roundabout), the same scenarios as above were tested. In addition, year 2027, 2029 and 2044 with no Art Centre Development were also tested in order to determine the actual impact of the introduction of traffic generated by the proposed development.

Junction capacity test results for proposed Art Centre Access junction on the R352 Tulla Road

The results of the capacity test undertaken for the proposed Art Data Centre access junction on the R352 Tulla Road are set out in Table 12.21.

The maximum ratio of flow to capacity (RFC) for the proposed access junction is forecast to apply to traffic turning right out of the site onto the R352 Tulla Road during the PM peak hour, and is forecast to occur during the peak construction scenario in the year 2027. For this movement the maximum RFC is forecast to be 61.6% (up to 85% is within capacity), with the corresponding maximum queue forecast to be 1.56 PCUs, which will occur on the internal access road, and delay to be 0.35 minutes (21 seconds), which will apply to traffic exiting the site.

For traffic turning right off the R352 Tulla Road into the site the maximum ratio of flow to capacity (RFC) of 19.7 % is forecast, with a corresponding maximum queue in the right turn lane proposed on the R352 Tulla Road forecast to be 0.24 PCUs with an associated delay of 0.13 minutes (8 seconds).

For the days when the peak number of HGV deliveries are made to the site, the only movement that has a higher RFC compared to the equivalent peak construction day discussed above, is the right turn from the development during the AM peak hour, which is forecast to have an RFC of 15%, with a corresponding queue of 0.18 PCUs and delay of 0.15 minutes (9 seconds)

Once fully operational in the future year 2044 the maximum RFC is forecast to apply to traffic turning right out of the development during both the AM (11.6%) and PM peak (11.2%) hours, with the maximum queue forecast to be 0.13 PCUs with corresponding delay of 0.16 minutes (10 seconds).

The result of the capacity tests show that during both peak hours, the proposed access junction is forecast to operate well within capacity without and significant queuing forecast for traffic exiting the site, or for traffic turning right into the site from the R352 Tulla Road.

Junction capacity test results for M18 / R352 Tulla Road East Clare Roundabout

The results of the capacity test undertaken for the East Clare Roundabout are set out in Table 12.22.

The maximum RFC forecast for this roundabout is forecast to occur during the peak construction period in the year 2027 and is forecast to apply to traffic on the R352 Tulla Road heading out of Ennis during the AM peak hour. For this arm a maximum RFC of 29.7% is forecast to apply for the no Art Data Centre development scenario, increasing to 44.3 with the inclusion of the Art Data Centre construction traffic. For the “without development” development scenario a maximum queue of 0.4 PCUs, and delay of 0.05 minutes (or 3 seconds) are forecast. These are forecast to increase marginally for the ”with development” scenario with a maximum queue of 0.8 PCUs, and delay of 0.06 (or 4 seconds) are forecast.

It is noted that for the PM peak hour it is the same movement that is forecast to have the highest RFC, with the future year 2044 Art Data Centre fully operational scenario being the worst case. For this movement it is forecast that the RFC will increase from a “without development” level of 36.1%, increasing to 38.6% with the Art Data Centre traffic on the network. For the “without development” scenario, a maximum queue of 0.6 PCU, and delay of 0.05 (or 3 seconds) are forecast, with a negligible impact on these criteria tor the “with development” scenario (maximum queue of 0.6 PCU, and delay of 0.06 (or 4 seconds).

It is noted that the maximum impacts that are forecast during the months when the maximum number of deliveries are made to the site will be similar, but marginally less than those set out above for the peak construction months. With respect to the impacts on the M18 slip road approach to the roundabout it is forecast that the worst case will be during the AM peak hour for the peak construction months in 2027, when an RFC of 7.6% for the “without development” scenario will increase to 11.9% with the Art Data Centre traffic introduced on the network. For all scenarios tested, the maximum queuing for this movement is forecast to be less than 1 PCU. While in reality there will be occasions when minor queuing will occur, the assessment indicates that traffic generated by the proposed Art Data Centre will have a negligible impact on the M18 slip lane approach to the East Clare Roundabout.

The result of the capacity tests for the East Clare Roundabout forecasts that the existing roundabout will operate well within capacity for all scenarios up to and beyond the development future year of 2044.

Junction capacity test results for M18 / R352 Tulla Road West Roundabout

The results of the capacity test undertaken for the Tulla Road West Roundabout are set out in Table 12.23.

The maximum RFC for the Tulla Road West roundabout is forecast to occur during the peak construction period in the year 2027 and is also forecast to apply to traffic on the R352 heading out of Ennis during the AM peak hour. For this arm a maximum RFC of 35.0% is forecast to apply with no Art Data Centre development traffic, increasing to 47.5% with the proposed development construction traffic on the network. For the "without development" scenario a maximum queue of 0.51 PCUs is forecast with a corresponding delay of 0.06 (or 4 seconds) which is forecast to increase marginally to for the "with development" scenario to a maximum queue of 0.9 PCUs with a corresponding delay of 0.07 (or 4 seconds).

During the PM peak hour, it is the same movement that is forecast to have the highest RFC (outbound from Ennis on the R357), with the Art Data Centre fully operational in 2044 being marginally the worst case. For this movement it is forecast that the RFC will increase from a no development level of 42.1%, to 43.7% with the Art Data Centre traffic on the network. For the "without development" scenario, a maximum queue of 0.7 PCUs, and delay of 0.06 (or 4 seconds) are forecast, increasing marginally for the "with development" scenario to a maximum queue of 0.8 PCU, and delay of 0.07 (or 4 seconds).

As for the neighbouring East Clare Roundabout, it is noted that the maximum impacts that are forecast for the Tulla Road East Roundabout during the months when the maximum number of deliveries are made to the site will be similar, but marginally less than those set out above for the peak construction months. At the Tulla Road West roundabout during the critical peak construction months in 2027 it is forecast that the RFC for the M18 slip road approach to the roundabout will increase from a background level of 12.7% to 17.4% with the Art Data Centre traffic during the AM peak hour, and from 35.9% to 40.5% during the PM peak hour. For the worst case PM peak hour it is forecast that for the "without development" scenario there will be a maximum queue of 0.6 PCUs, with a corresponding delay of 0.07 minutes (or 4 seconds). For the "with development" scenario this is forecast to increase to a queue of 0.7 PCUs and delay of 0.08 minutes (5 seconds).

As for the M18 slip on the East Clare Roundabout, while in reality there will be occasions when minor queuing does occur, the assessment confirms that traffic generated by the proposed Art Data Centre will have a minimal impact on the M18 slip lane approach to the Tulla Road West Roundabout.

The result of the capacity tests for the Tulla Road West Roundabout forecasts that the existing roundabout will operate well within capacity for all scenarios up to and beyond the development future year of 2044.

The model output files for each of the 3 junctions are included for the "with Art Data Centre" peak construction, PM peak hour, year 2027, as Appendix 12.7.

Table 12.21 *Junction capacity test results – Art Data Centre access junction on the R352 Tulla Road, with development traffic, by year and time period*

Year	Arm	AM peak hour			PM peak hour		
		RFC	Q	Delay	RFC	Q	Delay
2027 (Average construction day)	Right turn from development	7.1	0.08	0.13	35.3	0.54	0.21
	Left turn from development	0.7	0.01	0.10	11.9	0.13	0.13
	Right turn into development	11.1	0.12	0.11	1.3	0.01	0.11
2027 (Peak construction day)	Right turn from development	12.4	0.14	0.15	61.6	1.56	0.35
	Left turn from development	1.3	0.01	0.11	24.8	0.33	0.19
	Right turn into development	19.7	0.24	0.13	2.3	0.02	0.11
2027 (Peak HGV delivery day)	Right turn from development	15.0	0.18	0.15	44.0	0.78	0.24
	Left turn from development	2.3	0.02	0.11	14.6	0.17	0.15
	Right turn into development	13.7	0.16	0.11	2.9	0.03	0.11
2029 (Fully operational)	Right turn from development	11.5	0.13	0.14	11.0	0.12	0.15
	Left turn from development	1.5	0.02	0.10	3.0	0.03	0.11
	Right turn into development	8.5	0.09	0.11	2.3	0.02	0.11
2044 (Fully operational)	Right turn from development	11.6	0.13	0.14	11.2	0.13	0.16
	Left turn from development	1.5	0.02	0.10	3.1	0.03	0.12
	Right turn into development	8.5	0.09	0.11	2.3	0.02	0.11

Table 12.22 *Junction capacity test results - East Clare Roundabout, without and with development traffic,*

by development scenario, year r and time period

Year	Arm	AM peak hour						PM peak hour					
		No development			With development			No development			With development		
		RFC	Q	Delay	RFC	Q	Delay	RFC	Q	Delay	RFC	Q	Delay
2027	R352 Ennis Road	29.7	0.4	0.05	38.2	0.6	0.05	33.1	0.5	0.05	35.0	0.5	0.05
(Average	M18 slip	7.6	0.1	0.04	10.0	0.1	0.04	9.8	0.1	0.05	10.3	0.1	0.05
construction day)	R352 Tulla Road	19.9	0.2	0.04	21.9	0.3	0.04	18.9	0.2	0.04	28.3	0.4	0.05
2027	R352 Ennis Road	29.7	0.4	0.05	44.3	0.8	0.06	33.1	0.5	0.05	36.4	0.6	0.06
(Peak	M18 slip	7.6	0.1	0.04	11.9	0.1	0.05	9.8	0.1	0.05	10.5	0.1	0.05
construction day)	R352 Tulla Road	19.9	0.2	0.04	23.2	0.3	0.05	18.9	0.2	0.04	35.1	0.5	0.06
2027	R352 Ennis Road	29.7	0.4	0.05	40.2	0.7	0.06	33.1	0.5	0.05	36.4	0.6	0.06
(Peak HGV	M18 slip	7.6	0.1	0.04	11.3	0.1	0.04	9.8	0.1	0.05	11.5	0.1	0.05
delivery day)	R352 Tulla Road	19.9	0.2	0.04	24.0	0.3	0.05	18.9	0.2	0.04	30.5	0.4	0.05
2029	R352 Ennis Road	30.7	0.4	0.05	37.5	0.6	0.05	34.1	0.5	0.05	36.6	0.6	0.06
(Fully	M18 slip	8.0	0.1	0.04	10.0	0.1	0.04	10.2	0.1	0.05	11.1	0.1	0.05
operational)	R352 Tulla Road	20.6	0.3	0.04	23.8	0.3	0.05	19.5	0.2	0.04	22.3	0.3	0.05
2044	R352 Ennis Road	32.4	0.5	0.05	39.3	0.6	0.06	36.1	0.6	0.05	38.6	0.6	0.06
(Fully	M18 slip	8.4	0.1	0.04	10.5	0.1	0.04	10.8	0.1	0.05	11.8	0.1	0.05
operational)	R352 Tulla Road	21.7	0.3	0.04	25.0	0.3	0.05	20.6	0.3	0.05	23.4	0.3	0.05

Table 12.23 *Junction capacity test results - Tulla Road West Roundabout, without and with development traffic, by development scenario, year and time period*

Year	Arm	AM peak hour						PM peak hour					
		No development			With development			No development			With development		
		RFC	Q	Delay	RFC	Q	Delay	RFC	Q	Delay	RFC	Q	Delay
2027	R352 Ennis Road	35.0	0.5	0.06	42.2	0.7	0.06	38.7	0.6	0.06	39.7	0.7	0.06
(Average	Local access	0.0	0.0	0.00	0.0	0.0	0.00	0.7	0.0	0.06	0.7	0.0	0.06
construction day)	R352 Tulla Road	22.2	0.3	0.04	23.3	0.3	0.04	21.3	0.3	0.04	28.5	0.4	0.05
	M18 slip	12.7	0.1	0.05	15.4	0.2	0.05	35.9	0.6	0.07	38.6	0.6	0.07
2027	R352 Ennis Road	35.0	0.5	0.06	47.5	0.9	0.07	38.7	0.6	0.06	40.3	0.7	0.06
(Peak	Local access	0.0	0.0	0.00	0.0	0.0	0.00	0.7	0.0	0.06	0.7	0.0	0.06
construction day)	R352 Tulla Road	22.2	0.3	0.04	23.9	0.3	0.04	21.3	0.3	0.04	33.7	0.5	0.05
	M18 slip	12.7	0.1	0.05	17.4	0.2	0.05	35.9	0.6	0.07	40.5	0.7	0.08
2027	R352 Ennis Road	35.0	0.5	0.06	43.2	0.8	0.06	38.7	0.6	0.06	40.1	0.7	0.06
(Peak HGV	Local access	0.0	0.0	0.00	0.0	0.0	0.00	0.7	0.0	0.06	0.7	0.0	0.06
delivery day)	R352 Tulla Road	22.2	0.3	0.04	24.3	0.3	0.04	21.3	0.3	0.04	29.6	0.4	0.05
	M18 slip	12.7	0.1	0.05	16.8	0.2	0.05	35.9	0.6	0.07	39.9	0.7	0.08
2029	R352 Ennis Road	36.0	0.6	0.06	41.5	0.7	0.06	39.9	0.7	0.06	41.4	0.7	0.06
(Fully	Local access	0.0	0.0	0.00	0.0	0.0	0.00	0.7	0.0	0.06	0.7	0.0	0.06
operational)	R352 Tulla Road	22.9	0.3	0.04	24.6	0.3	0.04	22.0	0.3	0.04	23.9	0.3	0.05
	M18 slip	13.1	0.1	0.05	15.5	0.2	0.05	37.3	0.6	0.07	39.2	0.6	0.07
2044	R352 Ennis Road	38.0	0.6	0.06	43.5	0.8	0.06	42.1	0.7	0.06	43.7	0.8	0.07
(Fully	Local access	0.0	0.0	0.00	0.0	0.0	0.00	0.8	0.0	0.06	0.8	0.0	0.06
operational)	R352 Tulla Road	24.2	0.3	0.04	25.9	0.3	0.05	23.2	0.3	0.05	25.2	0.3	0.05
	M18 slip	13.9	0.2	0.05	16.5	0.2	0.05	39.6	0.7	0.07	41.6	0.7	0.08

12.6 REMEDIAL AND MITIGATION MEASURES

This section summarises the mitigation measures proposed to minimise the effects of the proposed Art Data Centre during both the construction and operational stages.

12.6.1 Mitigation by design

Mitigation by design measures include the following;

- Selection of the most appropriate delivery routes to transport materials to and from the site, limiting the distance travelled on local and regional roads to a minimum.
- Where possible gravel and stone material will be obtained from borrow pits on site. For all sand, stone and cement required to be delivered to the site all materials will be sourced from suppliers that are both closest to the proposed development site, and also those that will minimise the amount of time / distance travelled by truck on local and regional roads. The quarries considered most suitable on this basis are discussed in Section 12.7.2.
- Construction of a new access junction in the form of a priority junction with right turn and left slip lanes on the R352 Tulla Road to provide access for all construction and operational traffic generated by the proposed Art Data Centre.

12.6.2 Construction Phase

The successful completion of the Art Data Centre will require significant coordination and planning, and a comprehensive set of mitigation measures will be in place before and during the construction stages in order to minimise the effects of the additional traffic generated on the adjacent road network. While a detailed **Traffic Management Plan (TMP)** will be submitted for agreement with the Road Section of Clare County Council well in advance of the construction phase of the proposed Art Data Centre, a preliminary **Outline Traffic Management Plan (OTMP)** incorporating all the likely potential mitigation measures is submitted as part of the CEMP included with the application documentation. The OTMP, and subsequently, the TMP, will be finalised and agreed with Clare County Councils Road Section and An Garda Síochána prior to construction works commencing on site. The TMP will include as a minimum the following:

Traffic Management Coordinator – A competent Traffic Management Co-ordinator will be appointed by the Client / Contractor for the duration of the project. This person will be the main point of contact for the public and public bodies, including Clare County Council and An Garda Síochána, for all matters relating to traffic management during the construction of the proposed Art Data Centre.

Delivery Programme – A programme of deliveries will be submitted to Clare County Council in advance of all deliveries to the Art Data Site, with preliminary daily traffic volumes included by construction month included as Appendix 12.5 of this EIAR. The proposed development will be constructed over a 6.5 year period, commencing in December 2022, with completion forecast in July 2029.

Identification of delivery routes – These routes will be agreed and adhered to by all contractors. As discussed with Clare County Councils Road Section during pre-planning, where possible suppliers will be selected to minimise the amount of distance travelled by truck and HGV movements generated during the construction phase. While the origins of the suppliers of general construction materials and data centre components are not known at this stage, in relation to supply of sand, aggregate, stone and cement, which will comprise a significant proportion of HGV traffic generated during the construction phase, 3 quarries have been identified for consideration, with the locations and routes shown in Figure 12.4 at the end of this chapter, this shows;

- *Quarry Option 1* - located in Bunratty the total distance to the Art Data site is 24 kms of which the majority of the route is on the M18 motorway, with only a short section of the L3122 north of Bunratty and the 1km section of the R352 between the M18 and the site access being on non-national roads.
- *Quarry Option 2* - located in Toonagh north of Ennis, the total travel distance is just 11 kms of which 4 kms is on the R476, and 1 km on the R352 between the M18 and the site access.
- *Quarry Option 3* – This quarry is 17 kms from the site and is located to the east of Tulla with the entire route on the R352 non-national road.

Discussions will be held with the Road Section of Clare County Council to discuss the traffic implications of each quarry location well in advance of the commencement of construction.

Traffic volumes and impacts of traffic during construction – A summary of the traffic volumes and the forecast impacts of additional traffic movements generated during the construction of the Art Data Centre, (as set out in detail in Table 12.9 of the EIAR is as follows;

Staff trips – It is forecast that during the busiest construction month (month 61 in the year 2027) a maximum of 1,200 construction staff will require to travel to and from the site per day. While a detailed travel plan will be prepared by the contractor, which will involve the transportation to and from the site by bus for a significant number of construction staff, the scenario tested in the EIAR assumes that all construction staff will travel by car, with an average of 1.5 staff to each car. For the busiest construction days, this will result in 800 car trips to and from the site per day, with 40% (320 car trips) travelling during the traditional peak hours. It is estimated that site staff will generate 464 cars trips to and from the site on an average day, with 189 travelling to the site during the AM peak hour and from the site during the PM peak hours.

HGV – It is noted that when considering HGV movements only, the busiest period is forecast to be early in Phase 1, when it is estimated that 115 HGV movements will require to travel to / from the site during one day, resulting in 12 trips per hour, or on average 1 load in and out of the site every 5 minutes.

Detailed capacity tests were undertaken at the proposed access junction on the R352 Tulla Road and the 2 roundabouts linking the M18 slip roads to the R352 Tulla Road (East Clare Roundabout and Tulla Road West roundabout, as shown in Figure 12.1 of the EIAR. At this preliminary stage it was assumed that 40% of all HGV trips will travel to/from the site via the M18 from the north, with the same amount to and from the M18 in the south. It was assumed that the remaining 20% would travel to and from the direction of the quarry located close to Tulla. For all cases the proposed access junction and roundabouts are forecast to operate well within capacity (maximum of 48% while up to 85% capacity is considered acceptable) with no queueing forecast for the M18 slip road approaches to the roundabouts (therefore no forecast risk of blocking back to M18 carriageway).

It is acknowledged that the above capacity assessment is based on uniform arrivals / departures to and from the site, and this will require to be co-ordinated between the supplier and site staff during the peak construction months. This will include the presence of construction staff (flagman) located at key junctions during peak delivery days and times who will be in constant 2-way radio contact. Continual monitoring of the M18 slip roads at the East Clare and Tulla Road West roundabouts will be undertaken during busing periods. It is noted that contingency measures are provided in the CEMP in the event that an incident occurs at the M18 slip approach to the Tulla Road West roundabout in order to avoid the build-up of HGVs queuing back to the main M18 carriageway. These measures involve the immediate re-routing of HGV movements off the M18 to temporary detours via the N85 and through Ennis.

Travel plan and parking for construction workers – While the traffic impact assessment included in Section 12.5 of the EIAR assumes the worst case scenario that all construction workers will drive to the site, the construction company will be required to implement a travel plan for construction staff, which will include the provision of buses to / from the site for a significant portion of the workforce.

Based on the worst case it is forecast that up to 800 parking spaces will be required to be available for site staff during the busiest month, reducing to 400 for an average month.

Information to locals – All residents and businesses in the area will be informed of any upcoming traffic related matters. Information will include the contact details of the Contract Project Co-ordinator, who will be the main point of contact for all queries from the public or local authority during normal working hours. An "out of hours" emergency number will also be provided.

A Pre and Post Construction Condition Survey – A pre-condition survey of roads associated with the proposed development will be carried out prior to construction commencement to record the condition of the road. A post construction survey will be carried out after works are completed. Where required the timing of these surveys will be agreed with the local authority. All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the local authority engineers.

Liaison with the relevant local authority - Liaison with Clare County Councils Road Section and An Garda Siochana during the delivery of any abnormal loads, when an escort may be required.

Temporary traffic signs – As part of the traffic management measures temporary traffic signs will be put in place at all key junctions, including the new junction providing access to the site the R352 Tulla Road. All measures will be in accordance with the *"Traffic Signs Manual, Section 8 – Temporary Traffic Measures and Signs for Road Works"* (DoT now DoTT&S) and "Guidance for the Control and Management of Traffic at Roadworks" (DoTT&S). A member of construction staff (flagman) will be present at key junctions during peak delivery days and times. This will include the monitoring of traffic on the M18 slip roads at the East Clare and Tulla Road West roundabouts.

Delivery times of abnormal loads - The management plan will include the option to deliver any abnormal loads at night in order to minimise disruption to general traffic during the construction stage.

Additional measures - Various additional measures will be put in place in order to minimise the effects of the development traffic on the surrounding road network including wheel washing facilities on site and sweeping / cleaning of local roads as required.

Re-instatement works - All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the Road Section of Clare County Council. The roads conditions survey (and any other analyses required by the Roads Section of the Council) will be undertaken immediately prior to construction commencement of the project to assess the condition of the road network at that time and to agree any required works with the local authority. Such a survey would be repeated immediately after completion of the construction phase of the project in order to ensure that any reinstatement works were carried out to a satisfactory standard as required by the local authority.

Road Opening Licence – Roads works associated with the proposed access junction on the R352 Tulla Road will be undertaken in line with the requirements of a road opening licence as agreed with Clare County Council.

12.6.3 Operational Phase

In addition to the provision of the proposed access junction on the R352 Tulla Toad that will provide access to the site for all traffic during the operational stage up to and beyond the test year of 2044, the following measures will be put in place as mitigation measure;

Travel Plan – While an outline Travel Plan is provided as part of the current planning application to Clare County Council (included as Appendix 12.6), a detailed plan will be developed prior to opening. The plan will be updated as each Data Centre is occupied, with the aim to encourage the use of sustainable modes of travel to the Art Data Centre, including walking, cycling, public transport (if an option) and car sharing / pooling.

The provision of a safe environment for all sustainable modes - Including footpaths and crossing facilities and cycle paths throughout the Art Data campus.

The provision of a safe internal road network - Including parking and delivery bays to provide a safe environment for all staff, visitors and deliveries to the site.

12.6.4 Mitigation during decommissioning

In the event that the Art Data Centre is decommissioned after the life of the proposed development a decommissioning plan, including material recycling / disposal and traffic management plan will be prepared for agreement with the local authority. The mitigation measures would be similar to those proposed during the construction phase.

12.7 PREDICTED IMPACTS OF THE PROPOSED DEVELOPMENT

12.7.1 Do Nothing

An alternative scenario to developing the proposed Art Data Centre would be to do nothing and leave the site as it is. For this scenario there will be no additional traffic generated or works carried out on the road network and therefore no effects with respect to traffic.

12.7.2 Construction Phase

Worst case Art Data Centre peak construction scenario - 2027 (as presented in Section 12.5)

Based on the worst case scenario that all construction staff trips are car-based, during the busiest months of the 6.5 year (80 month) construction period, the likely effects on the surrounding road network are forecast to be as follows;

Link flows and delays on R352 Tulla Road – Traffic volumes during peak hours on the R352 Tulla Road are forecast to increase by up to 77% just to the west of the proposed access junction during the AM peak hour, reducing to 23% during the course of the day. The junction capacity tests undertaken for the critical AM and PM peak hours indicate that the forecast increase in traffic flows will translate into relatively small impacts to general traffic flow in terms of delays and queues. It is therefore determined that the effects on traffic on the R352 Tulla Road will be negative, will be slight, and will be short term, lasting for approximately 18 months between the years 2026 to 2028.

Link flows and delays on M18 slip roads and the M18 – During these peak construction months peak hour traffic flows on the M18 slip roads linking into the R352 roundabouts are forecast to increase by between 12% and 23% during the peak hours, and by 7% during the course of the day. On the M18 main carriageway construction traffic during the peak months is forecast to result in between a 1% to 10% increase during peak hour flows, and 1% to 3% during the day. As for the R352 approaches to the roundabouts, the junction capacity tests undertaken for the AM and PM peak hours show that the additional traffic will relatively minor impacts to general traffic flow in terms of delays and queues on the M18 slip road approaches. It is, therefore, also determined that the effects on traffic on the M18 slip roads and on the M18 main carriageway will also be negative, will be slight, and will be short term, lasting for approximately 18 months between the years 2026 to 2028.

Average and lower than average construction scenario between 2023 and 2029

During the remaining 5 years construction period the impacts on the local network as a result of construction traffic will be less than for the peak construction scenario, as set out above. It is therefore determined that the effects on traffic on the R352 Tulla Road and on the M18 slip roads and main M18 carriageway will be negative, will be slight, and will be short term, lasting for approximately 5 year, between the years 2023 to 2029.

12.7.3 Operational Phase

Art Data Centre Fully Operational – 2029 to 2044

Additional traffic volumes that will be generated during the operational stage will be significantly less than an average construction day. It is therefore determined that the effects on traffic on the R352 Tulla Road, the M18 slip roads and the M18 main carriageway during the operational phase will be negative, will be slight, and will be long term, lasting for the life time of the Art Data Centre.

12.7.4 Decommissioning

It is forecast that the traffic related impacts during the decommissioning phase of the Art Data Centre will be similar, but significantly less that those determined for construction phase.

12.8 CUMULATIVE IMPACTS

The one significant pending development that could have the potential for cumulative traffic impacts with the Art Data Centre is the decommissioning of the Roche Pharmaceutical facility located in Clarecastle, County Clare. As assessment of the potential cumulative traffic effects with the proposed Art Data Centre was undertaken based on the following criteria;

- Project status (proposed to operational and the potential for developments periods of activity to overlap),
- Degree of overlap with the Proposed Development delivery highway network (low to high),
- Traffic volumes (low to high).

The construction of the proposed Art Data Centre will take place between the year 2023 to 2029, and will be operational for the foreseeable future. The works associated with the decommissioning of the Roche facility will take place between the years 2021 to 2024. In terms of project scheduling there is therefore an overlap in years 2023 and 2024.

With respect to the area of the road network that is impacted and the traffic volumes generated by both developments, the EIAR prepared for the Roche site identified the area impacted to be roads local to Clarecastle and the R458 between the site and Junction 11 of the M18, beyond which the “impact of traffic generated by the Proposed Development will be below the TII thresholds, therefore, an assessment of the traffic and transportation impacts beyond Junction 11 of the M18 is not required”. As set out in Section 12.5 of this EIAR, it is concluded that the effects of traffic generated by the Art Data Centre will be limited to the R352 Tulla Road and the slip roads of Junction 13 of the M18. It is therefore concluded that the potential for cumulative impacts will imperceptible.

12.9 RESIDUAL IMPACTS

12.9.1 Construction stage

During the 6.5 year construction stage of the Art Data Centre, it is forecast that the additional traffic that will appear on the delivery routes indicated in Figure 12.1 will have a slight to moderate and temporary impact on existing road users, which will be minimised with the implementation of the mitigation measures included in the proposed traffic management plan.

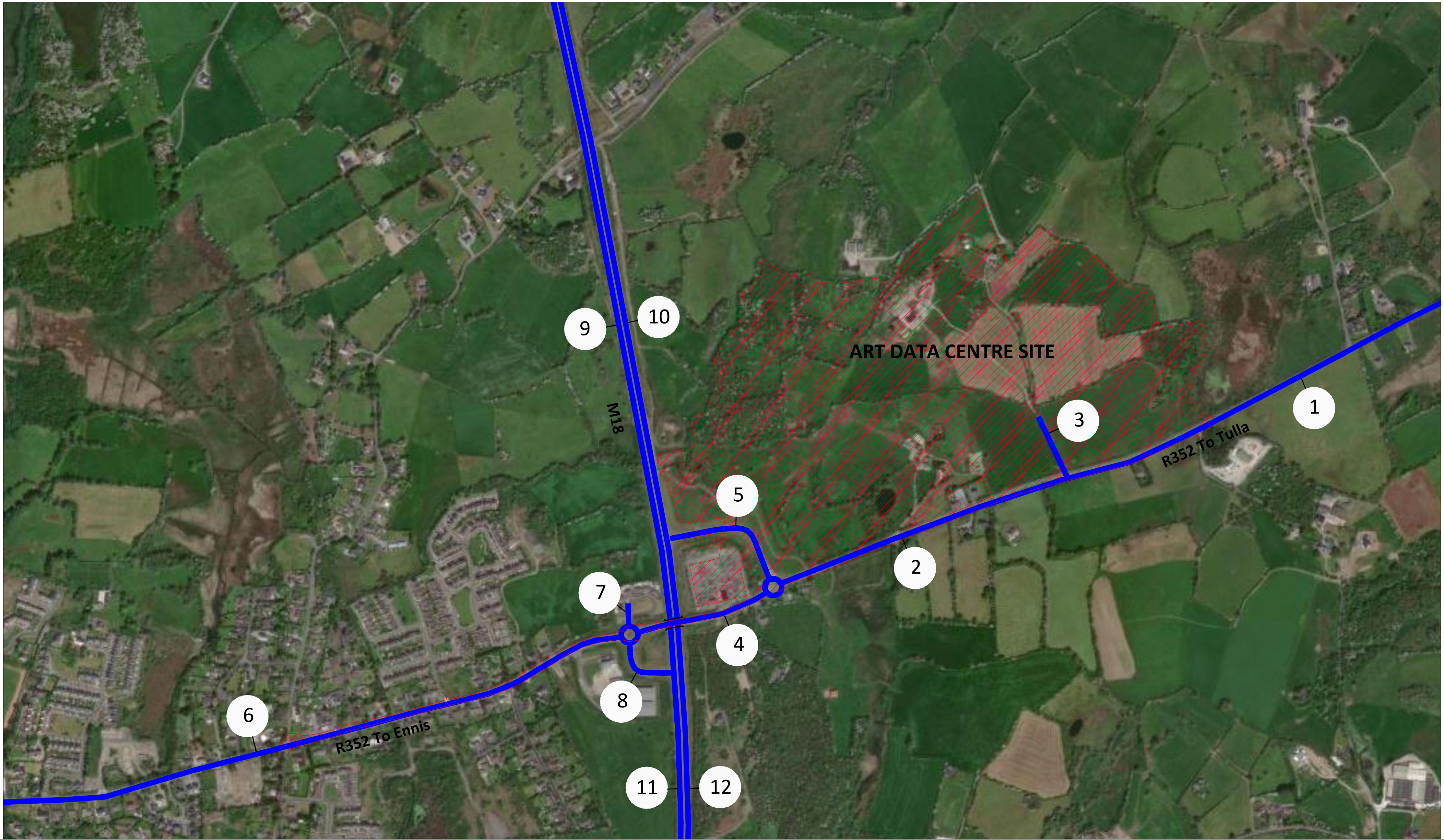
12.9.2 Operational stage

During operational stage of the Art Data Centre, it is forecast that the effects on existing road users and businesses due to the additional traffic that will travel on the road network will be slight and will be minimised with the implementation of the mitigation measures included in the proposed Travel Plan.

12.9.3 Decommissioning

As stated above, in the event that the proposed Art Data Centre is decommissioned a decommissioning plan will be prepared and implemented in order to minimise the residual impacts during this stage. In the event that decommissioning of the site takes place the residual effects will be similar, but less than for the construction stage, and will have a slight to moderate and temporary impact on existing road users.

NOTES: PLANNING DRAWING ONLY	Figure 12.1 Local road network				
	PROJECT:	Art Data Centre - Ennis Campus, Co Clare			ALAN LIPSCOMBE TRAFFIC & TRANSPORT CONSULTANTS
	CLIENT:	Art Data Centres	SCALE:	NTS	
	AL PROJECT NO: 7680	DATE: 02.06.22	DRAWN BY:	AL	



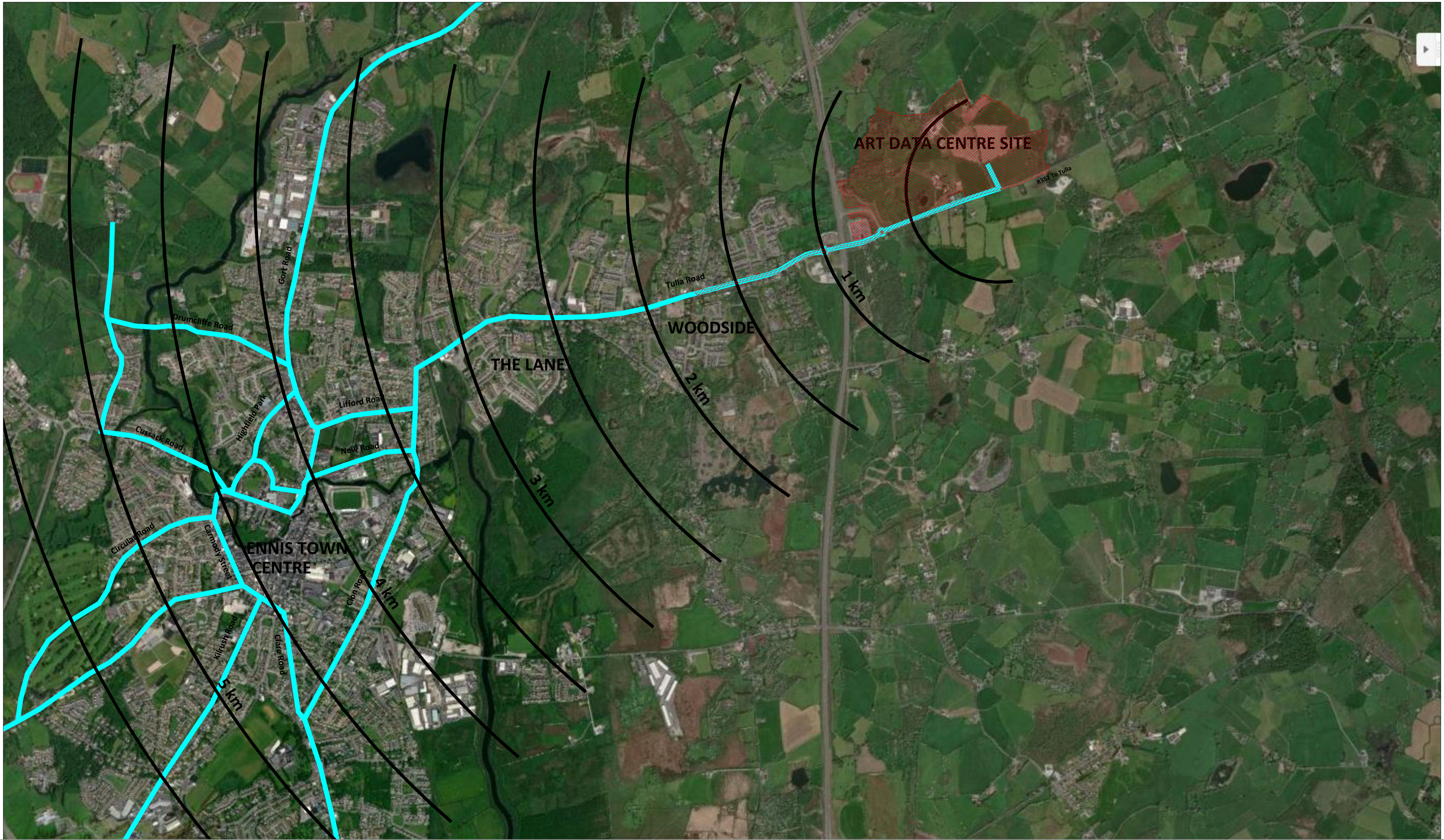
NOTES:

PLANNING DRAWING ONLY

Figure 12.2 Link locations for traffic assessment

PROJECT:	Art Data Centre - Ennis Campus, Co Clare		
CLIENT:	Art Data Centres	SCALE:	NTS
AL PROJECT NO: 7680	DATE: 02.06.22	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



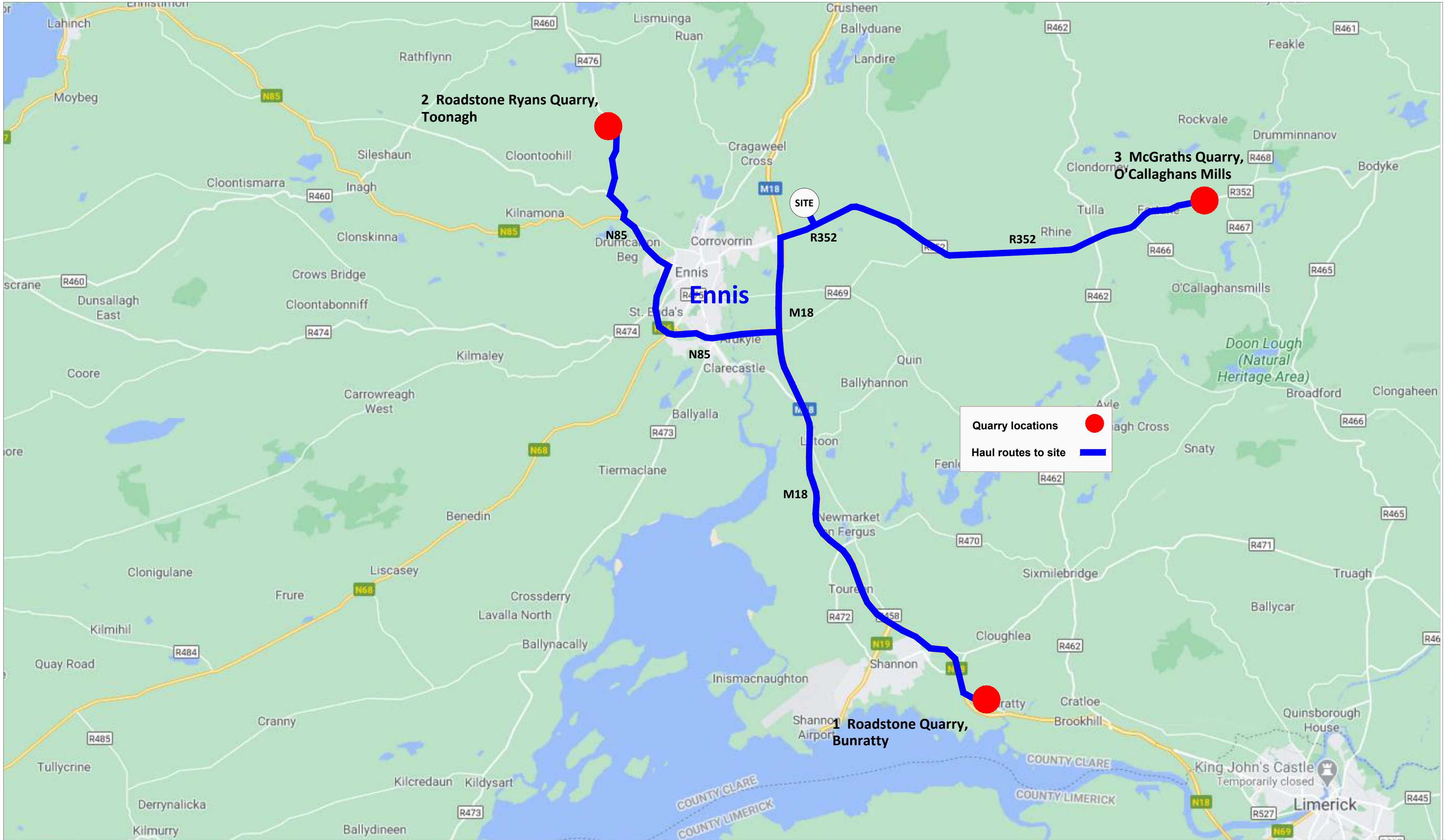
NOTES:

PLANNING DRAWING ONLY

Figure 12.3 Distances from Art Data Centre to Ennis town centre

PROJECT:	Art Data Centre - Ennis Campus, Co Clare		
CLIENT:	Art Data Centre	SCALE:	NTS
AL PROJECT NO: 8810	DATE: 02.06.22	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



NOTES:

PLANNING DRAWING ONLY

Figure 12.4 Locations of potential quarries for stone and ready mix concrete, and delivery routes

PROJECT:	Art Data Centre - Ennis Campus, Co Clare		
CLIENT:	Art Data Centres	SCALE:	NTS
PROJECT NO: 8810	DATE: 07.05.21	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

13.0 MATERIAL ASSETS

13.1 INTRODUCTION

This chapter prepared evaluates the potential impacts, from the proposed development on Material Assets, as defined in the EPA Guidelines '*Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports* (EPA, 2017), Advice Notes *Draft Advice Notes for Preparing Environmental Impact Statements* (EPA, 2015), and *European Commission Guidance on Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report* (2017).

13.2 METHODOLOGY

The Directive 2011/92/EU defined Material Assets as '*resources that are valued and that are intrinsic to specific places; they may be of either human or natural origin'* : this included architectural and archaeological heritage. The Directive 2014/52/EU included architectural and archaeological heritage as components of cultural heritage; this EIA report has done likewise within in Chapter 12 Archaeological, Architectural and Cultural Heritage.

The EPA Guidelines (2017) state that material assets are taken to mean "*built services and infrastructure, roads and traffic and waste management"*. The EPA Advice Notes (2015) also gives examples of material assets including; assimilative capacity of air and water; ownership and access; and tourism and recreational infrastructure. The European Commission Guidance (2017) refers to a number of examples of material assets including buildings, other structures, mineral resources and water resources.

In this EIA Report, the impacts on some of the material assets described in the above guidance have already been considered in the following chapters and therefore these aspects will not be addressed in specific detail within this chapter.

- Chapter 4, Population and Human Health;
- Chapter 5, Land, Soils, Geology & Hydrogeology;
- Chapter 6, Hydrology;
- Chapter 8, Air Quality & Climate;
- Chapter 11, Cultural Heritage
- Chapter 12, Traffic & Transportation; and
- Chapter 14, Waste Management.
-

This chapter assesses ownership and access, built services and infrastructure, which have not already been addressed elsewhere in this EIA Report. Section 13.3 addresses ownership and access. The subsequent sections address built services and infrastructure. The potential impacts on built services and infrastructure, if any, are assessed in terms of the following:

- Land Use, Property, and Access
- Power, Electrical, and Gas Supply;
- Telecommunications;
- Surface water infrastructure;
- Foul drainage infrastructure; and
- Water supply.

The proposed development will not impact on any other structures or water resources. The associated built services and infrastructure in the vicinity of the site are summarised in the

following sections; further detail is provided within the planning application documentation including details of consultation with utility suppliers.
The assessment of impact on utilities has been undertaken by confirmation of supply with the utility supplier, Clare County Council (CCC), Eirgrid, ESB Networks and Irish Water (IW). Mitigation measures are proposed where required.

13.3 RECEIVING ENVIRONMENT

The associated built services and infrastructure currently in the vicinity of the site are summarised in the following sections.

13.3.1 Land Use, Property, and Access

The proposed development site is under third party ownership. There currently exists an agreement between the Applicant and the owner of the site. A letter of consent, to apply for development on the lands from the site owner, is included with the planning application.

The proposed development footprint is c. 60 hectares (ha) and is located to the east of Ennis in the townland of Tooreen and Cahernalough with small sections extending west into the townlands of Ballymacahill and Knockanean. The lands are bordered to the south by the R352 (Tulla Road) and to the west by the M18. The lands are traversed by a gas pipeline and overhead powerlines connecting to the existing Ennis 110kv Substation that adjoins the western boundary.

The site is currently predominantly in agricultural use and comprises a series of irregularly shaped fields divided by hedgerows and ditches typical of its agricultural setting. The site contains a number of existing dwellings and farm outbuildings.

The land proposed for development have been identified by Clare Co Co (CCC) as zoned as suitable for Enterprise (ENT3) . CCC Variation No.1 to the CCDP 2017-2023 states that "lands zoned *enterprise* shall be taken to include the use and development of land for high end research and development, business science and technology -based industry, financial services, call centres/telemarketing, software development, datacentres, enterprise and incubator units, small/medium manufacturing or corporate office in high quality campus/park type development". The main existing access to the site is from Tulla Road along the southern boundary.

13.3.2 Power, Electrical, and Gas Supply

The availability of power is a key consideration in site selection. The lands are traversed by a gas pipeline and overhead power lines connecting to the existing Ennis 110kV Substation that adjoins the western boundary. There is a high pressure gas main running north/south to the east side of the site.

13.3.3 Telecommunications

A variety of providers including Aurora, BT, ESB and PiPiper are available in the locality of the site and discussions are ongoing to create at least three fibre entries to provide resilience.

13.3.4 Surface Water Infrastructure

Stormwater currently discharges to ground and the Ballymacahill River which borders the west of the site.

13.3.5 Foul Drainage Infrastructure

There is an existing 225 mm diameter foul drain that forms part of an existing foul drainage network that services the existing Knockanean area southwest of the proposed development along the existing Tulla Road. This existing foul drain discharges to the existing pumping station at Gort Na mBlath located c. 550 m further west from the proposed development. The wastewater ultimately discharges to Ennis North (Clonroadmore) WWTP Reg D0048.

13.3.6 Water Supply

A 450mm diameter mains runs along Tulla road and has capacity to supply adequate water for the proposed development.

13.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

This section describes the built services and infrastructure for the proposed development during both construction and operation are described below.

13.4.1 Land Use, Property, and Access

The proposed data storage facility and energy centre covers an area of 60 hectares and of the total land area, 10 ha of the lands are retained as buffer zones. The land proposed for development have been identified by Clare Co Co (CCC) as zoned as suitable for Enterprise (ENT3). CCC Variation No.1 to the CCDP 2017-2023 states that “lands zoned *enterprise* shall be taken to include the use and development of land for high end research and development, business science and technology -based industry, financial services, call centres/telemarketing, software development, datacentres, enterprise and incubator units, small/medium manufacturing or corporate office in high quality campus/park type development”.

A number of the existing dwellings and farm outbuildings will be retained and some (one house and eight farm buildings) will be demolished as part of the proposed site redevelopment. Details on demolition are included in the demolition report provided with this planning submission and also addressed in Chapter 13 (Waste) and the Construction Environmental Management Plan (CEMP).

The main access to the proposed development site will be off the Tulla Road along the southern boundary, with a secondary access and egress for emergency use only, off the Tulla road to the west of the main entrance. These entrances will connect to an internal road network that will serve two purposes public 24/7 access to the Vertical Farm, Substations, Energy Centre, and Gas AGI; and to provide a secure private road network circumnavigating the Data Centres for staff access, connection between buildings and for the delivery of equipment and materials. There is good visibility on approach to both access points as detailed in Chapter 12 (Traffic and Transportation).

13.4.2 Power, Electrical, and Gas Supply

During construction, contractors will require power for heating and lighting of the site and their on site construction compound. The power requirements will be relatively minor and will be provided by a temporary power supply.

During operation, the six data storage facilities will require up to 200 MW IT load. The data halls equipment, including servers and the air handling plant require energy to maintain server availability and the necessary environmental conditions. As detailed in Chapter 2 (Description of the Development) it is proposed to construct an energy centre in the east of the site. This energy centre and connection to the electricity grid with an additional onsite substation will service the power needs of the data storage facilities.

It is envisaged that phase 1 (80MW) will be provided by electrical power from the grid. It is proposed to underground two existing overhead 110kV circuits to the Ennis substation as they come onto the site on the east side. A new substation will be created on the east site, partly for extending Eirgrid’s substation (the existing has no additional space) and for transforming to 10kV / 20kV for distribution to the data centres. Dual feeders will be provided to each data centre via a set of underground ducts that will be created in the service roads.

Connecting to the Eirgrid network gives the opportunity to use low carbon energy that is now generated across the island of Ireland through wind generation and photo voltaic solar farms. These renewable sources of energy currently provide up to 40% of the total supply at any one time. This will increase significantly over the next decade or so as more and more renewable capacity is added to the network. The additional phases (120 MW) will be powered by the on-site gas powered energy centre or a combination of both. The Applicant intends to construct the energy centre in order to respond flexibly to the evolving energy market and to ensure the capacity to have future security of supply and also to respond to any future grid capacity constraints.

There is a high pressure gas main running north/south to the east side of the site. In conjunction with Gas Networks Ireland, a pressure reduction station (AGI) will be installed to provide delivery of gas for the generators to be located in the energy centre. The initial provision of generation on site will be based on using Natural Gas from Gas Networks Ireland (GNI). GNI have announced that they are already looking at injecting green or blue hydrogen into their network to improve their carbon impact, as per their Vision 2050. The graph below shows how the use of natural gas will reduce to 0% by 2050. The engines on-site will be specified to work on Natural Gas or Hydrogen or any mix in between in order to future proof the plant and to take the opportunity to reduce the carbon impact.

In the event of a loss of power to the site, diesel-powered back-up generators will be activated to provide power pending restoration of mains power. Based on experience of many other datacentre developments, the back-up generators will rarely be used.

13.4.3 Telecommunications

Telecommunications including fibre required during the construction phase will be provided via a mobile connection or temporary connection to the nearby telephone network.

A variety of providers including Aurora (running long the gas line), BT, ESB and PiPiper are available in the locality of the site and discussions are ongoing to create at least 3 fibre entries to provide resilience.

A fibre optic cable distribution network will be installed with a separate incoming fibre infrastructure and provided to each building via underground fibre ducts. There are existing underground carrier ducts adjacent to the site that will be utilised for the development. The connection into the wider telecommunications network will be undertaken by a statutory telecommunications operator.

The installation of a new fibre optic cable network on the site will be carried out in accordance with best practice standards. Consultation with the providers has confirmed there is sufficient capacity in the network for the proposed development.

13.4.4 Surface Water Infrastructure

During construction run-off into excavations/earthworks cannot be prevented entirely and is largely a function of prevailing weather conditions. Earthwork operations will be carried out such that surfaces, as they are being raised, shall be designed with adequate drainage, falls and profile to control run-off and prevent ponding and flowing along with mitigation measures in place to ensure that any impacts on surface water is minimised at source. Any discharge water will be treated using a silt-buster or similar to removed suspended solids prior to discharge.

The proposed surface water drainage service to the development comprises various drainage components including positive stormwater networks, attenuation systems and several Sustainable Drainage Systems (SuDS) elements. The proposed surface water drainage was designed in accordance with the SuDS Manuel 2015.

The developed area of the site is 17.3 ha and attenuation has been designed on site for the 1:100 yr. flood event including consideration of a 20 % allowance for climate change. An overflow subsurface pipeline will discharge at current discharge rates (greenfield) to the Ballymacahill River. Drainage will be from a single lined attenuation pond.

Rainwater run-off from the roofs of the six datacentres will be collected and will feed water harvesting tanks with any excess overflow into the common road drainage network. This water will be available as cooling water. Other SuDs measures will include permeable paving and swales. These drains and swales will discharge to a surface water attenuation pond where the discharge will be controlled using a "Hydrobrake Optimum" vortex flow control device to limit the maximum discharge to 50 l/s during the 1/100 year storm (the calculated Qbar value attributed to the site is 61l/s). The attenuation pond to be constructed to retain a constant volume of water to promote settling and reduce conveyance of suspended solids and other particles to the receiving waters. An attenuation volume of 9293 m^3 is designed as part of the proposed development. A Class (I) bypass separator with a suitable capacity will be installed downstream of the proposed hydrobrake. The function of the separator is to intercept pollutants (any petroleum /oil) and prevent their entry to the Ballymacahill River. As such there is no potential for increase or flooding or impact on water quality as a result of the proposed development. Further details are provided in Chapter 7 of the EIAR and within the CSEA engineering report prepared for planning.

13.4.5 Foul Drainage Infrastructure

Welfare facilities will be provided for the contractors via portable sanitary facilities within the construction compound site during the construction works. It is an anticipated that initially, waste collected by means of a temporary sealed storage tank, with all wastewater being tankered off-site to an appropriately licensed facility for disposal. The site contractor may wish to establish temporary connections to the existing services established to provide service and utilities subject to relevant applications and approvals.

A temporary trench excavation along the Tulla road will be undertaken to facilitate pipe laying for connection with the existing pumping station of Gort Na mBlath located approximately 550 m west of the main site. The wastewater ultimately discharges to Ennis North (Clonroadmore) WWTP Reg D0048.

There is no trade effluent proposed for this development. Consultation with CCC has confirmed that sufficient wastewater capacity is available and a pre-connection enquiry PCE application form has been submitted to Irish Water (IW). A review of the most recent Annual Environmental Report (2019) for the receiving IW wastewater treatment plant and confirmation with IW and CCC confirms there is no capacity issues.

Table 13.1 2019 AER Confirming available capacity for Receiving WWTP.

2.1.4.2 Treatment Capacity Report Summary - ENNIS NORTH WWTP

Treatment capacity is an assessment of the hydraulic (flow) and organic (the amount of pollutants) load a treatment plant is designed to treat versus the current loading of that plant.

ENNIS NORTH WWTP	
Peak Hydraulic Capacity (m^3/day) - As Constructed	16272
DWF to the Treatment Plant (m^3/day)	6784
Current Hydraulic Loading - annual max (m^3/day)	20495
Average Hydraulic loading to the Treatment Plant (m^3/day)	13132
Organic Capacity (PE) - As Constructed	31500
Organic Capacity (PE) - Collected Load (peak week)[Note1]	23980
Organic Capacity (PE) - Remaining	7520
Will the capacity be exceeded in the next three years? (Yes/No)	No

Nominal design capacities can be based on conservative design principles. In some cases assessment of existing plants has shown organic capacities significantly higher than the nominal design capacity. Accordingly plants that appear to be overloaded when comparing a collected peak load with the nominal design capacity can be fully compliant due to the safety factors in the original design.

The designed Dry Weather Flow DWF of the development is 20.9 m^3/day. The proposed foul drainage service will incorporate a foul pumping station and associated rising main which will also include a 24-hour emergency storage tank (in the unlikely event that the proposed foul pump malfunctions).

13.4.6 Water Supply

During construction, a water source will be required for the duration of the works for welfare facilities, dust suppression and general construction activities. Initially, water supply will be provided by tankered water and bottled water to the site. A temporary connection to the existing existing watermain will be established to provide service and utilities subject to relevant applications and approvals. The water demand during the construction phase will not be significant enough to affect existing pressures.

A 450mm diameter mains runs along the Tulla Road and following a proposed upgrade for connection (within the existing road), has capacity to supply adequate water for the proposed development. Peak daily usage will be 48 l/s and average demand 11.2 l/s (Adiabatic Cooling System) during high temperature condition), plus 1.2 l/s for domestic use. On the rare occasions that evaporative cooling is required (temperature of 27^{0}C the requirement is 1,000 m^3 /day for the whole site.

13.5 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

13.5.1 Construction Phase

Land Use, Property, and Access

During the construction phase there are potential short-term nuisances such as dust, noise, as well as the potential for pollution of groundwater or the existing drainage ditches associated with demolition, excavations and construction. To minimise nuisance for neighbours, the contractor will be required to operate in compliance with the Construction Environmental Management Plan (CEMP). The potential impact associated with land use and property for the construction phase will be *localised, negative, not significant and short term*.

Power, Electrical, and Gas Supply

During construction, contractors will require power for heating and lighting of the site and their onsite accommodation. In addition, some on site equipment/plant will require power.

A construction compound and temporary power supply will be installed for the construction the proposed development. The contractor compound and car parking for contractors will move as the development proceeds through the different phases. Planned locations are outlined in the CEMP and drawing ART-ARC-SP-00-DR-A-004. No off site parking is required. The power requirements for the construction phase will be relatively minor and therefore the power demand for the construction phase will have a *short term imperceptible* impact.

Excavations within the vicinity of existing electrical services will be carried out in consultation with EBS Networks to ensure there is no impact on existing users. There are no potential impacts associated with power supply for the proposed development for the construction phase.

Telecommunications
Telecommunications including fibre required during the construction phase will be provided via a mobile connection. There are no potential impacts associated with telecommunications for the proposed development for the construction phase.

Surface Water Infrastructure
The contractor will be required to manage surface water as outlined in the construction surface water management plan included in the Construction Environmental Management Plan (CEMP). The design and control measures will ensure that run-off water containing silt or potential construction contaminants (oil and alkaline water from cement) will be contained on site and treated. Run off will be managed to greenfield run-off rates and as such there is no potential for off-site flooding.

As detailed in Chapter 6, the potential impacts associated with surface water run-off for the proposed development during the construction phase is *short term, neutral and imperceptible*.

Foul Drainage Infrastructure and Water Supply
Welfare facilities (canteens, toilets etc.) will be required for the construction crew. Portable toilets will be provided onsite for construction staff.
There are no potential impacts on the existing infrastructure associated with wastewater management for the proposed development for the construction phase.

Water will be supplied via a connection to the existing mains along the Tulla road, which will serve the construction compound, welfare facilities and any other construction activities for the duration of construction works on the proposed development. Consultation with CCC and IW has been undertaken to confirm availability of supply requirement and a Pre Connection Enquiry (PCE) has been submitted to IW. A copy is included in the engineering report provided with planning documentation.

It is concluded the potential impacts associated with wastewater and water supply for the proposed development for the construction phase are *short-term, neutral and imperceptible*.

13.5.2 Operational Phase

Land Use, Property, and Access
During the operational phase the Proposed Development is not anticipated to generate significant air (including odour), noise or water emissions during normal operating conditions; these have been discussed further in the respective EIAR chapters, Chapter 6 (Hydrology), Chapter 8 (Air Quality & Climate) and Chapter 9 (Noise and Vibration) Chapters.

The proposed development represents a loss of agricultural land however in the overall context of Ireland's available agricultural land the loss is negligible. There is no net loss of soil from the site. Due to the zoning of these lands for development, the overall potential impact associated with land use and property for the operational phase will be a localised *neutral, slight, and long term*.

Power, Electrical, and Gas Supply

A 200 MW IT Load in total will be required for the operation of the 6 no. data storage facilities). The data halls equipment, including servers and the air handling plant require energy to maintain server availability and the necessary environmental conditions. This energy will be provided by electrical power from the grid and onsite gas-powered engines located in the energy centre, or a combination of both.

To facilitate connection with the grid, construction of an additional on-site substation is required. The latter will form part of a separate application to An Bord Pleanála but is assessed within this EIAR.

The data storage facility will also have diesel powered back-up generators, as a contingency power measure in the event of a loss of electrical power/gas supply loss. These diesel generators will be located in three external plant compounds. In addition, a back-up generator will be located in the energy centre building.

The Applicant is within the standard process of consent with EirGrid and Gas Networks Ireland. Based on these discussions with Eirgrid, and Gas Networks Ireland as well as Eirgrid's All-Island Generation Statement 2020-2029, there is a *long-term, neutral, not significant* effect on power and electrical supply during the operational phase of the Proposed Development.

Telecommunications

The proposed development will not make a connection to public network, a dedicated direct connection to services will be provided, and therefore there is no perceptible impact on the existing telecommunications infrastructure.
There is sufficient capacity available within a number of networks to accommodate the development, so there are no potential impacts associated with telecommunications for the Proposed Development for the operation phase.

Surface Water Infrastructure

The operational phase of the development represents an increase in hardstanding area that has the potential to cause an increase in surface water run-off and flooding offsite and downstream of the development site. As the design incorporates management of run-off to greenfield run off rate and in compliance with GSDS requirements there is no perceptible impact on receiving surface water infrastructure. The design incorporates measures for management of hydrocarbons and mitigation for any leaks and spills though interceptors (see Chapter 6 Hydrology).

Foul Drainage and Water Supply Infrastructure

Consultation has been undertaken with CCC with regard to available capacity and required upgrades to sewers. A PCE was submitted to IW which addressed water demand (and wastewater) for the proposed development (ref: Engineering report - CSEA). The overall water demand and wastewater discharge associated with the proposed development is in accordance with the water demand outlined in the PCE.

There is no trade effluent proposed for this development. Consultation with CCC has confirmed that sufficient wastewater capacity is available and a pre-connection enquiry PCE application form has been submitted to Irish Water (IW). The designed Dry Weather Flow DWF of the development is 20.9 m^3/day. The proposed foul drainage service will incorporate a foul pumping station and associated rising main which will also include a 24-hour emergency storage tank (in the unlikely event that the proposed foul pump malfunctions).

A 450mm diameter mains runs along the Tulla Road and following a proposed upgrade for connection (within the existing road), has capacity to supply adequate water for the proposed development. Peak daily usage will be 48 l/s and average demand 11.2l/s (Adiabatic Cooling System) during high temperature condition). plus 1.2 l/s for domestic use. On the rare occasions that evaporative cooling is required (temperature of 27^0C the requirement is 1,000 m^3 /day for the whole site.

13.6 REMEDIAL AND MITIGATION MEASURES

13.6.1 Construction Phase

Construction of the proposed development will require connections to water supply and drainage infrastructure, power and telecommunications.

Ongoing consultation with CCC, Irish Water, EirGrid, ESB Networks, Gas Networks Ireland and other relevant service providers within the locality and compliance with any requirements or guidelines they may have will ensure a smooth without disruption to local and business community.

The works contractor will be obliged to put best practice measures in place to ensure that there are no interruptions to utilities considered above, unless this has been agreed in advance.

Power and Electricity Supply

The power demand for the construction phase will be relatively minor and the connection works are almost entirely within proposed site boundaries with grid works within the road alignment (Tulla Road), so it is not anticipated that this would have any significant potential offsite impact. As such, no remedial or mitigation measures are required in relation to power supply for the construction phase.

Telecommunications

Telecommunications including fibre required during the construction phase will be provided via a mobile connection prior to connecting to existing networks along existing roads to accommodate the proposed development by the relevant network companies. No remedial or mitigation measures are required in relation to telecommunications.

Surface Water Infrastructure

During the construction phase, surface water management will be in accordance with a specific surface water management plan (SWMP) developed for the site (see CEMP). Any surface water run-off collecting in excavations or from exposed soil will likely contain a high sediment load. This will be diverted for appropriate settlement and will not be allowed to directly discharge directly to the existing lakes/springs or Ballymacahill River. Buffer zones adjacent to open water areaswill be applied. The SWMP will incorporate specific measures for managing run-off water quality.

Foul Drainage Infrastructure

Portable toilets will be provided for construction staff. Once operational, the new pumping station to the foul drainage network which runs along the R147 with pipe upgrades in accordance with the requirements of IW and CCC. A temporary connection will be established.

Foul drainage for the proposed development will be in accordance with the Building Regulations Technical Guidance Document H for design and construction.

Strict quality control measures will be undertaken while laying pipes to minimise or eradicate infiltration and ex-filtration.

Water Supply

A connection will be put in place for the construction of the proposed development. This will be fed from the existing 450mm diameter mains along the R147. The works contractor will be obliged to put best practice measures in place to ensure that there are no interruptions to the water supply, unless this has been agreed in advance.

Strict quality control measures will be undertaken while laying pipes to minimise or eradicate infiltration and ex-filtration.

13.6.2 Operational Phase

Power and Electricity Supply

The data halls equipment, including servers and the air handling plant require power to maintain server availability and the necessary environmental conditions. The data halls equipment, including servers and the air handling plant require energy to maintain server availability and the necessary environmental conditions. It is envisaged that this energy will be provided by electrical power from the grid, or onsite gas-powered engines located in the energy centre, or a combination of both. The Applicant intends to construct the energy centre for reasons of commercial need in order to respond flexibly to the evolving energy market and to ensure the capacity to have future security of supply and also to respond to any future grid capacity constraints.

The proposed development includes a number of sustainable measures to minimise energy use on site through building design and use of solar panels and waste heat. These are outlined in Chapter 2 Description of the Proposed Development and the Energy and Sustainability Report provided with the planning application documentation. The waste heat will be used for a vertical farm to be located on site.

No remedial or mitigation measures are required in relation to power and electricity.

Telecommunications

There is sufficient capacity available in the network to accommodate the development, and as such there are no potential impacts associated with telecommunications for the proposed development for the operational phase. No remedial or mitigation measures are required in relation to telecommunications.

Surface Water Infrastructure

The stormwater system has been designed to collect rainwater runoff from the impermeable areas of the site, roofs and road/car park and directed to an appropriate SuDS and attenuation system. The allowable greenfield runoff rate has been established by the project engineers, CSEA, using the methodology set out in the *Engineering Services Report.*

The drainage design for the proposed development includes a Class 1 full retention separators downstream of the fuel unloading areas and a Class 1 bypass interceptor upgradient of the attenuation basin to ensure the quality of surface water discharge is controlled prior to attenuation and discharge offsite. In addition, a hydrodynamic solid separator is provided within the drainage network to screen rubbish, debris and sediment from the surface water runoff before it enters the attenuation basin. A shut off valve is included in the design to ensure that site discharges can be shut off in the event of a fire or other form of significant surface water contamination event. No remedial or mitigation measures are required.

Foul Drainage and Water Supply Infrastructure
IW have agreed in principal that the wastewater requirements for the development can be accommodated, subject to application. The PCE form to IW his included in the engineering report provided with planning. No remedial or mitigation measures are required in relation to foul drainage or water supply infrastructure.

13.7 PREDICTED IMPACTS OF THE PROPOSED DEVELOPMENT

13.7.1 Construction Phase
The works contractor will be obliged to follow best practice measures to ensure that there are no interruptions to service from the existing telecommunications network, watermain, sewer and electrical grid. Any planned interruptions will be agreed in advance with the utilities suppliers. Strict quality control measures will be undertaken while laying pipes to minimise or eradicate infiltration and ex-filtration.

The implementation of mitigation measures within each chapter, and detailed in Section 13.6.1 will ensure that the predicted impacts of the proposed development on material assets will be *neutral, imperceptible,* and *short -term* for the construction phase.

13.7.2 Operational Phase
The implementation of mitigation measures within each chapter and detailed in Section 13.6.2 will ensure that the predicted impacts on the material assets during the operational phase will be *neutral, not significant and long term*.

13.8 RESIDUAL IMPACTS

The Proposed Development requires electrical power, gas usage, water supply and wastewater treatment. Consultations have been undertaken with CCC, Irish Water, Eirgrid and Gas Networks Ireland, respectively, and confirmed availability of supply. These entities in considering future connection take into consideration the environmental impacts of planned developments within the wider network. The provision of a combined gas and electric power provides additional resilience in the network. As such, there will therefore be no significant impact on material assets to the wider economy or environment. The overall predicted impact of the Proposed Development can be classed as *long-term, neutral* and *not significant* with respect to material assets.

13.9 CUMULATIVE IMPACT ASSESSMENT

The following considers the cumulative impacts of the proposed development and proposed and permitted and operating facilities in the surrounding area in relation to Material Assets and Waste.

13.9.1 Construction Phase
The construction of the Proposed Development and other surrounding proposed and permitted developments considered, which are identified in Chapter 3 and Appendix 3.1 require site clearance, excavations and levelling which will generate localised requirement for soil removal and/or import, power and water supply and wastewater discharge. However, provided standard mitigation measures set out in the EIA Reports for these developments or where EIA does not apply, provided that planning conditions are implemented, the cumulative impact will be short term negative and imperceptible.

13.9.2 Operational Phase

The Proposed Development and all permitted developments considered, which are identified in Chapter 3 and associated appendices are required to engage with Irish Water, Gas Ireland and Eirgrid to ensure that there is sufficient capacity to cater for the increase in water and wastewater, gas and electricity requirements. Based on known current and known future developments there is adequate capacity of supply available within the local environs. . In developing long term plans for security of supply, these National Authorities for water and energy supply are required to develop resources in compliance with sustainable environmental planning.

The cumulative impacts associated with material assets will be *long-term negative and not significant.*

Interactions are presented in Chapter 15.

14.0 WASTE MANAGEMENT

14.1 INTRODUCTION

This Chapter of the EIAR comprises an assessment of the likely impact of the proposed development from the waste generated from the development as well as identifying proposed mitigation measures to minimise any associated impacts.

A site-specific Construction and Demolition Waste Management Plan (C&D WMP) has been prepared by AWN Consulting Ltd to deal with waste generation during the demolition, excavation and construction phases of the proposed development and has been included as Appendix 14.1. The C&D WMP was prepared in accordance with the 'Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects' document produced by the National Construction and Demolition Waste Council (NCDWC) in conjunction with the Department of the Environment, Heritage and Local Government in July 2006.

The Chapter has been prepared in accordance with EPA Guidelines on the Information to be contained in EIAR (2017, Draft)

These documents will ensure the sustainable management of wastes arising at the Development site in accordance with legislative requirements and best practice standards.

14.2 METHODOLOGY

The assessment of the impacts of the proposed development, arising from the consumption of resources and the generation of waste materials, was carried out taking into account the methodology specified in relevant guidance documents, along with an extensive document review to assist in identifying current and future requirements for waste management; including national and regional waste policy, waste strategies, management plans, legislative requirements and relevant reports. A summary of the documents reviewed, and the relevant legislation is provided in the C&D WMP provided in Appendix 14.1 and in sections 14.2.1 and 14.10 of this chapter.

This Chapter is based on the proposed development , as described in Chapter 2 (Description of the Proposed Development) and considers the following aspects:

- Legislative context;
- Construction phase (including demolition, site preparation and excavation);
- Operational phase; and
- Decommissioning Phase

A desktop study was carried out which included the following:

- Review of applicable policy and legislation which creates the legal framework for resource and waste management in Ireland;
- Description of the typical waste materials that will be generated during the Construction and Operational phases; and
- Identification of mitigation measures to prevent waste generation and promote management of waste in accordance with the waste hierarchy.

Estimates of waste generation during the construction and operational phases of the proposed development have been calculated. The waste types and estimated quantities are based on published data by the EPA in the National Waste Reports and National Waste Statistics, data recorded from similar previous developments, Irish and US EPA waste generation research as well as other available research sources.

Mitigation measures are proposed to minimise the effect of the proposed development on the environment during the construction and operational phases, to promote efficient waste segregation and to reduce the quantity of waste requiring disposal. This information is presented in Section 14.6

A detailed review of the existing ground conditions on a regional, local and site-specific scale are presented in Chapter 6 of this EIAR (Land, Soils, Geology and Hydrogeology).

14.2.1 Legislation and Guidance

Waste management in Ireland is subject to EU, national and regional waste legislation and control, which defines how waste materials must be managed, transported and treated. The overarching EU legislation is the Waste Framework Directive (2008/98/EC) which is transposed into national legislation in Ireland. The cornerstone of Irish waste legislation is the Waste Management Act 1996 (as amended). European and national waste management policy is based on the concept of 'waste hierarchy', which sets out an order of preference for managing waste (prevention > preparing for reuse > recycling > recovery > disposal) (Figure 14.1).

Figure 14.1: Waste Hierarchy (Source: European Commission)

The Irish government issues policy documents which outline measures to improve waste management practices in Ireland and help the country to achieve EU targets in respect of recycling and disposal of waste. The most recent policy document, *Waste Action Plan for a Circular Economy – Waste Management Policy in Ireland*, was published in 2020 and shifts focus away from waste disposal and moves it back up the production chain. The move away from targeting national waste targets is due to the

Irish and international waste context changing in the years since the launch of the previous waste management plan, *A Resource Opportunity,* in 2012. The need to embed climate action in all strands of public policy aligns with the goals of the European Green Deal.

The strategy for the management of waste from the construction phase is in line with the requirements of the *Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects*, published by the Department of Environment, Heritage and Local Government (DoEHLG) in 2006. The guidance document, *Construction and Demolition Waste Management: A Handbook for Contractors and Site Managers* (FÁS & Construction Industry Federation, 2002), was also consulted in the preparation of this assessment.

There are currently no Irish guidelines on the assessment of operational waste generation, and guidance is taken from industry guidelines, plans and reports including the *Southern Region (SR) Waste Management Plan 2015 – 2021*, *BS 5906:2005 Waste Management in Buildings – Code of Practice*, the Clare County Council (CCC) County Clare Waste Management Bye-Laws 2018, the EPA National Waste Database Reports 1998 – 2018 and the EPA National Waste Statistics Web Resource.

14.2.2 Terminology

Note that the terminology used herein is generally consistent with the definitions set out in Article 3 of the Waste Framework Directive. Key terms are defined as follows:

Waste - Any substance or object which the holder discards or intends or is required to discard.

Prevention - Measures taken before a substance, material or product has become waste, that reduce:

a) the quantity of waste, including through the re-use of products or the extension of the life span of products;
b) the adverse impacts of the generated waste on the environment and human health; or
c) the content of harmful substances in materials and products.

Reuse - Any operation by which products or components that are not waste are used again for the same purpose for which they were conceived.

Preparing for Reuse - Checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing.

Treatment - Recovery or disposal operations, including preparation prior to recovery or disposal.

Recovery - Any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy. Annex II of the Waste Framework Directive sets out a non-exhaustive list of recovery operations.

Recycling - Any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations.

Disposal - Any operation which is not recovery even where the operation has as a secondary consequence the reclamation of substances or energy. Annex I of the Waste Framework Directive sets out a non-exhaustive list of disposal operations.

14.3 RECEIVING ENVIRONMENT

The proposed development includes six data storage facilities, an energy centre an Above Ground Installation (AGI) building, vertical farm, a substation compound and associated ancillary development on a greenfield site (previously used for agriculture and hosting power transmission infrastructure) in the townlands of Tooreen and Cahernalough, Co Clare.

In terms of waste management, the receiving environment is largely defined by CCC as the local authority responsible for setting and administering waste management activities in the area. This is governed by the requirements set out in the *Southern Region (SR) Waste Management Plan 2015 – 2021*, which sets out the following targets for waste management in the region:

- A 1% reduction per annum in the quantity of household waste generated per capita over the period of the plan;
- Achieve a recycling rate of 50% of managed municipal waste by 2020; and
- Reduce to 0% the direct disposal of unprocessed residual municipal waste to landfill (from 2016 onwards) in favour of higher value pre-treatment processes and indigenous recovery practices.

The Regional Plan sets a specific target for C&D waste of "*70% preparing for reuse, recycling and other recovery of construction and demolition waste*" (excluding natural soils and stones and hazardous wastes) to be achieved by 2020.

The National Waste Statistics update published by the EPA in August 2020 identifies that Ireland's current progress against this C&D waste target is at 77% and our progress against 'Preparing for reuse and recycling of 50% by weight of household derived paper, metal, plastic & glass (includes metal and plastic estimates from household WEEE)' is at 51%. Both of these targets are required to be met by 12 December 2020 in accordance with the requirements of the Waste Framework Directive; however, the EPA are yet to confirm that these were met.

The Clare County Development Plan 2017 – 2023 also sets policies and objectives for the CCC area which reflect those set out in the regional waste management plan.

In terms of physical waste infrastructure, CCC no longer operates any municipal waste landfill in the area. There are a number of waste permitted and licensed facilities located in the Southern Waste Region for management of waste from the construction industry as well as municipal sources. These include soil recovery facilities, inert C&D waste facilities, municipal waste landfills, material recovery facilities and waste transfer stations.

There is a number of licensed, permitted and registered waste facilities in the Clare region and in the surrounding counties. However, these sites may not be available for use when required or may be limited by the waste contractor selected to service the development in the appropriate phase. In addition, there is potential for more suitably placed waste facilities or recovery facilities to become operational in the future which may be more beneficial from an environmental perspective.

The ultimate selection of waste contractors and waste facilities would be subject to appropriate selection criteria proximity, competency, capacity, serviceability, and cost. Potential waste facilities have been identified in in section 14.3.1 and section 14.3.2.

14.3.1 Current C&D Waste Disposal / Recovery Routes

During the planning phase and prior to the appointment of waste contractors, waste destinations for C&D Waste cannot be supplied. These details are to be finally determined prior to demolition and construction beginning. Waste facilities have capacity and life span limitations that may not be available at the of construction & demolition phases of the development.

As well as EPA licensed facilities, there are currently a number of facilities in Clare and the counties surrounding the proposed Project in possession of a Waste Facility Permit or Certificate of Registration from the applicable County Councils which accept soils and inert waste from construction and demolition works. These facilities are all permitted or certified to operate Class 5, Class 6, and/or Class 7 waste activities as described in the Third Schedule of the Waste Management (Facility Permit and Registration) Regulations 2007 (S.I. No. 821/2007).

The currently licensed or permitted facilities which can operate under these classes of activity and are closest to the proposed development are listed in Table 14.1. There are also registered sites that can receive waste from the development that are not included in the table due to their lower capacity limits, however they can still potentially be used by the yet to be selected waste contractor. All details were collected from the National Waste Collection Permit Office and Environmental Protection Agency websites (July 2021) and a full list of licensed, permitted and register sites can be found on the registers contained on these sites.

***Table 14.1**: Potential destinations for Construction & Demolition Waste*

Facility / Applicant Name	Licence Number & Facility Type	Location
Potential Soil Recovery Facilities		
Tulligmore Quarry Solutions Limited	W0255-02	Tulligmore Quarry Solutions Limited, Tulligmore, Dripsey, Cork.
Lennon Quarries Limited	W0272-02	Lennon Quarries Limited, Tallagh, Belmullet, Mayo.
Mallow Contracts Limited	W0266-01	Mallow Contracts Limited, Lissard & Ballyhilloge, Mourneabbey, Co. Cork, Cork.
Potential Permitted Waste Facilities for Soil		
Cloonaughter Parteen Co Clare	WFP-CE-17-0001-01	Cloonaughter Parteen Co Clare
Clare Waste & Recycling Co. Ltd	WFP-CE-08-0002-03	Raheen Tuamgraney Co. Clare V94 WY67
Jim Bolton Sand and Gravel Ltd	WFP-CE-19-0001-01	Faheymore O'Briens Bridge Co Clare V94 F635
Kieran Kelly Haulage Ltd	WFP-CE-19-0002-01	Ballynacragga Newmarket-on-Fergus Co Clare
Lymar Contracts Ltd.	WFP-CE-20-0002-01	Caherea Lissycasey Ennis Co Clare
Potential Permitted Waste Facilities for Demolition and Construction Waste		
Clare Waste & Recycling Co. Ltd	WFP-CE-08-0002-03	Raheen Tuamgraney Co. Clare V94 WY67

Facility / Applicant Name	Licence Number & Facility Type	Location
Clean (Irl) Refuse & Recycling Company	WFP-CE-08-0003-03	Smithstown Industrial Estate Shannon Co Clare V14 HP89
Potential Waste Facilities Hazardous Waste		
Enva Ireland Limited	W0145-02	Enva Ireland Limited (Cork), Unit 9, Raffeen Industrial Estate, Raffeen, Monkstown, Cork.

14.3.2 Current Operational Waste Disposal / Recovery Routes

During the planning phase and prior to the appointment of operational phase waste contractors, waste destinations for the Operational Phase Waste cannot be supplied. These details will be finally determined prior to the operational phase beginning. Waste facilities have capacity and life span limitations that may change throughout the life of the operational phase of the development that cannot be controlled. There will be other operational limitations such as cost and serviceability capabilities of provider that will not be known until the waste contractor selection process is undertaken in the detailed design phase or prior to occupation of the development.

As well as EPA licensed facilities, there are currently a number of facilities in Clare and the counties surrounding the development in possession of a Waste Facility Permit or Certificate of Registration from the applicable County Councils which accept the same types commercial and municipal waste.

The currently licensed or permitted facilities which are closest to the proposed development are listed in Table 14.2. There are also registered sites that can receive waste from the development that are not included due to their lower capacities however they can still potentially be used by the waste contractor. All details were collected from the National Waste Collection Permit and Environmental Protection Agency website (July 2021) and a full list of licensed, permitted and register sites can be found on their registers.

***Table 14.2**: Potential destinations for Operational Waste*

Facility / Applicant Name	Licence Number & Facility Type	Location
Potential Waste Facilities (Transfer Stations) for Operational Waste		
Starrus Eco Holdings Limited	W0058-01	Starrus Eco Holdings Limited (Sligo), Deepwater Quay, Sligo, Sligo.
Mr Binman Limited	W0061-01	Mr Binman Ltd, Luddenmore, Grange, Kilmallock, Limerick.
Bruscar Bhearna Teoranta	W0106-02	Bruscar Bhearna Teoranta (Carrowbrowne), Carrowbrowne, Headford Road, Galway, Galway.
The City Bin Co.	W0148-01	City Bin Co Ltd, Townlands of Carrowmoneash, Oranmore, Galway.
Potential Permitted Waste Facilities for Operational Waste		
Clare Waste & Recycling Co. Ltd	WFP-CE-08-0002-03	Raheen Tuamgraney Co. Clare V94 WY67
Clean (Irl) Refuse & Recycling Company	WFP-CE-08-0003-03	Smithstown Industrial Estate Shannon Co Clare V14 HP89

14.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

A full description of the proposed development can be found in Chapter 2 (Description of the Proposed Development). The characteristics of the proposed development that are relevant in terms of waste management are summarised below.

14.4.1 Demolition Phase

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

Further detail on the waste materials likely to be generated during the demolition works are presented in the project-specific C&D WMP in Appendix 14.3. The C&D WMP provides an estimate of the main waste types likely to be generated during the C&D phase of the proposed development . The reuse, recycling / recovery and disposal rates have been estimated using the EPA National Waste Reports and these are summarised in Table 14.3.

Table 14.3 *Estimated off-site reuse, recycle and disposal rates for demolition waste.*

Waste Type	Tonnes	Reuse		Recycle / Recovery		Disposal	
		%	Tonnes	%	Tonnes	%	Tonnes
Glass	32.6	0	0.0	85	27.7	15	4.9
Concrete, Bricks, Tiles, Ceramics	184.7	30	55.4	65	120.0	5	9.2
Plasterboard	14.5	30	4.3	60	8.7	10	1.4
Asphalts	3.6	0	0.0	25	0.9	75	2.7
Metals	79.7	5	4.0	80	63.7	15	11.9
Slate	3.6	0	0.0	85	3.1	15	0.5
Timber	43.5	10	4.3	60	26.1	30	13.0
Asbestos	0.1	0	0.0	0	0.0	100	0.1
Total	**362.2**		**68.1**		**250.2**		**43.9**

14.4.2 Construction Phase

During the construction phase, waste will be produced from surplus materials such as broken or off-cuts of timber, plasterboard, concrete, tiles, bricks, etc. Waste from packaging (cardboard, plastic, timber) and oversupply of materials may also be generated. The appointed Contractor will be required to ensure that oversupply of materials is kept to a minimum and opportunities for reuse of suitable materials is maximised.

There will also be soil, stones, clay and made ground excavated to facilitate construction of new foundations, underground services, and the installation of the proposed basements. The development engineers (Clifton Scannell Emerson Associates Consulting Engineers) have estimated that c. 111,424 m^3 of material will need to be excavated to do so. It is currently envisaged that all of the excavated material will be able to be retained and reused onsite for landscaping and fill. These estimates will be refined prior to commencement of construction.

If the material that requires removal from the site is deemed to be a waste, removal and reuse / recycling / recovery / disposal of the material will be carried out in accordance with the Waste Management Act 1996 (as amended), the Waste Management (Collection Permit) Regulations 2007 (as amended) and the Waste

Management (Facility Permit & Registration) Regulations 2007 (as amended). The volume of waste requiring recovery / disposal will dictate whether a Certificate of Registration (COR), permit or licence is required for the receiving facility. Alternatively, the material may be classed as by-product under Article 27 classification (European Communities (Waste Directive) Regulations 2011, S.I. No. 126 of 2011). For more information in relation to the envisaged management of by-products, refer to the C&D WMP (Appendix 14.1).

In order to establish the appropriate reuse, recovery and / or disposal route for the soils and stones to be removed off-site, it will first need to be classified. Waste material will initially need to be classified as hazardous or non-hazardous in accordance with the EPA publication *Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous* (2019). Environmental soil analysis will be carried out prior to removal of the material on a number of the soil samples in accordance with the requirements for acceptance of waste at landfills (Council Decision 2003/33/EC Waste Acceptance Criteria). This legislation sets limit values on landfills for acceptance of waste material based on properties of the waste, including potential pollutant concentrations and leachability. It is anticipated that the surplus material will be suitable for acceptance at either inert or non-hazardous soil recovery facilities / landfills in Ireland or, in the unlikely event of hazardous material being encountered, be transported for treatment / recovery or exported abroad for disposal in suitable facilities.

Waste will also be generated from construction phase workers e.g. organic / food waste, dry mixed recyclables (waste paper, newspaper, plastic bottles, packaging, aluminium cans, tins and Tetra Pak cartons), mixed non-recyclables and, potentially, sewage sludge from temporary welfare facilities provided on-site during the Construction phase. Waste printer / toner cartridges, waste electrical and electronic equipment (WEEE) and waste batteries may also be generated in small volumes from site offices.

Further detail on the waste materials likely to be generated during the excavation and construction works are presented in the project-specific C&D WMP (Appendix 14.1). The C&D WMP provides an estimate of the main waste types likely to be generated during the Construction phase of the proposed development . These are summarised in Table 14.4.

Table 14.4: *Predicted on and off-site reuse, recycle and disposal rates for construction waste*

Waste Type	Tonnes	Reuse		Recycle / Recovery		Disposal	
		%	Tonnes	%	Tonnes	%	Tonnes
Mixed C&D	310.1	10	31.0	80	248.1	10	31.0
Timber	263.2	40	105.3	55	144.7	5	13.2
Plasterboard	94.0	30	28.2	60	56.4	10	9.4
Metals	75.2	5	3.8	90	67.7	5	3.8
Concrete	56.4	30	16.9	65	36.7	5	2.8
Other	141.0	20	28.2	60	84.6	20	28.2
Total	**939.8**		**213.3**		**638.1**		**88.3**

14.4.3 Operational Phase

An Operational Waste Management Plan (OWMP) will be developed prior to commencement of operations. The plan will seek to ensure the facility contributes to the targets outlined in the *SR Waste Management Plan 2015 – 2021*. Mitigation measures proposed to manage impacts arising from wastes generated during the operation of the Proposed development are summarised below.

Segregation of Waste Materials Onsite

All waste materials will be segregated into appropriate categories and will be stored in appropriate bins or other suitable receptacles in a designated, easily accessible areas of the site.

Table 14.5 below summarises the anticipated management strategy to be used for typical wastes to be generated at the data storage facilities and the estimated waste to be generated.

Table 14.5 Anticipated Onsite Waste Management and Estimated Average Quantities

Waste Type	Hazard Y/N	On-site Storage/Treatment Method (anticipated)	Method of Treatment or Disposal (offsite)	Waste Volume (kg / week)
Packaging Waste	N	Segregated bins/skips	Recycle	165.0
Office Waste	N	Segregated bins/skips	Recycle	80.0
General Non-Hazardous Waste	N	Segregated bins/skips	Recovery	172.5
Empty Containers	N	Segregated bins/skips	Disposal to landfill	40.0
Canteen/Kitchen Waste	N	Segregated bins for compost, mixed recyclable and general waste	Compost food waste. Recycle mixed dry recyclable waste. Recovery of other general waste	37.5
Non-hazardous WEEE	N	Segregated bins for waste electric and electronic equipment	Recovery	60.0
Landscaping waste	N	Composting bins	Composting	20.0
Vertical Farm	N	Segregated bins/skips	Compost organic waste. Recycle mixed dry recyclable waste. Recovery of other general waste	3,300.0
Waste Oil	Y	Oil drum in external waste storage area	Recovery	5.0
Waste sludge from oil separator	Y	Storage tank connected to oil separator	Recovery or disposal	5.0
(Wet) Batteries	Y	Specialised container in waste storage area	Return to supplier	20.0
(Dry) Batteries	Y	Specialised container in waste storage area	Recovery	20.0

Hazardous Waste

Hazardous waste may be generated from batteries, contaminated chemical drums and other packaging. If the packaging contains residues of or if it is contaminated by dangerous substances, it may be classed as a hazardous waste (depending on the volume and concentration of contaminants). If the drums are found to be unsuitable for re-use, they will be classed as a waste. Any waste classed as hazardous will be stored in a designated area (suitably bunded, where required) and will be removed off site by a licensed hazardous waste contractor(s).

Waste sludge from the petrol interceptors will be pumped out/removed as required by a suitably permitted/licenced contractor.

14.4.4 Decommissioning Phase

The Proposed Development may be decommissioned at some stage in the future. At that time, a demolition or refurbishment plan will be formulated for the decommissioning phase of the Proposed Development to ensure no waste nuisance occurs at nearby sensitive receptors.

14.5 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

This section details the potential waste effects associated with the proposed development .

14.5.1 Construction Phase

The proposed development will generate a range of non-hazardous and hazardous waste materials during site demolition, excavation and construction. General housekeeping and packaging will also generate waste materials, as well as typical municipal wastes generated by construction employees, including food waste. Waste materials will be required to be temporarily stored on-site pending collection by a waste contractor. If waste material is not managed and stored correctly, it is likely to lead to litter or pollution issues at the development site and in adjacent areas. The indirect effect of litter issues is the presence of vermin in areas affected. In the absence of mitigation, the effect on the local and regional environment is likely to be **indirect, *short-term, significant*** and ***negative****.*

The use of non-permitted waste contractors or unauthorised waste facilities could give rise to inappropriate management of waste, resulting in indirect negative environmental impacts, including pollution. It is essential that all waste materials are dealt with in accordance with the European Union, regional and national legislation, as outlined previously, and that time and resources are dedicated to ensuring efficient waste management practices. In the absence of mitigation, the effect on the local and regional environment is likely to be **indirect, *long-term, significant*** and ***negative****.*

Wastes arising will need to be taken to suitably registered / permitted / licenced waste facilities for processing and segregation, reuse, recycling, recovery, and / or disposal, as appropriate. There are numerous licensed waste facilities in the Southern Region (SR) which can accept hazardous and non-hazardous waste materials, and acceptance of waste from the development site would be in line with daily activities at these facilities. At present, there is sufficient capacity for the acceptance of the likely C&D waste arisings at facilities in the region and within Ireland. The majority of construction materials are either recyclable or recoverable. However, in the absence of mitigation, the effect on the local and regional environment is likely to be **indirect, *short-term, significant*** and ***negative****.*

There is a quantity of excavated material which will need to be excavated to facilitate the proposed development. A detailed review of the existing ground conditions on a regional, local site-specific scale are presented in Chapter 5 (Land, Soils, Geology, and Hydrogeology). It is not anticipated excavated material will need to be removed off-site. Correct classification and segregation of the excavated material is required to ensure that any potentially contaminated materials are identified and handled in a way that will not impact negatively on workers as well as on water and soil environments, both on and off-site. However, in the absence of mitigation, the effect on the local and regional environment is likely to be **indirect, *short-term, significant*** and ***negative****.*

14.5.2 Operational Phase

The potential impacts on the environment of improper, or a lack of, waste management during the operational phase would be a diversion from the priorities of the waste hierarchy which would lead to small volumes of waste being sent unnecessarily to landfill. In the absence of mitigation, the effect on the local and regional environment is likely to be **indirect, *long-term, significant*** and ***negative****.*

The nature of the development means the generation of waste materials during the operational phase is unavoidable. Networks of waste collection, treatment, recovery and disposal infrastructure are in place in the region to manage waste efficiently from this type of development. Waste which is not suitable for recycling is typically sent for energy recovery. There are also facilities in the region for segregation of municipal recyclables which is typically exported for conversion in recycled products (e.g. paper mills and glass recycling).

If waste material is not managed and stored correctly, it is likely to lead to litter or pollution issues at the development site and in adjacent areas. The knock-on effect of litter issues is the presence of vermin in affected areas. However, in the absence of mitigation, the effect on the local and regional environment is likely to be **indirect, *short-term, significant*** and ***negative****.*

Waste contractors will be required to service the proposed development on a regular basis to remove waste. The use of non-permitted waste contractors or unauthorised facilities could give rise to inappropriate management of waste and result in negative environmental impacts or pollution. It is essential that all waste materials are dealt with in accordance with regional and national legislation, as outlined previously, and that time and resources are dedicated to ensuring efficient waste management practices. However, in the absence of mitigation, the effect on the local and regional environment is likely to be **indirect, *long-term, significant*** and ***negative****.*

14.5.3 Decommissioning Phase

The greatest potential impact on waste during the decommissioning phase of the Proposed Development would be if the building waste to be demolished or refurbished.

The decommissioning of the proposed development will generate a range of non-hazardous and hazardous waste materials during site demolition / refurbishment. General housekeeping and packaging will also generate waste materials, as well as typical municipal wastes generated by construction employees, including food waste. Waste materials will be required to be temporarily stored on-site pending collection by a waste contractor. If waste material is not managed and stored correctly, it is likely to lead to litter or pollution issues at the development site and in adjacent areas. The indirect effect of litter issues is the presence of vermin in areas affected. In the absence of mitigation, the effect on the local and regional environment is likely to be **indirect, *short-term, significant*** and ***negative***.

The use of non-permitted waste contractors or unauthorised waste facilities could give rise to inappropriate management of waste, resulting in indirect negative environmental impacts, including pollution. It is essential that all waste materials are dealt with in accordance with the European Union, regional and national legislation, as outlined previously, and that time and resources are dedicated to ensuring efficient waste management practices. In the absence of mitigation, the effect on the local and regional environment is likely to be **indirect, *long-term, significant*** and ***negative***.

Wastes arising will need to be taken to suitably registered / permitted / licenced waste facilities for processing and segregation, reuse, recycling, recovery, and / or disposal, as appropriate. There are numerous licensed waste facilities in the Southern Region (SR) which can accept hazardous and non-hazardous waste materials, and acceptance of waste from the development site would be in line with daily activities at these facilities. At present, there is sufficient capacity for the acceptance of the likely C&D waste arisings at facilities in the region and within Ireland. The majority of construction materials are either recyclable or recoverable. However, in the absence of mitigation, the effect on the local and regional environment is likely to be **indirect, *short-term, significant*** and ***negative***.

14.5.4 Do Nothing Scenario

If the proposed development was not to go ahead (i.e. in the Do-Nothing scenario) there would be no demolition, excavation or construction or operational waste generated at this Site. There would, therefore, be a neutral effect on the environment in terms of waste.

14.6 REMEDIAL AND MITIGATION MEASURES

This section outlines the measures that will be employed in order to reduce the amount of waste produced, manage the wastes generated responsibly and handle the waste in such a manner as to minimise the effects on the environment.

14.6.1 Construction Phase

The following mitigation measures will be implemented during the construction phase of the proposed development :

As previously stated, a project specific C&D WMP has been prepared in line with the requirements of the requirements of the *Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects* (DoEHLG, 2006), and is included as Appendix 14.1. Adherence to the high-level strategy presented in this C&D WMP will ensure effective waste management and minimisation, reuse, recycling, recovery and disposal of waste material generated during the demolition, excavation and construction phases of the proposed development .

- Prior to commencement, the appointed Contractor(s) will be required to refine / update the C&D WMP (Appendix 14.1) in agreement with CCC, or submit an addendum to the C&D WMP to CCC, detailing specific measures to minimise

waste generation and resource consumption, and provide details of the proposed waste contractors and destinations of each waste stream.
- The Contractor will be required to fully implement the C&D WMP throughout the duration of the proposed construction and demolition phases.

A quantity of topsoil, sub soil, clay and made ground will need to be excavated to facilitate the proposed development. Project Engineers have estimated that excavated material will not need to be removed off-site. Correct classification and segregation of the excavated material is required to ensure that any potentially contaminated materials are identified and handled in a way that will not impact negatively on workers as well as on water and soil environments, both on and off-site.

In addition, the following mitigation measures will be implemented:

- Building materials will be chosen to 'design out waste';
- On-site segregation of waste materials will be carried out to increase opportunities for off-site reuse, recycling and recovery. The following waste types, at a minimum, will be segregated:
    - Concrete rubble (including ceramics, tiles and bricks);
    - Plasterboard;
    - Metals;
    - Glass; and
    - Timber.
- Left over materials (e.g. timber off-cuts, broken concrete blocks / bricks) and any suitable construction materials shall be re-used on-site, where possible;
- All waste materials will be stored in skips or other suitable receptacles in designated areas of the site;
- Any hazardous wastes generated (such as chemicals, solvents, glues, fuels, oils) will also be segregated and will be stored in appropriate receptacles (in suitably bunded areas, where required);
- A Waste Manager will be appointed by the main Contractor(s) to ensure effective management of waste during the demolition, excavation and construction works;
- All construction staff will be provided with training regarding the waste management procedures;
- All waste leaving site will be reused, recycled or recovered, where possible, to avoid material designated for disposal;
- All waste leaving the site will be transported by suitably permitted contractors and taken to suitably registered, permitted or licenced facilities; and
- All waste leaving the site will be recorded and copies of relevant documentation maintained.

Nearby sites requiring clean fill material will be contacted to investigate reuse opportunities for clean and inert material, if required. If any of the material is to be reused on another site as by-product (and not as a waste), this will be done in accordance with Article 27 of the EC (Waste Directive) Regulations (2011). EPA approval will be obtained prior to moving material as a by-product. However, it is not currently anticipated that Article 27 will be used.

These mitigation measures will ensure that the waste arising from the construction phase of the proposed development is dealt with in compliance with the provisions of the Waste Management Act 1996, as amended, associated Regulations and the Litter Pollution Act 1997, and the SR Waste Management Plan 2015 – 2021. It will also ensure optimum levels of waste reduction, reuse, recycling and recovery are achieved and will promote more sustainable consumption of resources.

14.6.2 Operational Phase

All waste materials will be segregated into appropriate categories and will be temporarily stored in appropriate bins, skips or other suitable receptacles in a designated, easily accessible areas of the site.

The Operator / Buildings Manager of the Site during the operational phase will be responsible for ensuring – allocating personnel and resources, as needed – the ongoing implementation of the below mitigation measures, ensuring a high level of recycling, reuse and recovery at the Site of the proposed development.

The following mitigation measures will be implemented:

- The Operator / Buildings Manager will ensure on-Site segregation of all waste materials into appropriate categories, including (but not limited to):
    - Organic waste including Vertical Farm organic waste;
    - Dry Mixed Recyclables;
    - Mixed Non-Recyclable Waste;
    - Glass;
    - Waste Oil;
    - Waste electrical and electronic equipment (WEEE) including computers, printers and other ICT equipment;
    - Batteries (non-hazardous and hazardous);
    - Light bulbs; and
    - Cleaning and Farming chemicals (pesticides, paints, adhesives, resins, detergents, etc.).
- The Operator / Buildings Manager will ensure that all waste materials will be stored in colour coded bins or other suitable receptacles in designated, easily accessible locations. Bins will be clearly identified with the approved waste type to ensure there is no cross contamination of waste materials;
- The Operator / Buildings Manager will ensure that all waste collected from the Site of the proposed development will be reused, recycled or recovered, where possible, with the exception of those waste streams where appropriate facilities are currently not available; and
- The Operator / Buildings Manager will ensure that all waste leaving the Site will be transported by suitable permitted contractors and taken to suitably registered, permitted or licensed facilities.

These mitigation measures will ensure the waste arising from the proposed development during the operational phase is dealt with in compliance with the provisions of the Waste Management Act 1996, as amended, associated Regulations, *the Litter Pollution Act 1997*, the *SR Waste Management Plan 2015 – 2021* and the CCC Waste Management Bye-Laws 2018. It will also ensure optimum levels of waste reduction, reuse, recycling and recovery are achieved.

14.6.3 Decommissioning Phase

The following mitigation measures will be implemented during the decommissioning of the proposed development:

- Prior to commencement, the appointed Contractor(s) will be required to prepare a Demolition or Refurbishment Waste Management Plan (DR WMP) in agreement with CCC, detailing specific measures to minimise waste generation and resource consumption, and provide details of the proposed waste contractors and destinations of each waste stream.

- The Contractor will be required to fully implement the DR WMP throughout the duration of the decommissioning.

In addition, the following mitigation measures will be implemented:

- On-site segregation of waste materials will be carried out to increase opportunities for off-site reuse, recycling and recovery. The following waste types, at a minimum, will be segregated:
    - Concrete rubble (including ceramics, tiles and bricks);
    - Plasterboard;
    - Metals;
    - Glass; and
    - Timber.
- All waste materials will be stored in skips or other suitable receptacles in designated areas of the site;
- Any hazardous wastes generated (such as chemicals, solvents, glues, fuels, oils) will also be segregated and will be stored in appropriate receptacles (in suitably bunded areas, where required);
- A Waste Manager will be appointed by the main Contractor(s) to ensure effective management of waste during the demolition / refurbishment works;
- All construction staff will be provided with training regarding the waste management procedures;
- All waste leaving site will be reused, recycled or recovered, where possible, to avoid material designated for disposal;
- All waste leaving the site will be transported by suitably permitted contractors and taken to suitably registered, permitted or licenced facilities;
- All waste leaving the site will be recorded and copies of relevant documentation maintained.

14.7 PREDICTED IMPACTS OF THE PROPOSED DEVELOPMENT

14.7.1 Construction Phase

A carefully planned approach to waste management as set out in Section 14.6.1 and adherence to the C&D WMP (Appendix 14.1) during the construction phase will ensure that the predicted effect on the environment will be ***short-term*, *imperceptible* and *neutral*.**

14.7.2 Operational Phase

During the operational phase, a structured approach to waste management as set out in Section 14.6.2 will promote resource efficiency and waste minimisation. Provided the mitigation measures are implemented and a high rate of reuse, recycling and recovery is achieved, the predicted impact of the operational phase on the environment will be ***long-term, imperceptible and neutral.***

14.7.3 Decommissioning Phase

A carefully planned approach to waste management as set out in Section 14.6.3 and adherence to a DR WMP during the demolition / refurbishment phase will ensure that the predicted effect on the environment will be ***short-term***, ***imperceptible*** **and** ***neutral*****.**

14.7.4 Conclusion

Assuming the full and proper implementation of the mitigation measures set out herein and, in the C&D WMP (Appendix 14.1), no likely significant negative effects are predicted to occur as a result of the construction or operational of the proposed development.

14.8 RESIDUAL IMPACTS

The implementation of the mitigation measures outlined in Section 14.6 will ensure that high rates of reuse, recovery and recycling are achieved at the Site of the proposed development during the construction and operational phases. It will also ensure that European, National and Regional legislative waste requirements with regard to waste are met and that associated targets for the management of waste are achieved.

14.9 CUMULATIVE IMPACT ASSESSMENT

The following considers the cumulative impacts of the proposed development along with permitted and operating facilities in the surrounding area in relation to Material Assets Waste Management.

14.9.1 Construction Phase

Multiple permissions remain in place (see Chapter 3 Planning and Alternatives for list) for both residential and commercial developments within the vicinity of the proposed development. In a worst-case scenario, multiple developments in the area could be developed concurrently or overlap in the construction phase. Due to the high number of waste contractors in the Clare region there would be sufficient contractors available to handle waste generated from a large number of these sites simultaneously, if required. Similar waste materials would be generated by all the developments.

Other developments in the area will be required to manage waste in compliance with national and local legislation, policies and plans which will mitigate against any potential cumulative effects associated with waste generation and waste management. As such the effect will be ***short-term, not significant*** and ***neutral***.

14.9.2 Operational Phase

There are existing residential and commercial developments close by, along with the multiple permissions remaining in place and the potential for more future development in the area. All of the current and potential developments will generate similar waste types during their operational phases. Authorised waste contractors will be required to collect waste materials segregated, at a minimum, into recyclables, organic waste and non-recyclables. An increased density of development in the area is likely improve the efficiencies of waste collections in the area.

Other developments in the area will be required to manage waste in compliance with national and local legislation, policies and plans which will minimise/mitigate any potential cumulative impacts associated with waste generation and waste management. As such the effect will be a **long-term, imperceptible** and **neutral**.

14.10 REFERENCES

1. Waste Management Act 1996 (No. 10 of 1996) as amended.
2. Protection of the Environment Act 2003, (No. 27 of 2003) as amended.
3. Litter Pollution Act 1997 (S.I. No. 12 of 1997) as amended
4. Southern Region Waste Management Plan 2015 – 2021 (2015).
5. Department of Environment and Local Government (DoELG) *Waste Management – Changing Our Ways, A Policy Statement* (1998).
6. Forum for the Construction Industry – Recycling of Construction and Demolition Waste.
7. Department of Communications, Climate Action and Environment (DCCAE), Waste Action Plan for the Circular Economy - Ireland's National Waste Policy 2020-2025 (Sept 2020).
8. Department of Environment, Heritage and Local Government, Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects (2006).
9. FÁS and the Construction Industry Federation (CIF), Construction and Demolition Waste Management – a handbook for Contractors and site Managers (2002).
10. Clare County Council (CCC), Clare County Development Plan 2017-2023 (As varied) (2017)
11. CCC, County Clare Waste Management Bye-Laws (2018)
12. BS 5906:2005 Waste Management in Buildings – Code of Practice
13. Planning and Development Act 2000 (No. 30 of 2000) as amended
14. Environmental Protection Agency (EPA), Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous (2015)
15. Council Decision 2003/33/EC, establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC.
16. EPA, *European Waste Catalogue and Hazardous Waste List* (2002)
17. EPA, National Waste Database Reports 1998 – 2018.
18. US EPA, *Characterisation of Building Uses* (1998);
19. EPA and Galway-Mayo Institute of Technology (GMIT), EPA Research Report 146 – A Review of Design and Construction Waste Management Practices in Selected Case Studies – Lessons Learned (2015)

15.0 INTERACTIONS – INTERRELATIONSHIPS BETWEEN THE ASPECTS

15.1 INTRODUCTION

This chapter has been produced following the guidance within the EIA Directive, the *Planning and Development Act 2000* (as amended), the *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* (EPA, 2017) and EPA Draft *Advice Notes for Preparing Environmental Impact Statements* (EPA, 2015).

In accordance with the guidance not only are the individual significant impacts required to be considered when assessing the impact of a development on the environment, but so must the interrelationships between these factors be identified and assessed.

The majority of the EIA Report chapters have already included and described assessments of potential interactions between aspects, considered by the various specialists contributing to this impact assessment. The quality, magnitude and duration of potential impacts are defined in accordance with the criteria provided in the EPA 2017 Guidance as outlined in Chapter 1 (Introduction). This section of the assessment presents a summary and assessment of the identified interactions.

Section 171A of the Planning and Development Act requires that the interactions between the following be assessed:

- Population and human health;
- Land, soil, water, air and climate;
- Biodiversity, with particular attention to species and habitats protected under the Habitats Directive and the Birds Directive; and
- Material assets, cultural heritage, and the landscape;

15.2 DISCUSSION – POSITIVE IMPACTS

The reasoning behind the interactions that are considered to have a positive effect (i.e. a change which improves the quality of the environment) is outlined in this section.

<u>Planning and Alternatives on:</u>

Population and Human Health

The proposed development will create up to 450 full time jobs within the data centre and 40 in the vertical farme during operation with an average of 600 during the construction phase, peaking at 1200, which will have a *long-term*, *positive* effect on employment.

15.3 DISCUSSION – NEUTRAL IMPACTS

The reasoning behind the interactions that are considered to have a neutral effect (i.e. no effects or effects that are imperceptible, within the normal bounds of variation or within the margin of forecasting error) is outlined in this section.

15.3.1 Land, Soils, Geology and Hydrogeology on:

Population and Human Health

There will be a loss of soil available for agricultural use due to the development. However, the area of development is zoned by Clare Co Co (CCC) for development and as such it is not intended that it will be returned to agricultural use. In addition, the employment created by the construction and operation of the proposed development counterbalances this economic loss to some extent and so the impact is *long-term, imperceptible* and *neutral*.

Hydrology

Levelling and landscaping will have the potential to increase suspended solids within run-off during construction. However, the implementation of a CEMP as detailed Chapter 6 (Hydrology) durng construction and desin measures (bunding of oil), SUDs meausres including attenuation and use of interceptors will ensure the effect will be The impact is *short term imperceptible* and *neutral during construction and long-term*, *imperceptible* and *neutral during operation.*

Biodiversity

The change in use of land from agricultural to industrial with result in loss of natural flora and fauna has been removed/displaced. However, the proposed landscaping as outlined in the landscape and biodiversity management plan will result in enhancing local biodiversity by incorporating native species and pollinator planting. The design measures and mitigation measures incorporated in the CEMP (and the surface water management plan) will ensure that there is no change in the overall water regime at water dependent habitats on site. The impact is *short term imperceptible* and *neutral during construction and long-term*, *imperceptible* and *neutral during operation.*

Archaeological, Architectural and Cultural Heritage

Although the archaeological assessment for the proposed development has identified no known features of archaeological interest on the site, aspects of the proposed development have the potential to impact on unidentified archaeological features during construction works. However, mitigation measures detailed in Chapter 11 (Archaeological, Architectural and Cultural Heritage) including a geophysical survey and test trenching and ceasing works if archaeological features or material is uncovered, will ensure that the effect is *short-term, imperceptible* and *neutral* during construction. Delinating of the archaeological buffer zone will ensure no impact to any archaeology during operation resulting in a *long-term*, *imperceptible* and *neutral impact* during operation.

Waste Management

As detailed in Chapter 14 (Waste Management), c. 107,376m^3 of material will be excavated and reused for landscaping and berms. Any spoil which cannot be reused on site will be removed off site for reuse or recovery, where practical, with disposal as last resort. Adherence to the mitigation measures in Chapter 14 and the requirements C&D Waste Management Plan (included as Appendix 14.1), will ensure the effect is *short-term, imperceptible* and neutral.

15.3.2 Hydrology on:

Population and Human Health

The proposed development will generate wastewater emissions (foul water) from the site. This will discharge following an upgrade of the foul sewer on the Tulla road to the Local Authority wastewater treatment plant (WWTP) at Gort Na mBlath located approximately 550 m west of the main site. The wastewater ultimately discharges to Ennis North (Clonroadmore) WWTP Reg D0048 which generally operates in compliance with its EPA licence. Consultation with CCC and IW has shown that there is sufficient capacity for the wastewater discharges from the proposed development. As the WWTP will provide treatment for wastewater emissions, the effect is considered to be *long-term, imperceptible* and *neutral*.

Land, Soils, Geology and Hydrogeology

Stormwater will be collected for hardstand areas and attenuated to greenfield run-off rates prior to discharge. However, a significant proportion of the site will remain greenfield and as such the impact on the groundwater regime will be *long-term*, *imperceptible* and *neutral*.

Biodiversity

The design measures and mitigation measures incorporated in the CEMP (and surface water management plan) will ensure that there is no change in the overall water regime at water dependent habitats on site. The impact is *short term imperceptible* and *neutral during construction and long-term*, *imperceptible* and *neutral* during operation.

Waste Management

Hydrocarbon sludge waste and debris will be generated in the hydrocarbon interceptors which will treat the surface water run-off from the proposed development during the operational phase. This waste stream will be managed in accordance with the relevant legislation identified in Chapter 14 such that the effect of the waste generation will be *long-term, imperceptible* and *neutral*.

15.3.3 Air Quality and Climate on:

Hydrology

Mitigation measures implemented during the construction phase will ensure that the deposition of dust is minimised and therefore the predicted effect from air (including dust) on the water environment during construction is *short-term, imperceptible* and *neutral*.

The operational procedures and other general site maintenance regime in accordance with the Environmental Safety and Health Management Procedures for the facilities will ensure that the impact of the facility complies with all ambient air quality legislative limits and therefore the predicted impact from air (including dust) on the water environment is *long term, imperceptible* and *neutral*.

Biodiversity

Mitigation measures during the construction phase of the proposed development will ensure that dust generation is minimised and the effect on biodiversity will be *short term*, *imperceptible* and *neutral*.

Results from the modelling of air emissions including emissions from back-up generators during the operational phase show that the emissions from the facility will comply with the relevant air quality legislative limits and the effect on biodiversity will be *long term*, *imperceptible* and *neutral*.

15.3.4 Air Quality and Climate on:

Population and Human Health

The design and mitigation measures set out in Section 8.6 of Chapter 8 (Air Quality and Climate) that will be put in place at the proposed facility will ensure that the impact of the facility complies with all ambient air quality legislative limits and therefore the predicted impact is *long term, imperceptible* and neutral

15.3.5 Landscape and Visual on:

Biodiversity

The construction of the proposed development will involve the removal of some of the existing natural hedgerows. However, this will be replaced by other suitable landscaping treatments and overall will have a *long-term, imperceptible* and *neutral* impact.

15.3.6 Material Assets on:

Population and Human Health

The proposed development will have an impact on material assets such as surface water drainage, water supply, wastewater drainage, power supply and road infrastructure. The individual chapters of this EIA Report (Chapter 12 Traffic and Transportation and Chapter 13 Material Assets) have assessed the capacities of the available infrastructure to accommodate the proposed development and the implementation of the mitigation measure proposed in these chapters will ensure there are no residual negative impacts on the local population. The predicted effect is *long term, not significant* and *neutral*.

Hydrology

The proposed development will result in changes to surface water drainage (as a greenfield site is being developed), water supply and wastewater networks. However, a combination of mitigation measures to be implemented as detailed in Section 7.6 of Chapter 6 (Hydrology), as well as the capacity already built into these networks, will ensure that these changes will result in a *long-term, not significant* and *neutral* impact.

15.4 DISCUSSION – NEGATIVE IMPACTS

The reasoning behind the interactions that are considered to have a negative effect (i.e. a change which reduces the quality of the environment) is outlined in this section.

15.4.1 Noise on:

Biodiversity

Noise generated during the construction phase of the proposed development will have a *short-term, slight and negative* impact on fauna which are likely to be displaced during construction works. During operation, following additional landscaping to provide suitable habitats, the impacts will be *longterm-term, imperceptible.*

15.4.2 Noise on:

Population and Human Health

The potential impact of noise and vibration on the local population is discussed in Chapter 4 (Population and Human Health) and Chapter 9 (Noise & Vibration). The application of noise limits and limits on the hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration impact is kept to a minimum. The noise impact is assessed to *be short-term* in duration with a *slight to moderate negative* significance considering the existing background low level of noise in this rural location. As reported, the noise impact will reduce to *slight* as construction moves above ground. Due to the distance between the site and the nearest sensitive locations, vibration impacts generated during construction are expected to be *short term* duration and *imperceptible* significance. Therefore, the noise and vibration impact of the construction phase of the proposed development is negative but not considered significant with respect to human health.

The predicted noise emissions associated with the proposed development of the site during the operational phases are within the relevant noise criteria considered suitable for the development considering the guidance outlined in EPA: *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4 – 2016)*. These guidelines consider impacts on human health. As such the modelling has due consideration to human health, and has shown that although there will be an increase in noise as a result of the operation of the facility, this is not considered to have a significant impact on human health. The proposed development will not generate any perceptible levels of vibration during operation and therefore there will be no impact from vibrations on human health.

15.4.3 Traffic on:

Population and Human Health

The traffic assessment shows that the impacts on the local community resulting from the additional traffic movements associated with the proposed development were found to be *short-term, negative* and *slight* for the construction phase and *long-term, negative* and *slight* for the operational phase. No significant traffic delays are forecast during either the construction or operational phases.

15.4.4 Air Quality on:

Landscape

The proposed development will include industrial type generator stacks which will permanently alter the existing landscape. The generator stacks associated with the Data Centres will not be visible as they will be screened by the Data Centres and the proposed landscaping measures. The taller 25m stacks associated with the Energy Centre have greater potential for visibility. However, due to the siting of the Energy Centre next to the tall hill on site, views towards the stacks from the east and south will be screened for the most part. In views from the north and west, where the stacks may be visible these will be viewed at a similar vertical scale to existing trees on the horizon. The residual landscape and visual effects are considered to range from *long term negative*, *moderate significance* down to *not Significant.*

15.4.5 Landscape and Visual on:

Population and Human Health

The predicted impact of the proposed development on the landscape is described in Chapter 10. The proposed development is well-sited and includes architectural and landscape proposals that will ensure the development is integrated into its setting, including the use of landscaped berms and woodland planting which will provide visual screening. Residual impact in terms of landscape amenity will be *long term*, negative and *moderate significance.*

15.4.6 Land, Soils, Geology and Hydrogeology on:

Noise

Impacts associated with excavation works will be transient in nature and have a temporary to short-term impact on the noise environment, which will be mitigated by the implementation of the measures outlined in Chapter 9. The effect of construction noise impacts will be *slight to moderate (dependant on location), negative* and *short-term* in nature. Also, it is considered that as the proposed development progresses from initial ground works that construction noise impacts will reduce to slight. There is no longterm interaction.

15.5 SUMMARY

In summary, the interactions between the environmental factors and impacts discussed in this EIA Report have been assessed and the majority of interactions are *short to long-term* and *neutral*.

15.6 TABLE OF INTERACTIONS

Table 15.1 Summary of interrelationships Between the Aspects

	Planning and Alternatives		**Population & Human Health**		Land, Soils and Hydrogeology		Hydrology		Biodiversity		Air Quality and Climate		Noise and Vibration		Landscape and Visual Impact		Cultural Heritage		Material Assets, including Transport and Waste	
	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.
Planning and Alternatives			+	+	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕
Population & Human Health					o	o	o	o	✕	✕	o	o	-	-	-	-	✕	✕	o	o/-
Land, Soils and Hydrogeology							o	o	o	o	-	✕	-	✕	✕	✕	o	✕	o	o
Hydrology									o	o	o	o	✕	✕	✕	✕	✕	✕	o	o
Biodiversity											o	✕	-	✕	o	o	✕	✕	✕	✕
Air Quality and Climate													✕	✕	✕	-	✕	✕	✕	✕
Noise and Vibration															✕	✕	✕	✕	✕	✕
Landscape and Visual Impact																	✕	✕	✕	✕
Cultural Heritage																			✕	✕
Material Assets, including Transport and Waste																				

Con.	Construction Phase
Op.	Operational Phase
✕	No Interaction

+	Positive Interaction
o	Neutral Interaction
-	Negative Interaction