ENVIRONMENTAL IMPACT ASSESSMENT REPORT

for

Internal Works & Change in Activity
at
Abbvie Ireland, NL B.V
Ballytivnan, Sligo

prepared for

on behalf of

by

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1 INTRODUCTION

1.1 INTRODUCTION AND TERM OF REFERANCE

1.1.1 GENERAL

Environmental Impact Services has been commissioned by Jacobs to carry out an Environmental Impact Assessment (EIA) and prepare an Environmental Impact Statement Report (EIAR) for the proposed development at the existing Abbvie Ireland facility in Ballytivnan County Sligo.

Abbvie Ireland NL B.V (hereafter referred to as Abbvie) has decided to develop an integrated bio-chemical suite at their facility at Ballytivnan Sligo. The facility at Ballytivnan is located approximately 1.7km north east of Sligo town centre as shown in Figure 1.1. The site is also located approximately 1 km from another Abbvie facility on the Manorhamiltion Road established in 2002.

The proposed project consists of internal alterations to accommodate an integrated Bio-Chemical manufacturing facility sized 3,476 square metres, within the building fabric of the existing Abbvie Ballytivnan building.

Internal alterations to accommodate an integrated Bio-Chemical manufacturing facility sized 3,476 square metres (m^2), within the existing Abbvie Ballytivnan building.

New roof-mounted plant and Penthouse Louvres 1.8 m high and removal of existing roof-mounted equipment. The construction of additional plant room internal mezzanines, sized 645 m^2 within the existing building and an external single storey extension sized 20 m^2 and 9.6 m high, located to the north of the existing facility. A revised yard layout, located to the north of the existing facility, including a new single storey electrical room extension sized 155 m^2 and 7.1 m high. The enclosure of an existing walled yard area with a new roof and cladding, sized 150 m^2, to house chillers. The addition of 4 no. new boiler flues, 17.5 m high above ground level and 500 mm diameter. 2 no. new above-ground bunded waste water holding tanks, housed in a building sized 110 m^2 and 9 m high, and associated tanker un-loading area. 2 no. bunded underground tanks housed in a building sized 75 m^2 and 4 m high. 3 no. cooling towers 9 metres high. A nitrogen tank sized 8 metres high and 2 m diameter, and an emergency generator and its associated diesel tank and its 10 m high stack.

Site works include revised road and car parking layouts, additional temporary contractor related car parking for 109 cars located to the east of the existing electrical substation. Underground and over-ground utilities, landscaping and a landscaped berm. A single storey sprinkler pumphouse sized 24 m^2 and 6 m high. New sprinkler tank and site fencing.

The description included in Section 4 *Project Description* of this EIAR describes the proposal in more detail and the further details are included in the planning application documents and drawings which accompany this EIAR in the application for planning permission to Sligo County Council.

Figure 1.1 Site Location[1]

1.1.2 OBJECTIVES OF THIS EIAR

The core objectives of this EIAR are to predict any significant environmental impacts that are likely to occur due to the proposed development and, where applicable, propose measures to avoid, reduce or remedy them.

It reports on the findings of the EIA process to date and informs the Planning Authority (Sligo County Council), statutory consultees, other interested parties and the public in general about the likely effects of the project on the environment.

In doing this the EIAR has been prepared in compliance with the EU Directive on EIA. Section 2 *Screening & Scoping* provides details of the Directive as well as the Irish legislation that has been followed and the guidelines that have been taken into account. The relationship between this EIAR and other assessments prepared under separate legislation is also discussed in Section 2.

[1] Source: *Google Maps*

1.2 EIAR FORMAT

This EIAR follows a grouped format structure. Using this structure the EIAR examines each environmental topic in a separate section. These sections generally follow this format:

Table 1.1 EIAR Format Structure

Section	Notes
Introduction/methodology	
the proposed development	including measures incorporated to avoid, prevent or reduce environmental effects (design stage mitigation)
the receiving environment	
predicted impacts	focussing on impacts that are likely and significant
mitigation measures	post-assessment measures were required to reduce, remedy or offset predicted impacts
residual impacts	where relevant

Interactions between issues that arise in separate sections are assessed as they occur in each section. Cumulative effects are similarly assessed as appropriate in the relevant sections of the EIAR. The final section of the EIAR, Section 16 *Interactions & Cumulative Effects*, shows where interactions and cumulative effects have been identified and how they have been addressed.

Section 2 *Screening & Scoping*, gives more detail on the issues addressed under each heading.

Separate reports prepared in accordance with other (non-EIA) requirements cover other topics. A full list of these is provided in the Planning Report. They include:

- Appropriate Assessment (AA) Screening Report
- Flood Risk Assessment (FRA) Screening Report
- Traffic and Transportation Assessment (TTA) Report
- Outline Construction Environmental Management Plan
- Sustainability Statement
- Planning Application Report

Some of these reports are also relevant in the consideration of the prescribed EIA topics so these are referred to in the EIAR, as and where appropriate. For example, the Water & Hydrology section refers to the FRA Screening and Civil Drainage Reports, the Traffic & Transportation section refers to the TTA Report and MMP and the Biodiversity section refers to the AA Screening Report.

The mitigation measures proposed in an EIAR constitute important and enforceable undertakings about the details of how a project is developed and managed. For ease of comprehension – especially during the EIA process by Consenting Authorities – it has proven useful to have an overview of all of the measures that are proposed within the EIAR to mitigate adverse effects. Appendix 1.1 provides a collection – or compendium – of all of the mitigation measures that are proposed.

1.3 STUDY TEAM

Table 1.2 Study Team for EIAR

Role	Personnel	Company
Study Director	Conor Skehan	Environmental Impact Services
Study Manager	Paul Fingleton	Environmental Impact Services
Study Coordinator	Andrew Reynolds	Environmental Impact Services
Specialist Topics (Section 2 *Screening & Scoping* sets out the basis for selection of these topics)		
Population & Human Health	Tómas Glancy	AOS Planning
Biodiversity	Andrew Torsney	Environmental Impact Services
Land, Soils, Geology & Hydrogeology	Teri Hayes Colm Driver	AWN Consulting
Water & Hydrology	Terri Hayes Colm Driver	AWN Consulting
Air Quality & Climate	Ciara Nolan	AWN Consulting
Noise and Vibration	Dermot Blunnie	AWN Consulting
Landscape	Conor Skehan	Environmental Impact Services
Material Assets	Paul Fingleton & Andrew Reynolds	Environmental Impact Services
Traffic & Transportation	Kevin Burke	Jacobs Engineering
Waste Management	Elaine Neary Emer O'Brien	AWN Consulting
Cultural Heritage	Paul Fingleton Andrew Reynolds	Environmental Impact Services
Interactions & Cumulative Effects	Paul Fingleton Andrew Reynolds	Environmental Impact Services

Study Director - Conor Skehan (BSC), (MLArch) Master of Landscape Architecture, University of Pennsylvania, 1983. Conor has been chartered by a number of professional Institutes including the International Association for Impact Assessment; the Irish Landscape Institute; the Royal Institute of the Architects of Ireland; and the Irish Planning Institute. He co-founded and served as President of the Irish Landscape Institute from 1993 to 1994. Environmental Impact Services is a Registered Assessor member of the Institute of Environmental Assessment (UK). Conor is an Architect, Landscape Architect, Strategic Planner, Impact Analyst, academic and writer.

He has worked for over 30 years in many countries providing strategic and spatial planning and environmental consultancy to a wide range of government, public and private clients on assignments varying in scale from very large-scale infrastructural and industrial projects to large urban renewal and tourism projects. He has made significant contributions to a wide range of complex Environmental Impact Statements, planning applications and environmental reports for Industry (ICT, Bio-pharma) , Infrastructure (road, rail, airport, port, power, energy waste, drainage and water supply), Institutions (hospital, prison projects) as well as major urban renewal and extension projects

Study Manager, Paul Fingleton has an MSc in Rural and Regional Resources Planning (with specialization in EIA), University of Aberdeen, 1990. Paul is a member of the International Association for Impact Assessment as well as the Institute of Environmental Management and Assessment. Paul has over twenty years' experience working in the area of Environmental Assessment. Paul has been involved in a diverse range of projects including contributions to, and co-ordination of, a number of complex EIARs, NISs and / or IPPCL Applications for projects.

Study Coordinator - Andrew Reynolds has a BSc in Environmental Planning and Management, Dublin Institute of Technology, 2015. Andrew has contributed to a number of complex Environmental Impact Statements, planning applications and environmental reports. He has experience working as part of team projects and in the preparation of EIA documents on behalf of multi-nationals and infrastructural providers for a diverse range of projects.

Population & Human Health - Tomás Glancy has a BSc in Spatial Planning, Dublin Institute of Technology, 2015. Tomás is a member of the Irish Planning Institute (IPI). Tomás experience working as part of team projects and in the preparation of planning and EIA documents on behalf of multi-nationals and infrastructural providers.He also liaises with the various government agencies and local authorities in order to assimilate the environmental baseline information that is used in SEAs and EIAs and assists in the preparation of the various SEA and EIA related documentation.

Biodiversity - Andrew Torsney has an MRes in in Biodiversity and Conservation from the University of Leeds. Andrew is a full member of the Chartered Institute of Ecology and Environmental Management (MCIEEM). Andrew has over five years' experience working as an Ecologist on both national and local scale projects. His experience ranges from academic research which has been implemented by practical management to extensive consultancy work. Andrew has designed and coordinated ecological elements of Environmental Impact Assessments (EIA) for multiple large scale projects.

Land, Soils, Geology & Hydrogeology and Water & Hydrology - Teri Hayes, BSc, MSc in Hydrogeology, 1990. Teri is a member of the International Association of Hydrogeologists (Irish Group) – former president and the Institute of Geologists of Ireland – Professional Member. Teri is a Director with AWN with 22 years of experience in water resource management and environmental assessment and remediation. She has contributed to numerous environmental impact assessments and design of appropriate mitigation measures, acted as an expert witness at public hearings, lectured in EIA and providing expert advice on EIA sections for planning authorities.

Land, Soils, Geology & Hydrogeology and Water & Hydrology – Colm Driver
Colm is an Environmental Consultant and Hydrogeologist at AWN Consulting Ltd. Colm obtained a Master's degree in Hydrogeology & Water Management from Newcastle University in the UK. Colm completed his undergraduate degree in UCD with a major in Geology. Colm is a recent graduate in AWN and has over 1.5 years of experience in hydrogeology, hydrology environmental impact assessment, contaminated land investigation, risk assessments and flood risk assessments (Stage I & Stage II).

Air Quality & Climate – Ciara Nolan is an Environmental Consultant in the Air Quality section of AWN Consulting. She holds a BSc (Hons) in Energy Systems Engineering from University College Dublin and has also completed an MSc in Applied Environmental Science at UCD. She is an Associate Member of the Institute of Air Quality Management. She specialises in the fields of ambient air monitoring, indoor air monitoring and EIAR.

Noise and Vibration – Dermot Blunnie (Senior Acoustic Consultant) holds a BEng(Hons) in Sound Engineering, MSc in Applied Acoustics and has completed the Institute of Acoustics (IOA) Diploma in Acoustics and Noise Control. He has been working in the field of acoustics since 2008 and is a member of the Institute of Engineers Ireland (MIEI) and the Institute of Acoustics (MIOA). He is experienced in building, environmental and architectural acoustics. He has extensive knowledge of all aspects of environmental surveying, noise modelling and impact assessment for various sectors including, energy, industrial, commercial and residential.

Traffic & Transportation – Kevin Burke graduated with an MSc in Town and County Planning from Queens University Belfast in 2005. Since then he has worked in a variety of urban planning and transport planning roles in Australia, New Zealand, the UK and Ireland. Kevin has produced a number of high profile transport strategies and been involved in the assessment and preparation of planning applications for strategic development sites for both the public and private sector.

Waste Management – Elaine Neary, BA (Natural Sciences), MApplSc. (Environmental Science) and is a Chartered Member of the Institute of Waste Management (MCWIM). She is an Associate in AWN and has over 14 years' experience in environmental consultancy with extensive experience in Waste Management and Environmental Impact Assessment. She has project managed, coordinated and prepared specialist inputs including the Waste Management Chapters, Operational and C&D Waste Management Plans for numerous EIS/EIA's.

Waste Management Chapter - Emer O'Brien, BSc (Environmental Management), MSc. (Environmental Science) and is a Graduate Member of the IEMA. She is an environmental consultant with AWN Consulting with a focus on Environmental Management, including Waste Management. She has prepared specialist Waste input for numerous EIS/EIA's including the Waste Management Chapters, Operational and C&D Waste Management Plans.

1.4 IMPACT PREDICTIONS

Rating of potential environmental impacts in the specialist sections is shown in Table 1.3 and is generally in accordance with the Glossary of Impacts contained in the EPA Guidelines[2], except where otherwise stated. This takes account of the quality, significance, duration and type of impact characteristic identified.

In this EIAR, consideration is given to both the importance of an attribute and the magnitude of the potential environmental impacts of the proposed activities on that attribute.

The duration of each impact is considered to be temporary, short-term, medium term, long- term, or a permanent impact. Temporary impacts are considered to be those which are construction related and last less than one year. Short term impacts are seen as impacts lasting one to seven years; medium-term impacts lasting seven to fifteen years; long-term impacts lasting fifteen to sixty years; and permanent impacts lasting over sixty years.

[2] Draft revised Guidelines on the information to be contained in Environmental Impact Statements, EPA, 2017 (Section 5)

Table 1.3 Impact Predictions[3]

Impact 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
	Slight	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities
	Moderate	An impact that alters the character of the environment in a manner consistent with existing and emerging trends
	Significant	An impact, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
	Profound	An impact which obliterates sensitive characteristics
Duration	Short-term	Impact lasting one to seven years
	Medium-term	Impact lasting seven to fifteen years
	Long-term	Impact lasting fifteen to sixty years
	Permanent	Impact lasting over sixty years
	Temporary	Impact lasting for one year or less
Type	Cumulative	The addition of many small impacts to create one larger, more significant impact
	'Do Nothing'	The environment as it would be in the future should no development of any kind be carried out
	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
	'Worst Case'	The impacts arising from a development in the case where the mitigation measures may substantially fail

1.5 DIFFICULTIES ENCOUNTERED

The EIA Regulations require that difficulties such as technical deficiencies, lack of information or knowledge encountered in compiling any specified information for the EIAR be described. In general, there were no significant difficulties encountered in the production of this EIAR. Any issues encountered during assessment of individual factors are as noted within the specialist sections.

[3] Adapted from *Glossary of Impacts* contained in EPA, draft revised *Guidelines on the information to be contained in Environmental impact Statements*, 2017

1.6 LEVEL OF DETAIL IN PROJECT DESCRIPTION

Some of the information provided in the description of the project (Section 4) will be subject to slight changes for these reasons:

- All descriptions of proposed developments are approximations compared to the finished development. The nature of the construction process limits the amount of detail that is available at this planning consent stage to documentation that may be decried as 'General Arrangement Illustrations'.

- While an outline Construction Environmental Management Plan (CEMP) is provided – some of the details of how the project is built will be a matter for the contractor who is awarded the project following a competitive tendering process. However it will need to be ensured that the environmental effects of any variations stay within the envelope of effects predicted in this EIAR.

- The detail required for later more specific consents – such as an IED licence application to the EPA – will be submitted to the relevant authority within the ranges and tolerances referred to herein or as otherwise agreed.

In all of these circumstances the project description specifies the outermost ('not to exceed') characteristics of the proposed development – maximum dimensions, tolerance for variation, maximum emissions, range of technologies and processes to be employed etc. This facilitates an evaluation of 'worst case' environmental effects. Actual effects will not exceed the predicted effects.

1.7 A NOTE ON QUOTATIONS

By their nature, Environmental Impact Assessment Reports contain statements about the proposed development, some of which are positive, and some less than positive. Selective quotation or quotations out of context can give a misleading impression of the findings of the study. Therefore, the study team urge that quotations should, where reasonably possible, be taken from the conclusions of specialists' sections or from the non-technical summary and taken not selectively or out of context.

2 SCREENING & SCOPING

2.1 LEGISLATION AND GUIDANCE

EIAs are carried out in response to the requirements of the European Directives on the assessment of the effects of certain public and private projects on the environment, as codified in Directive 2011/92/EU. The enabling statutory instruments (S.I.s) which transpose these Directives into law in Ireland are the European Communities (Environmental Impact Assessment) Regulations, 1989, as updated by the Planning and Development Acts 2000 to 2006 (the EIA Regulations), with the main legislation being S.I. 600/01. These Regulations outline the classes of projects subject to Environmental Impact Assessment (EIA) and the statutory format and content for an EIAR.

This EIAR has been prepared in accordance with the above and has regard to other relevant regulations such as the Environmental Protection Agency (EPA) *Guidelines on information to be contained in Environmental Impact Statements* (EPA 2002), the EPA *Advice Notes on Current Practice in preparation of Environmental Impact Statements* (EPA 2003) and relevant European Commission guidance documents[4].

A revised EIA Directive 2014/52/EU was adopted by the European Council on of 16 April 2014. This amends Directive 2011/92/EU. The deadline for Member States to bring into force the laws, regulations and administrative provisions necessary to comply with the amended Directive was 16 May 2017. As the amended Directive has come into force but regulations transposing it into national legislation have not been yet been enacted, the principle of direct effect applies.

The key changes affecting the information to be contained in an EIAR are set out in Table 2.1 below.

The EPA has made draft revised *Guidelines on the information to be contained in Environmental Impact Assessment Reports* (2017) available. While these are subject to further review by the EPA including changes to ensure alignment with the transposing legislation, they do indicate the changes that are likely to be introduced, particularly changes in the information that will be required to be contained in an EIAR to make it compliant with the new legislation. This EIAR has been prepared to comply with the current regulations and to anticipate and address the new requirements introduced by Directive 2014/52/EU. It follows the current Guidelines while also taking account of the changes contained in the draft revised Guidelines.

An Appropriate Assessment (AA) Screening has also been carried out to assess the potential of the proposal to affect the integrity of the Natura 2000 network. Its findings are provided in an AA Screening Report which is included as a separately bound document within the planning application document set. The findings of the screening report are referred to in the Biodiversity section of this EIAR, without duplicating its contents.

The relationship between this EIAR and other assessments prepared under separate legislation is discussed in Section 2.3.2.

[4] Including EIA-Guidance on Screening, EIA-Guidance on Scoping and EIA Review Checklist, all EC, 2001.

Table 2.1 How & where key changes arising from EIA Directive 2014/52/EU have been addressed

Change	Notes on Coverage in this EIAR	Section / Document Reference(s)
Mandatory assessment of 'reasonable alternatives'	Covered	Section 3 *Consideration of Alternatives*
Factor of *Human Beings* replaced by *Population & Human Health*	This change clarifies the meaning of *Human Beings* as *Population & Human Health*. Population is covered by a socio-economic assessment of the proposal. Human Health is addressed under the various factors through which effects on human health could be caused, e.g. Air Quality, Noise, Traffic.	Sections 5 to 14 and Section 16
Factor of *Flora & Fauna* replaced by *Biodiversity*	This change in title aligns with current terminology and does not affect the scope of this factor.	Section 6 Biodiversity
Introduction of topic of *Land*	This is largely intended to cover the effects of removal of land from other productive uses, primarily agricultural production.	Section 7 Land, Soils, Geology & Hydrogeology
Environmental effects of climate change risks to the development	There are no risks to the site, e.g. due to flooding of chemical storage areas which could affect surrounding flooded areas, that would have significant potential to cause environmental effects.	The separate Flood Risk Assessment Screening Report considers flood risk
Requirement for competent experts to prepare the EIAR	The study team are all appropriately qualified, experienced and expert in their respective fields.	Section 1.3 *Study Team*
Requirement for mitigation and monitoring proposals to be included in consent permission while avoiding duplication of monitoring under other EU legislation	Mitigation and monitoring measures proposed in the EIAR are clearly set out so that they can be readily referred to or included in planning condition. Duplication of monitoring required under other EU legislation such as Waste or Industrial Emissions Licencing is avoided. Measures incorporated into the design to avoid or reduce potential effects are generally described as being part of the proposed development. Mitigation measures proposed after the assessment of impacts in each section are generally limited to measures to reduce, remedy or offset specific predicted impacts. This approach facilitates alignment with the requirement of the amended Directive.	Sections 5 to 15 of the EIAR and Appendix 1.1 *Compendium of Mitigation Measures*
Requirement to consider assessments carried out under other EU Directives, while avoiding duplication of assessment	Covered.	Ref. section 2.3.2

2.2 SCREENING

The legislation[5] specifies classes of development and thresholds for determining which projects should be subject to EIA. Projects that fall into any of the specified classes or exceed the thresholds automatically require EIA. The legislation sets out criteria for deciding whether 'sub-threshold' projects should be subject to EIA.

The applicable class of development in this case is Type 6(e) in Part 1 of Schedule 5 to the Regulations[6]:-

> *Integrated chemical installations, i.e. those installations for the manufacture on an industrial scale of substances using chemical conversion processes, in which several units are juxtaposed and are functionally linked to one another and which are-*
>
> *(e) for the production of basic pharmaceutical products using a chemical or biological process*

The plant is currently a medical device production facility and no 'production of basic pharmaceutical products using a chemical or biological process' takes place on the site. The subject proposal introduces a bio-chemical process to the facility which causes it to fall into this class. There is no threshold associated with this class so scale is not relevant.

As the development causes the plant to fall into a project class contained in Schedule 5 and the Regulations give no threshold for this class, an EIAR must be submitted as part of the planning application.

2.3 SCOPING

2.3.1 BASIS OF SCOPING FOR THIS EIAR

Scoping is the process of identifying potential concerns that need to be examined in detail in an EIAR. The determination of potential concerns to be addressed in this EIAR was largely based on:

- the requirements of the EIA Regulations;
- the requirements of the EIA Directive 2011/92/EU (as amended);
- the Environmental Protection Agency's revised draft *Guidelines on the information to be contained in Environmental Impact Statements* (EPA, 2017) and *Advice Notes on Current Practice (in the preparation of EISs*) (EPA, 2003) ;
- the Environmental Protection Agency's draft *Revised Guidelines on the information to be contained in Environmental Impact Assessment Reports* (EPA 2015); and
- experience of the project team in preparing previous Environmental Impact Statements and EIARs.

The scoping process included circulation to and discussion of a draft scoping document with Sligo County Council. This is included as Appendix 2.1 to this EIAR. The sections which follow all follow the requirements of the agreed scope. The scope continued to be developed throughout the period of preparation of the EIAR based on the feedback received, practically relating to the flood risk issue identified in the Flood Risk Assessment (FRA) Screening Report submitted as part of this application.

As noted in the scoping document, the amendments to the EIA Directive include a requirement to consider the potential for the proposal to give rise to or be affected by accidents or disasters. The accompanying Flood Risk Assessment Screening report (ref section 2.3.2 below) finds that there are no significant flood risks associated with the proposal. The site is not a Seveso[7] site as it does not

[5] Particularly the Planning & Development Regulations, 2001 (S.I. 600/2001, as amended) and the EIA Directive 2011/92/EU (as amended).
[6] Planning & Development Regulations, 2001 (as amended)
[7] Ref Seveso Directive 82/501/EEC (as amended)

exceed the prescribed hazard criteria. A review has found that the proposal does not change this status as the quantities of chemicals used at the site are low. The design of the development and all details during fit-out and operation will be required to comply with strict design and safety standards. Compliance with these standards will ensure that risks are avoided or managed with safeguards put in place where appropriate. There is no significant environmental risk arising from elements of the proposal which could cause, or be affected by, accidents or disasters.

2.3.2 RELATIONSHIP BETWEEN THE EIAR AND ASSESSMENTS UNDER OTHER EU DIRECTIVES AND LEGISLATION

This EIAR takes account of available results from other relevant assessments while avoiding duplication of those assessments, particularly the following:

The Industrial Emissions Directive (20120/75/EU)
The development will be subject to an Industrial Emissions (IE) licence from the EPA. The licence (review) will be applied for after the planning application stage and in time for the licensing process to be completed prior to commencement of the proposed process operations in the extension.

Sections 7 to 10 of this EIAR (*Land, Soils, Geology & Hydrogeology*, *Water & Hydrology*, *Air Quality & Climate*, *Noise & Vibration* and *Waste Management*) refer to aspects that will be covered in more detail in the IE licence application.

The Habitats and Birds Directives (92/43/EEC and 79/409/EEC)
The proposal has been screened for requirement for a Natura Impact Statement (a.k.a. a Stage 2 Appropriate Assessment or AA). This screening has assessed the potential for the proposal to affect the integrity of the Natura 2000 network of protected sites and the findings are contained in a separate AA Screening report. Section 6, *Biodiversity*, takes account of the results of this screening report as relevant, without duplicating its contents.

The Waste Directive (2009/98/EC)
Section 10, *Waste Management*, and the *Construction & Demolition Waste Management Plan* in Appendix 10.1 consider aspects which also fall under this Directive, as appropriate.

The Floods and Water Framework Directives (2007/60/EC and 2000/60/EC)
A Flood Risk Assessment screening report and a Civil Engineering Planning Report are included as part of the planning permission application documents. The former follows the specific requirements of *The Planning System and Flood Risk Management - Guidelines for Planning Authorities* (OPW and the Department of the Environment and Local Government, 2009). Section 8 *Water & Hydrology* takes account of material presented in both of those reports as relevant. It also refers to requirements arising from the Water Framework Directive.

2.4 APPROACH TO EIAR REQUIREMENTS INTRODUCED BY DIRECTIVE 2014/52/EU

Table 2.2 Approach to EIAR Requirements Introduced by Directive 2014/52/EU[8]

Relevant requirement	Approach in this EIAR
description of reasonable, relevant alternatives	the alternatives are appropriate and relevant to the project brief, for an expansion at an existing facility in a suburban location
mandatory implementation of mitigation and monitoring measures	the mitigation measures and monitoring proposals arising from the EIA process are clearly set out to facilitate implementation
requirement for incorporation of mitigation and monitoring measures in consents and ensuring that developers deliver these measures	the mitigation measures and monitoring proposals arising from the EIA process are copied in a compendium of mitigation and monitoring measures (Appendix 1.1) to facilitate incorporation in the consent and post-consent implementation and auditing
addition of 'Land' as a prescribed environmental factor	this aspect is described and addressed, primarily in terms of impact on availability of the land for other beneficial purposes
replacement of prescribed environmental factor of 'Human Beings' with 'Population and Human Health'	Human Health is addressed by reference to relevant safety standards and hazard assessments and to the assessment of the proposal under the relevant environmental factors (e.g. Air Quality)
'Flora & Fauna' is replaced by 'Biodiversity'	the new title is used
streamlining	relevant assessments carried out under other Directives are referred to as applicable
EIA Quality	the competent expertise of all EIAR contributors is set out at the beginning of the report
demolition works	the EIAR describes and assesses the likely significant effects of any demolition works
use of natural resources during construction and operation	these are identified in the project description and assessed in the specialist sections as relevant to the assessment of likely significant effects
impacts of climate change on the project as well as impacts of the project on climate change	the principal potentially relevant effects of climate change on the proposal will be flooding and these are addressed in the separate Flood Risk Assessment which is referred to in the section of the EIAR dealing with hydrology
risks to human health, cultural heritage or the environment (due for example to accidents or disasters)	risks to human health, cultural heritage or the environment are addressed under the prescribed environmental factors / risks due to accidents or disasters are addressed as relevant by reference to the site's IE licence and safety assessment / compliance information

[8] as set out in Appendix II of the draft *Guidelines on the information to be contained in* EIARs (EPA, 2017)

3 ALTERNATIVES

3.1 INTRODUCTION

Before looking at the impacts of any development on the environment, the Planning and Development Regulations[9] require the EIAR to include an outline of the main alternatives studied by the developer and an indication of the main reasons for the selected choice, taking into account the effects on the environment.

3.1.1 LEGISLATION

The amended Directive[10] states that information to be contained in an EIAR shall include:

> *"(d) a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment;."*

While this wording is similar to the requirement contained in the Regulations[11], the words *reasonable*, *relevant* and *specific characteristics* are significant changes.

3.1.2 GUIDELINES

The Environmental Protection Agency's revised draft *Guidelines on the Information to be contained in Environmental Impact Statements*[12] gives considerable coverage to alternatives because the consultation about the effectiveness of EIA practice found that "the acceptability and credibility of EIA findings can be significantly affected by the extent to which this issue is addressed."

The Guidelines deal with the issue of alternatives under three key headings.

> *The consideration of alternative routes, sites, alignments, layouts, processes, designs or strategies, is the single most effective means of avoiding environmental impacts. The acceptability and credibility of EIA findings can be significantly affected by the extent to which this issue is addressed.*
>
> *However, it is important, from the outset, to acknowledge the existence of difficulties and limitations when considering alternatives. These include:*
>
> - *Hierarchy*
> - *Non Environmental Factors*
> - *Site Specific Issues*
>
> ***Hierarchy***
> *Many projects, especially in the area of public infrastructure, arise on account of plans, strategies and policies which have previously been decided upon. It is important to acknowledge that in some instances neither the applicant nor the competent authority can be realistically expected to examine options which have already been previously determined by a higher authority (such as a national plan or regional programme for infrastructure or a spatial plan).*

[9] 2001 – 2006 (S.I 600/2001), Schedule 6
[10] Article 5, 1 (d) of Council Directive 2011/92/EC (as amended by Directive 2014/52/EU)
[11] Schedule 6, 1 (d) of S.I. No. 600/2001 - the Planning and Development Regulations, 2001
[12] The 1992 Environmental Protection Agency Act (Section 72) provides for the preparation by the Environmental Protection Agency of guidelines on the information to be contained in an Environmental Impact Statement. The Act further provides that those preparing and evaluating Environmental Impact Statements shall have regard to such guidelines.

Non-environmental Issues
EIA is confined to the environmental effects which influence the consideration of alternatives. It is important to acknowledge that other non-environmental factors may have equal or overriding importance to the developer, e.g. project economics, land availability, engineering feasibility, planning considerations.

Site Specific Issues
The consideration of alternatives also needs to be set within the parameters of the availability of land (it may be the only suitable land available to the developer) or the need for the project to accommodate demands or opportunities which are site specific. Such considerations should be on the basis of alternatives within a site e.g. design, layout.

For the purposes of the Regulations, alternatives may be described at three levels:

1. *Alternative Locations*
2. *Alternative Designs*
3. *Alternative Processes*

As this development is an internal alternation to an existing facility, there was minimal scope for consideration of (*reasonable* and *relevant*) separate locations or process alternatives. The examination of alternatives focussed on consideration of the preferred area for the development to be located in within the existing site and arrangement of the various required elements within the chosen area.

3.2 ALTERNATIVE OPTIONS CONSIDERED

The design of the proposed bio-chemical manufacturing facility has involved a number of key decisions, including:

- selection of greenfield versus brownfield development
- selection of a preferred site location
- selection of a preferred site arrangement

The following discussion addresses each of these decisions, the alternatives considered and the basis for selection of the preferred option.

3.2.1 SELECTION OF GREENFIELD VERSUS BROWNFIELD DEVELOPMENT

The pre-prepared brownfield location within the existing building shell is the most advantageous solution in terms of operations and logistics. The front of the site is used for parking and laboratories.

3.2.2 SELECTION OF PREFERRED SITE LOCATION

The existing shell is also preferred to a potential extension on site in the front or rear of the facility due to the current zoning of manufacturing activities onsite. The shell re-use forms a logical pattern of manufacturing islands within the existing facility.

3.2.3 SELECTION OF A PREFERRED SITE ARRANGEMENT

The preferred site arrangement maximises the available floor space on site. The utility buildings are placed to the north so that the manufacturing floor can be developed easily. The new facility will utilise existing docks and laboratories.

3.2.4 OTHER DESIGN ALTERNATIVES

A number of iterations of various aspects of the design were drafted and reviewed, taking account of environmental factors where relevant. These were generally quite detailed and this process was ongoing throughout the design process. It is not practicable or useful to document these iterations. However it can be stated that the EIA process played a significant role during the evolution of the proposed design to avoid, reduce and ameliorate potential environmental effects.

4 PROJECT DESCRIPTION

4.1 PERMANENT ELEMENTS

The proposed development consists of the following:

- Internal alterations to accommodate an integrated Bio-Chemical manufacturing facility sized 3,476 square metres (m^2), within the existing Abbvie Ballytivnan building.
- New roof-mounted plant and Penthouse Louvres 1.8 m high and removal of existing roof-mounted equipment .
- The construction of additional plant room internal mezzanines, sized 645 m^2 within the existing building and an external single storey extension sized 20 m^2 and 9.6 m high, located to the north of the existing facility.
- A revised yard layout, located to the north of the existing facility, including a new single storey electrical room extension sized 155 m^2 and 7.1 m high.
- The enclosure of an existing walled yard area with a new roof and cladding, sized 150 m^2, to house chillers.
- The addition of 4 no. new boiler flues, 17.5 m high above ground level and 500 mm diameter.
- 2 no. new above-ground bunded waste water holding tanks , housed in a building sized 110 m^2 and 9 m high, and associated tanker un-loading area.
- 2 no. bunded underground tanks housed in a building sized 75 m^2 and 4 m high.
- 3 no. cooling towers 9 m high. A nitrogen tank sized 8 m high and 2 m diameter, and an emergency generator and its associated diesel tank and its 10 m high stack.
- Site works include revised road and car parking layouts, additional temporary contractor related car parking for 109 cars located to the east of the existing electrical substation. Underground and over-ground utilities, landscaping and a landscaped berm. A single storey sprinkler pumphouse sized 24 m^2 and 6 m high. New sprinkler tank and site fencing.

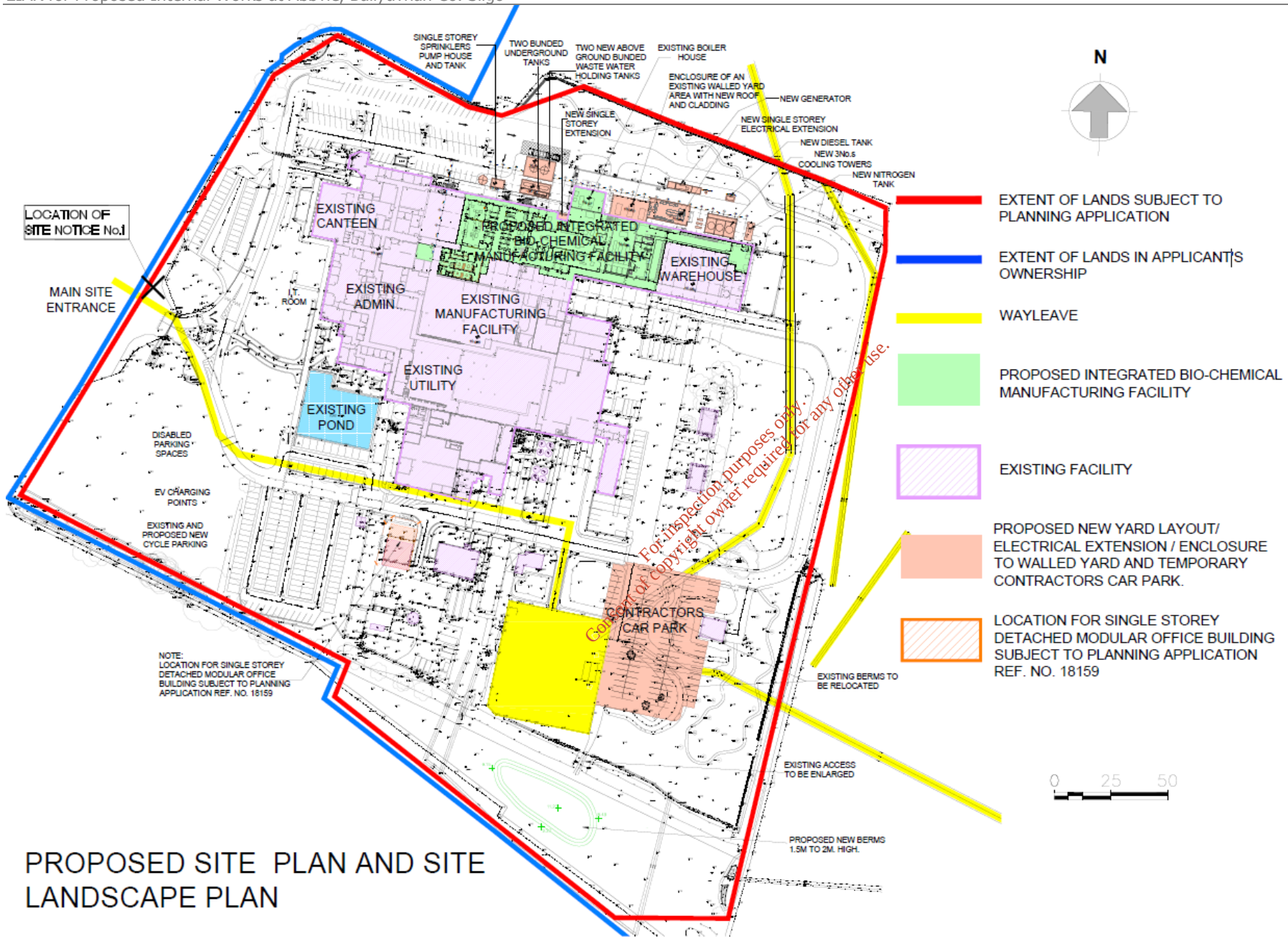

Figure 4.1 Proposed Site Plan

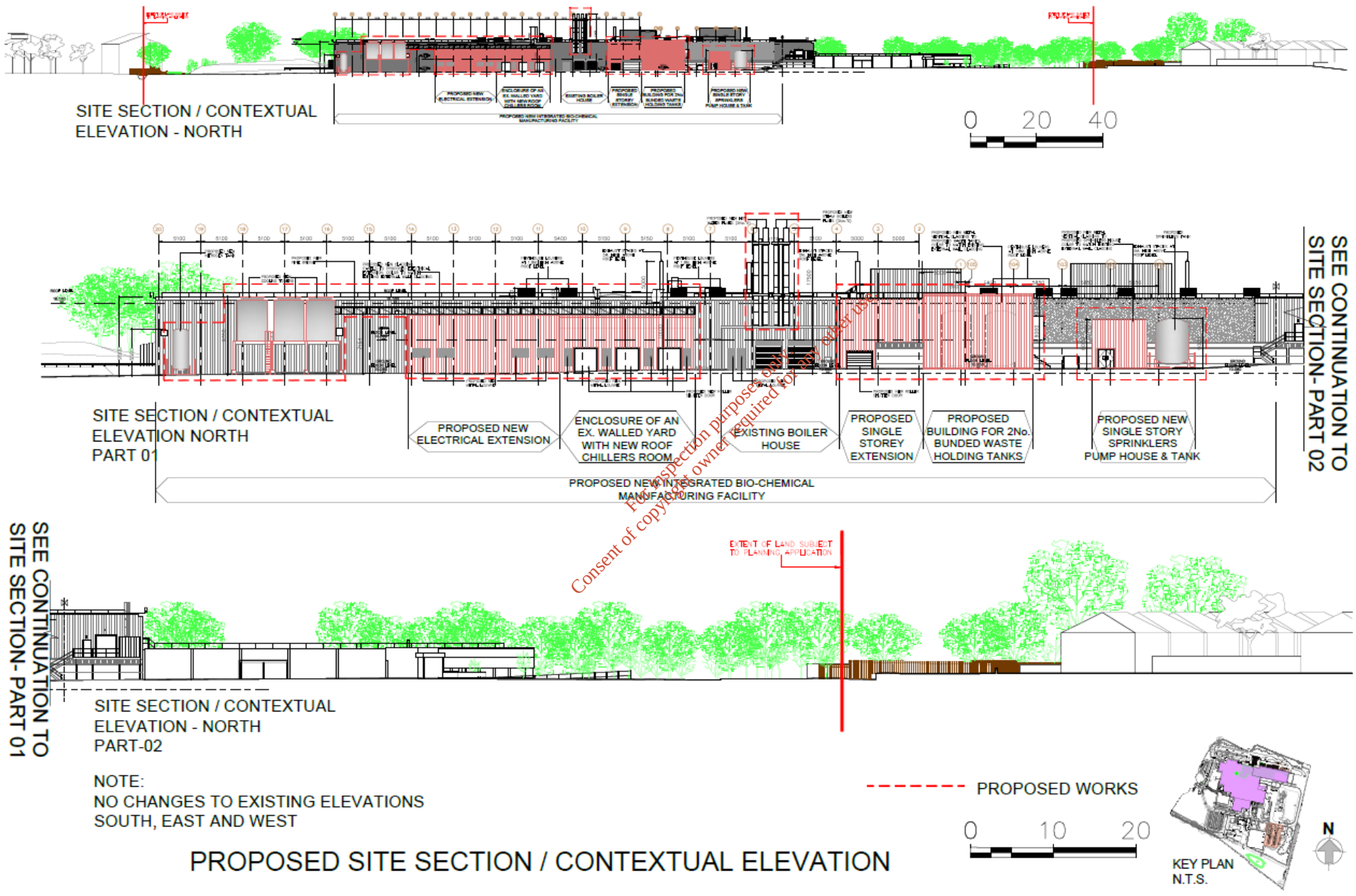

Figure 4.2 Proposed Elevations

The development will employ approximately 100 personnel and will operate on a shift basis, similar to existing shift patterns.

4.2 CONSTRUCTION PHASE

It is envisaged that the basic construction of the facilities will take approximately 16 months, starting with the internal clean out of the existing warehouse and manufacturing spaces and completing with the preliminary validation of the process systems, automation systems and clean rooms. The full validation process takes approximately 1 year after the completion of the buildings, after which the manufacture of medicines for patients can begin.

It is proposed to build this facility at an accelerated schedule so that Abbvie can in turn bring life enhancing medicines to their patients as soon as possible. The proposed general construction hours are as follows:

Main day shift: 7.00am to 7.00pm normal daily works - Monday to Friday, 8.00am to 4.00pm Saturday.

The primary construction access will for all be through the existing Abbvie entrance. This entrance will be used for all the construction traffic and heavy goods vehicles. A temporary car park for circa 109 car spaces will be constructed in the South East of the site. This temporary car park will be removed after the construction of the facility.

The construction site will be separated from the remainder of the site with temporary fencing and hoardings and a dedicated access route for construction personnel will be built on the periphery of the site.

Specific measures have been integrated into the construction proposals to avoid or reduce environmental impacts, which might otherwise occur. These are set out in the accompanying outline Construction Environment Management Plan (CEMP).

4.2.1 CONSTRUCTION STAGES AND SEQUENCING

The anticipated sequence of construction activities on site are summarised below.

1. Site Establishment and Temporary Works
2. Internal clean out and structural stiffening of existing steelwork
3. "Mini-Bore" piling and the erection of steel mezzanines
4. Installation of major ductwork, air handling units and pipework, mechanical and electrical systems.
5. Erection of the pre-assembled modular clean rooms, ceilings etc.
6. Installation of equipment and local hook up.
7. Cleaning, testing, commissioning.

All external plant items and structures are constructed in parallel to these.

5 POPULATION & HUMAN HEALTH

5.1 INTRODUCTION

This chapter considers the impact of the proposed development in the context of population and settlement, land use, employment and other impacts of a social and economic nature. In terms of human beings, the types of issues which developments such as this raise (both during construction and operation) include: impacts on amenities and services in the area; additional economic opportunities; increased traffic; and impacts on existing land uses. Whilst references are made to other environmental topics (such as traffic, noise and air) in this section, they are examined in detail in other sections of the EIAR.

5.2 THE PROPOSED DEVELOPMENT

The proposed development will facilitate the operation of a new manufacturing process on the Abbvie Ballytivnan site. 120 Personnel currently working at the site will be moved and deployed to a different manufacturing facility in the Sligo area and the circa 179 existing persons manufacturing medical devices will remain onsite. The current proposal will employ approximately 100 persons once fully operational. During the construction phase of the project it is estimated that employment on site over the approximate 16 month construction period will peak at 250 persons and will fall gradually as the project nears completion.

5.3 THE EXISTING ENVIRONMENT

5.3.1 PLANNING AND DEVELOPMENT CONTEXT

General

The existing facility is located on the Old Bundoran Road which is situated within Ballytivnan to the north of Sligo City, in relatively close proximity to the N16 route to the South East and the N15 to the West of the site. In addition to Ballytivnan site, an additional Abbvie facility is also located approximately 0.7 km to the east of the site on the N16 road.

Houses line the opposite side of the Old Bundoran Road, West of the site. Further residential lands are situated to the South of the site, while primarily agricultural/ undeveloped lands bound the site to the South East, East and North.

5.3.2 LAND USE STRUCTURE ADJACENT TO THE SITE

The site is an established manufacturing facility within a wider area which facilitates a diverse range of uses e.g. residential, health services, industry, educational. A number of establishments including an additional Abbvie production facility are located within close proximity of the site. The predominant land uses surrounding the Abbvie site is residential, with housing areas adjacent to west and south of the site, and undeveloped/agricultural lands directly to south-east, east and north.

The Sligo City Centre is located approximately 1.7 km to the south west of the site. Sligo I.T. is located approximately 0.6 km south east of the site.

In terms of infrastructure, the site is relatively well positioned to the East of the N15 road approximately 0.6 km from the junction from Elm Gardens road onto the N15. The Old Bundoran Road at the front of the site leads onto the N16 to the South.

5.3.3 SOCIO-ECONOMIC FACTORS

The following socio-economic analysis concentrates mainly on the immediate hinterland in terms of population and employment as this is the area where most impacts will arise.

The Abbvie site is located on the Old Bundoran Road which partially lies in the Electoral Division (ED) of Sligo North ED and is adjacent to the Drumcliff East ED, Calry ED, Sligo West ED and Sligo East ED (located to the north-west, east, south west and south east of the site respectfully). These areas can be regarded as within the immediate hinterland in terms of the socio-economic impacts arising from the new development. The secondary hinterland can be regarded as the County of Sligo and the Border Region, as direct and indirect employment, purchasing, employee's residences etc. are likely to be located throughout Sligo and the Border Region. Abbvie is located towards the northern area of the County and forms part of the Sligo County Council jurisdiction. This socio-economic section includes an analysis of the immediate and secondary hinterlands in terms of population and employment.

5.3.4 POPULATION

Population Change

In terms of the County, Region and State, population change is strongly influenced by migration and emigration rates, rather than birth and death rates. The 1990's and early 2000's saw a large movement of people into the Country due to the "economic boom" in Ireland. The Border and surrounding areas experienced high levels of population growth as a result of economic growth in the region. The past 10 years have seen a decline in economic growth and a return to emigration of people from Ireland. Economic indicators show that this trend is again reversing and signals of demand for skilled workforce and economic growth are retuning. 2016 Census data indicates that the county of Sligo saw a minor population increase of 0.2% in the period from 2011-2016, lower than the 3.8% national average. Notwithstanding this, Sligo North, Drumcliff East and Calry all saw population decreases of -5.1%, -1.6% and -5.8% respectively. Sligo West ED and Sligo East ED witnessed a growth of +1.3% and +1.2%, both of which are below the state average.

Table 5.1 below shows the changes in population for the state, immediate (North Sligo ED, Drumcliff East ED, Calry ED, Sligo West ED and Sligo East ED) and secondary (County of Sligo and the Border) hinterlands of the proposed development.

Table 5.1 Population Change at Sate, Secondary and Primary Hinterland Level[13]

	2011	2016	No. Change 2011-2016	% Change 2011-2016
State	4,588,252	4,761,865	173,613	+3.8%
Border Region[14]	514,891	394,333	-120,558	-23.4%
County Sligo	65,393	65,535	142	+0.2%
North Sligo ED	5,502	5,222	-283	-5.1%
Drumcliff East ED	736	724	-12	-1.6%
Calry ED	1,806	1,702	-104	-5.8%
Sligo West ED	7,129	7,219	90	+1.3%
Sligo East ED	4,937	4,998	61	+1.2%

Table 5.1 above shows a variation in the population growth in the Border Region, County Sligo, North Sligo ED, Drumcliff East ED, Calry ED, Sligo West ED and Sligo East ED. The Census data in 2011 and 2016 shown above indicate that minor population growth has taken place in the County of Sligo, Sligo West ED and Sligo East ED, lower than national percentage growth which has taken place over the same period in each case. The Border region has experienced a vast population decrease according to the census data, however, it should be noted that the *2016 CSO data for the Border Region excluded*

[13] *Census of Population 2011 and 2016*

[14] *The Border Region for the purposes of the 2011 CSO Census data included counties Donegal, Sligo, Leitrim, Cavan, Monaghan and Louth. The 2016 CSO data for the Border Region has excluded county Louth from this region.*

county Louth from this region, whereas county Louth was included as part of the Border Region for the 2011 CSO data. Despite the intermediate economic decline experienced in Ireland from 2008, population projections indicate that population in Sligo is expected to continue to growth. In order to counteract declines of the North Sligo, Drumcliff East and Calry ED's, and to maintain population growth in the Sligo West ED and Sligo East ED, it is important that the area's role and functions are consolidated and sustained. Further development, such as that of the Abbvie proposal, would contribute towards enabling the maintenance and growth of the population within the surrounding ED's such as those of North Sligo ED, Drumcliff East ED, Calry ED, Sligo West ED and Sligo East ED.

Labour Force Participation

Labour Force Participation (LFP) measures the percentage of all people aged 15 years or over who are available for work, which is either at work or unemployed (labour force). The 2016 census indicates that the county of Sligo has a LFP rate of 57.9%, North Sligo with a LFP rate of 45.2%, Drumcliff East as having a LFP rate of 51.2%, Calry having a 54.9% LFP rate, and Sligo West and Sligo East with LFP rates of 59.4% and 57.3% respectfully, all of which are lower than the state average at 61.9%.

Table 5.2 Labour Force Participation Rate, 2016[15]

	Labour Force Participation Rate
State	61.4 %
Border Region	59.1%
County Sligo	57.9%
North Sligo ED	45.2%
Drumcliff East ED	51.2%
Calry ED	54.9%
Sligo West ED	59.4%
Sligo East ED	57.3%

5.3.5 HOUSING DEMAND

Table 5.3 Population & Households at State, Secondary & Primary Hinterland Level[16]

	Population			Households		
	2011	**2016**	**% change**	**2011**	**2016**	**% change**
State	4,588,252	4,761,865	3.8%	1,654,208	1,702,289	+2.9%
Border Region	514,891	394,333	-23.4%	185,851	144,376	-22.3%
County Sligo	65,393	65,535	+0.2%	24,525	24,831	+1.2%
North Sligo ED	5,502	5,222	-5.1%	1,901	1,811	-4.7%
Drumcliff East ED	736	724	-1.6%	278	285	+2.5%
Calry ED	1,806	1,702	-5.8%	608	622	+2.3%
Sligo West ED	7,129	7,219	+1.3%	2,960	3,019	+2.0%
Sligo East ED	4,937	4,998	+1.2%	2,058	2,010	-2.3%

An analysis of the percentage of the population of County Sligo, North Sligo, Drumcliff East, Calry, Sligo West and Sligo East who are available for work, and the figures showing both increases and decreases in the population and number of households in the area illustrated in Table 5.2 and Table

[15] *Central Statistics Office Census of Population 2016*
[16] *Central Statistics Office Census of Population 2011 and 2016*

5.3 above, indicates that both the population and number of households have varied significantly in recent years within the immediate and secondary hinterland areas of the Abbvie site.

5.4 PREDICTED IMPACTS

5.4.1 INTRODUCTION

The proposed development will create a demand among employees for additional housing. The workforce will likely be drawn from the immediate hinterland and a wider geographical area. It is likely to have a small direct impact on the population of the hinterlands. It is also predicted that the proposed development will have significant effects on employment - both direct employment at the facility itself and indirect employment created by the multiplier effect. It is likely that these new employment opportunities will be availed of by both persons from the immediate hinterland of North Sligo, Drumcliff East, Calry, Sligo West and Sligo East, and the wider Sligo area, in addition to a wider catchment area extending into the Border Region. Because of the relatively high degree of accessibility of the site, the beneficial impacts of the development are likely to be diffused over an extensive catchment area.

5.4.2 EMPLOYMENT

The proposed development is consistent with the creation of new employment opportunities in the Sligo North ED ('business, industry and technology park' zoned area), and the wider area of Sligo and spanning into the Border region. Recent trends show that a significant proportion of new industrial/manufacturing/office employment is taking place outside of city centre locations and in locations where purpose-built facilities or suitable greenfield sites are available.

During the construction phase of the project it is estimated that employment on-site will increase gradually to a peak of 250 persons and then fall gradually over the last few months as the project nears completion. It is estimated that this construction stage will last approximately 16 months.

It is anticipated that the proposed development will provide employment for approximately 100 personnel once fully operational. It should be noted that in order to facilitate the operation of the proposed new manufacturing process on the Abbvie Ballytivnan site, 120 personnel currently working in the existing facility will be moved and deployed to a different manufacturing facility in the Sligo area, whilst the new subject proposal consisting of a new production process is expected to employ approximately 100 persons once fully operational and will therefore generate employment within the wider Sligo area.

It is anticipated that the staff profile (in educational terms) will consist of a significant proportion of third level graduates who have graduated from educational establishments throughout Ireland and abroad. Similar to the employment profile of other pharmaceutical manufacturing facilities, it is expected that the workforce will be made up of members of the local community, national and international graduates and European expatriates who have relocated back to Ireland.

5.4.3 HOUSING

It is not possible to accurately predict where employees of the new facility will reside but based on employment patterns in the area it is likely that the majority of employees will reside within a 30 km radius. According to the County Development Plan, the housing allocations required to accommodate the estimated population increase as set out within the RPG's for Sligo indicate that the County has a housing unit growth target of 3,705 within the period 2017 – 2023. There is a need to provide the appropriate social, economic and physical infrastructure to accommodate such growth.

The impact, on housing demand arising from the proposed new development is likely to be dispersed over a wide area including the county of Sligo and adjacent counties. It is not therefore likely that the proposed development will create any adverse housing impacts. The growth in housing demand locally as a result of the proposal should lead to a greater investment and improvement in services and amenities in the hinterland in response to increased demand from residents.

5.4.4 CONSTRUCTION COSTS

Total facility cost (fixed assets only) is estimated to be €113 million. It is envisaged that local contractors, services and materials will be utilised where possible.

According to the CSO Labour Market statistics (Q1 2016) the total number of persons at work in the construction sector in Ireland was 131,300 persons. The provision of up to 250 building and construction jobs during the construction of this project can be expected to generate significant income in wages and salaries which will be of benefit to the local economy in terms of the purchase of goods and services and also to the national exchequer as taxation revenue.

5.4.5 MULTIPLIER EFFECTS

Based upon research undertaken by the Economic and Social Research Institute the direct expenditure on wages and salaries would have a multiplier effect upon further indirect, or secondary service employment. According to the ESRI research, for every 100 jobs in direct manufacturing industry, there are 91 associated jobs in the supporting service industry.

5.4.6 IMPACTS FROM ADDITIONAL TRAFFIC

This section considers traffic in general terms as it how could affect the population and human health. Section 13 *Traffic and Transportation* gives a comprehensive analysis of all traffic issues.

The existing road network is currently operating well. The Traffic and Transport Assessment undertaken indicates that the existing road network can successfully accommodate the traffic generated from the proposal. The impact of the traffic generated by the proposed development will have no additional effects on the amenity of the area. The provision of a Construction Traffic Management Plan will mitigate and reduce the environmental impacts of the construction phase of the development. Furthermore, the introduction of a mobility management plan will highlight available travel options to staff, monitor travel patterns and minimise the impact of future travel levels.

5.4.7 HUMAN HEALTH

In an EIAR the potential for effects on human health are dealt with under the more specific topics of the environmental medium by which it might be caused. The topics include air, water, noise and waste.

Some health and safety related topics are covered by separate and more specific legislation and so do not form part of an EIAR – examples include worker health and safety and construction safety.

5.4.8 IMPACTS ON AMENITY

Local amenities in the area primarily include the Sligo Institute of Technology and its associated facilities and amenities including playing pitches, running tracks and recreational facilities to the south-east of the Abbvie site. These amenities are not directly adjacent the site and are located sufficiently far away from the proposed development site so as to be likely to have no recognisable impact on their amenity.

5.5 MITIGATION MEASURES

5.5.1 GENERAL

No specific mitigation measures are required to ameliorate the impacts on human beings as the impacts are largely positive. Section 13 on traffic and transport deals with specific mitigation measures proposed in relation to transport improvements, which will benefit residents of the general area. These are referred to in this section below. Mitigation measures in relation to the potential human health impacts of air and noise, particularly during construction are dealt with in detail in Section 9 and 10 of the EIAR.

5.6 RESIDUAL IMPACTS

The proposed development will have a positive long-term impact on the immediate and secondary hinterlands, North Sligo, Drumcliff East, Calry, Sligo West and Sligo East and the county of Sligo and the Border region through continued expanded employment and the associated economic and social benefit.

6 BIODIVERSITY

6.1 INTRODUCTION

This section assesses potential impacts that may arise from the proposed development on biodiversity within the receiving environment in accordance with the legislation and guidance cited in section 2.1 along with the following sectoral guidance documents:

- Chartered Institute of Ecology and Environmental Management (CIEEM) (2016). Guidelines for Ecological Impact Assessment.
- Chartered Institute of Ecological and Environmental Management (CIEEM) (2012). Preliminary Ecological Appraisal.
- Fossitt JA (2000). A Guide to Habitats in Ireland.
- The Heritage Council (2011) Habitat Survey Guidelines: A Standard Methodology for Habitat Survey and Mapping in Ireland.

It aims to discuss the existing ecological environment, the potential impacts of the scheme and avoidance and mitigation measures in relation to habitats, flora and fauna in the zone of influence (ZOI) of the proposed development. A separate stand-alone AA Screening Report is included in the planning application documentation.

Legislative Context

Specific focus is placed on protected species/habitat features as well as those of local or national importance. Ireland's national biodiversity action plan *Actions for Biodiversity 2011–2016*[17], in accordance with the Convention on Biological Diversity, is a framework for the conservation and protection of Ireland's biodiversity, with an overall objective to secure the conservation, including, where possible, the enhancement and sustainable use of biological diversity in Ireland and to contribute to collective efforts for conservation of biodiversity globally. The plan is implemented through legislation and statutory instruments concerned with nature conservation. The Planning and Development Acts, 2000–2015 and the European Communities (Environmental Impact Assessment) Regulations, 1989 (as amended) are particularly important in that regard and include a number of provisions directly concerned with the protection of natural heritage and biodiversity.

The Wildlife Acts, 1976–2012 are the principal mechanism for the legislative protection of wildlife in Ireland. They outline strict protection for species that have significant conservation value. In summary, the Wildlife Acts protect species from injury, disturbance and damage to breeding and resting sites. All species listed in the Wildlife Acts must, therefore, be a material consideration in the planning process. An important piece of national legislation for the protection wild flora, *i.e.* vascular plants, mosses, liverworts, lichens and stoneworts, is the Flora (Protection) Order, 2015, which makes it illegal to cut, uproot or damage a listed species in any way or to alter, damage or interfere in any way with their habitats. This protection applies wherever the species listed in the Schedules to the Order are found.

The European Communities (Birds and Natural Habitats) Regulations, 2011–2015 transpose into Irish law Directive 2009/147/EC (the Birds Directive) and the Habitats Directive, which list habitats and species of Community, *i.e.* European Union (EU), importance for conservation and that require protection. This protection is afforded in part through the designation of areas that represent significant populations of listed species within a European context, *i.e.* Natura 2000 sites. An area designated for bird species is classed as a Special Protection Area (SPA), and an area designated for other protected species and habitats is classed as a Special Area of Conservation (SAC). Birds listed in Annex I of the Birds Directive in SPAs and habitats and species listed in Annexes I and II, respectively, of the Habitats Directive in SACs in which they are designated features have full European protection. Species listed on Annex IV of the Habitats Directive are strictly protected wherever they occur, whether inside or outside European Sites. Annex I habitats outside of SACs are

[17] This is due to be replaced by the Action Plan for Biodiversity 2017-2023; however, this is pending

still considered to be of national and international importance and, under Article 27(4)(b) of the European Communities (Birds and Natural Habitats) Regulations, 2011, public authorities have a duty to strive to avoid the pollution or deterioration of Annex I habitats and habitats integral to the functioning of SPAs.

Sites of national importance for nature conservation are afforded protection under planning policy and the Wildlife Acts, 1976–2012. NHAs are sites that are designated under statute for the protection of flora, fauna, habitats and geological interest. Proposed NHAs (pNHAs) are published sites identified as of similar conservation interest but have not been statutorily proposed or designated.

The International Union for the Conservation of Nature and Natural Resources (IUCN) provides a global approach for evaluating the conservation status of species to inform and catalyse action for biodiversity conservation through the Red List of Threatened Species.

Approach to Ecological Evaluation and Impact Assessment

Assessing impact significance is a combined function of the value of the affected feature (its ecological importance), the type of impact and the magnitude of the impact. It is necessary to identify the value of ecological features within the study area in order to evaluate the significance and magnitude of possible impacts.

The following parameters are described when characterising impacts (following CIEEM (2016), EPA (2002) and NRA (2009)):

Direct and Indirect Impacts - An impact can be caused either as a direct or as an indirect consequence of a proposed development.

Magnitude - Magnitude measures the size of an impact, which is described as high, medium, low, very low or negligible.

Extent - The area over which the impact occurs – this should be predicted in a quantified manner.

Duration - The time for which the effect is expected to last prior to recovery or replacement of the resource or feature.

- Temporary: Up to 1 Year;
- Short Term: The effects would take 1-7 years to be mitigated;
- Medium Term: The effects would take 7-15 years to be mitigated;
- Long Term: The effects would take 15-60 years to be mitigated;
- Permanent: The effects would take 60+ years to be mitigated.

Likelihood – The probability of the effect occurring taking into account all available information.

- Certain/Near Certain: >95% chance of occurring as predicted;
- Probable: 50-95% chance as occurring as predicted;
- Unlikely: 5-50% chance as occurring as predicted;
- Extremely Unlikely: <5% chance as occurring as predicted.

The CIEEM Guidelines define an ecologically significant impact as an impact (negative or positive) on the integrity of a defined site or ecosystem and/or the conservation status of habitats or species within a given geographic area. The integrity of a site is the coherence of its ecological structure and function, across its whole area, which enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified (CIEEM, 2016).

The results of the ecological survey were evaluated to determine the significance of identified features located in the study area on an importance scale ranging from international-national-county-local. The local scale is approximately equivalent to one 10 km square but can be operationally defined to reflect the character of the area of interest. Because most sites will fall within the local scale, this is sub-divided into three categories: high local importance - local importance - local value. The criteria used for assessing the importance of ecological features are shown in Table 6.1.

Table 6.1 Criteria used in Assessing the Importance of Ecological Features

Importance	Criteria
International	An internationally designated site or candidate site (SPA, cSPA, SAC, cSAC, Ramsar Site, Biogenetic Reserve). Also, sites which qualify for designation as SACs or SPAs – this includes sites on the NGO shadow list of SAC's.
National	A nationally designated site or candidate site (NHA, pNHA). Sites which hold Red Data Book (Curtis and McGough, 1988) plant species.
County	Sites which hold nationally scarce plant species (recorded from less than 65 of the national 10 km grid squares); unless they are locally abundant. Sites which hold semi-natural habitats likely to be of rare occurrence within the county. Sites which hold the best examples of a semi-natural habitat type within the county.
High Local Importance	Sites which hold semi-natural habitats and/or species likely to be of rare occurrence within the local area. Sites which hold the best examples of a high quality semi-natural habitat type within the local area.
Local Importance	Sites which hold high quality semi-natural habitats.
Local Value	Any semi-natural habitat.

Consultation

Consultation was undertaken with Sligo County Council with regard to the scope of the EIAR. The consultation resulted in an expression of no concern in relation to biodiversity related impacts due to the low ecological value of the receiving environment and the distance from protected sites.

6.1.1 METHODOLOGY

Desk Study

A desktop review was carried out to identify features of ecological importance within the proposed development site and the wider environment. 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 potential effect is not of any relevance or significance.

- Source(s) – e.g. pollutant run-off from proposed works.
- Pathway(s) – e.g. groundwater connecting to nearby qualifying wetland habitats.
- Receptor(s) – qualifying aquatic habitats and species of European Sites.

Specific effort was put into the assessment of sensitive receptors of protected species/habitat features; as well as those of local or national importance. A source is any identifiable element of the Project proposal which is known to have interactions with ecological processes. Pathways are any connections or links between the source and the receptor. This report determines if direct, indirect or cumulative adverse effects will arise from the proposed development.

Field Survey Work

Data was collected after a walkover survey conducted on the 16th March 2018. This data covered the whole Abbvie site. A habitat survey of the site was conducted following standard guidelines set out in 'Best practice guidance for habitat surveys and mapping' developed by the Heritage Council of

Ireland[18]. Habitats were classified using habitat descriptions and codes published by the Heritage Council in 'A Guide to Habitat Types in Ireland'[19]. Plant species nomenclature follows Rose's 'The Wild Flower Key: How to identify wild flowers, trees and shrubs in Britain and Ireland'[20]. A list of the dominant and notable plant species was taken for each habitat type. Particular emphasis was given to the possible occurrence of rare or legally protected plant species (as listed in Flora Protection Order 1999) or Red-listed plant species (Curtis & McGough 1985, Wyse Jackson *et al.* 2016).

Observations were made for fauna species present or likely to occur on site. Emphasis was placed on mammals and birds, and especially for species listed in the respective Red lists, namely Colhoun and Cummins (2013), and Marnell et al. (2009). For mammals, search was focused on signs of their presence, such as tracks, feeding marks and droppings, as well as direct observations. For bats, the main focus was on evaluation of suitable habitats to support roosting bats. Bird species were recorded by sight and sound. However, as the survey was confined to one date, the likely presence in other seasons of bird species of conservation importance was assessed based on habitats present.

During all surveys, particular attention was given to assessing the presence of rare or protected species. Each species identified was assessed in term of the EU Habitat Directive (92/43/EEC), Bird Directive (2009/147/EC), the Wildlife Act (1976), the Wildlife Amendment Act (2000) and the Red Data Lists for threatened and protected species, published on the NPWS website (www.npws.ie).

6.1.2 LIMITATIONS

The biodiversity assessment was carried out outside the optimum time for botanical survey and is in the very early breeding season for birds. However, the site is an industrial facility with manmade planted habitats, and some scrublands in the margins. Overall, it is considered that there are no significant limitations to the present assessment of the ecological importance of the site.

6.2 PROPOSED DEVELOPMENT

The proposed works relate to internal works and extensions to a Bio-chemical manufacturing building, and redesign of car parking facilities. Full details of the proposed development are discussed in Section 4 *Project Description*.

The design incorporates mitigation measures as described in relevant sections of this EIAR. These are mainly integral to the design. An outline Construction Environmental Management Plan (CEMP) accompanies this application and provides additional management measures which will be implemented during construction. The CEMP has detailed methods relating to the control of the following potential impacts:

- Noise;
- Dust;
- Water Protection;
- Waste Management;
- Protection of Flora and Fauna; and
- Site Lighting.

6.3 RECEIVING ENVIRONMENT

6.3.1 OVERVIEW

The site sits to the north of Sligo town, on the edge of the urban sprawl area. It lies less than 200m west of the N15 and is bordered by agricultural fields and residential properties. The surrounding area north of the site is dominated by agricultural lands. The Willsborough Stream (35W01) flows westward, at the northern corner of the site; the Shannon Eighter Stream (35S29) flows southward

[18] Smith, George F., et al. "Best practice guidance for habitat survey and mapping." The Heritage Council: Ireland (2011)
[19] Fossitt, J.A., 2000. A guide to habitats in Ireland. Heritage Council/ Chomhairle Oidhreachta
[20] Rose, F., O'Reilly, C., Smith, D.P. and Colling

along the east of the site and joins the Willsborough Steam just before entering Sligo Bay (Figure 6.1.)

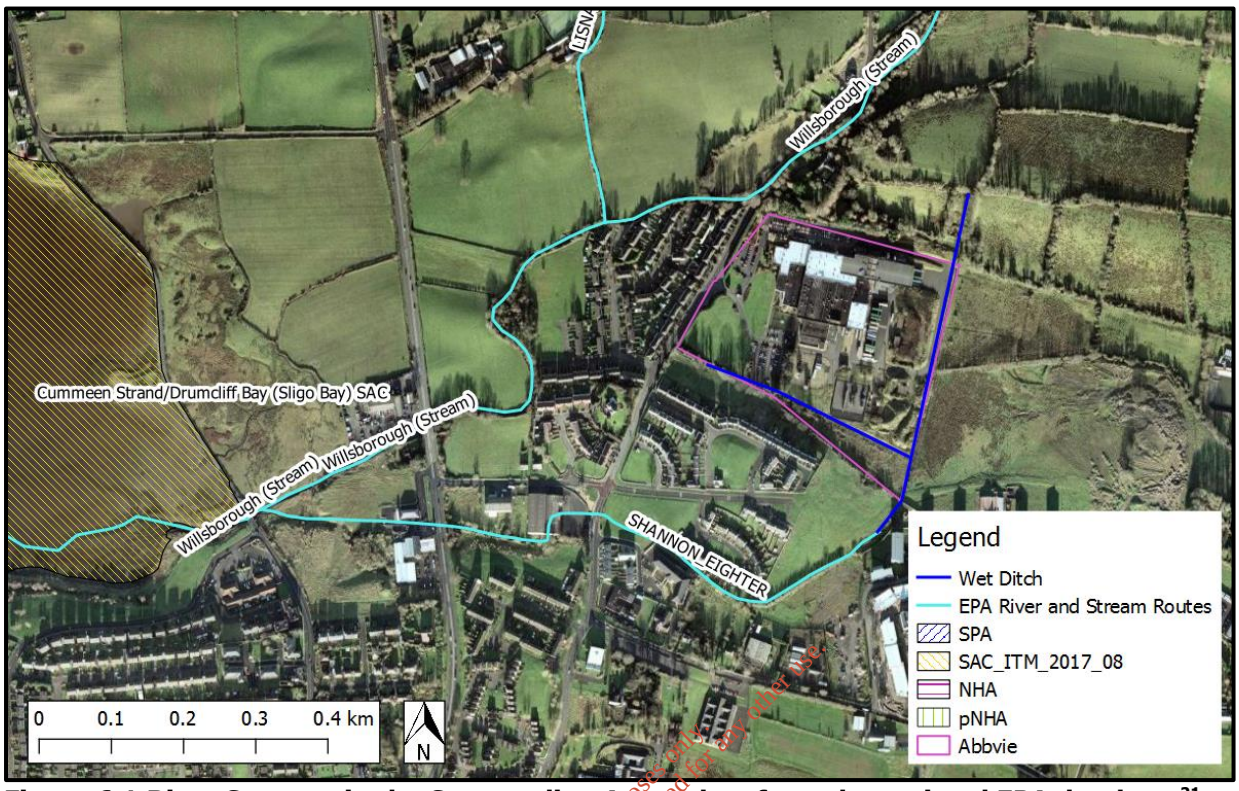

Figure 6.1 River Systems in the Surrounding Area taken from the national EPA database[21]

6.3.2 ZONE OF INFLUENCE

The operational phase works are not anticipated to have any impacts beyond the site boundary due to the proposed characteristics of the extension and the existing activities at the site. Specific noise pollution and hydrological assessments have been carried out (detailed in sections 10 *Noise & Vibration* and 8 *Water & Hydrogeology* respectively). In light of this assessment, following the source-pathway-receptor model, the Zone of Influence (ZOI) was identified to be localised/within the immediate vicinity; given the nature of the proposed works.

6.3.3 DESIGNATED AREAS

In accordance with the European Commission Methodological Guidance (EC, 2001), a list of European Designated Sites that can be potentially affected by the works has been compiled. A dedicated Appropriate Assessment Screening, reviewing all European Sites within the zone of influence of the project, was undertaken. A review of the conservation objectives and qualifying interests of these sites was undertaken in order to identify what habitats and/or species could be vulnerable to risk of impact from the proposed development. This was done by assessing whether any source receptor links existed between the qualifying interests of the designated sites and the site.

When assessing ecological impacts, the CIEEM Guideline recommend a 15 km zone of influence as an adequate buffer for effects. Due to the characteristics of the project, all other Natura 2000 sites and pNHA/NHA sites beyond threshold distances of 15 km are considered to be far enough away that no significant effects could be caused either directly or indirectly or in combination with other plans or projects to their interest features. Any impacts caused by the Abbvie development have no valid impact pathway to transfer along to reach any of the receptor interest features. These sites are 'screened out' and not considered further.

[21] *wet ditch identified on site during field work

In addition to examining European sites, NHAs and pNHA have been considered. Although NHAs and pNHAs do not form part of the Natura 2000 Network, they often provide an important supporting role to the network, particularly when it comes to fauna species which often do not obey site boundaries. There are however, NHAs and pNHAs that are designated for features that are not important at an international level and may not interact with the Natura 2000 network.

Appendix 6.1 gives a detailed list of all of the designated sites considered within the assessment and their relative distance to the Abbvie site. They are 'Screened in' and will now be assessed in this report. Figure 1 and 2 of Appendix 6.1 show the designated sites within and outside a 15 km radius buffer of the proposed Abbvie site.

The Abbvie site is close to the coast, and therefore has limited hydrological pathways to other Natura 2000 Sites. There are no water courses present on site; however, the Willsborough Stream (35W01) flows westward, at the northern corner of the site and the Shannon Eighter Stream (35S29) flows southward along the east of the site and joins the Willsborough Steam just before entering Sligo Bay. All surface water will be managed through a Surface Water Drainage plan. A stand-alone Screening Report expands on the potentially affected designated sites and their conservation objectives in more detail. The screening identified five European Sites within the zone of influence of Abbvie.

6.3.4 Records of Protected, Rare or Other Notable Flora and Fauna Species

The digital database of the National Biodiversity Data Centre (NBDC) was consulted to assess known records of rare, protected and invasive species that occur in the surrounding landscape. The collation of this information, as well as examination of aerial photographs allowed areas of potential ecological importance to be highlighted prior to field survey work. A search was undertaken of records of Red Data Book and Protected species held by the National Biological Data Centre Database. Records of Rare or Protected Species from the 10 km x 10 km grid squares occupied by the study area (the study area bordered two grid squares G63 & G73) are listed in Appendix 6.2 [NBDC data].

Invasive Flora Species

Publicly available NBDC data was accessed to identify invasive species in the hectads in which the Project is located (G63 & G73). Nine of the flora species and four of the fauna species listed below are subject to restrictions (Third Schedule) under Regulation 49 of the European Communities (Birds and Natural Habitats) Regulations, 2011.

6.3.5 Field Survey Results

Flora

None of the habitats on the site were found to contain Annex I type features; additionally, all of the habitats present on site were of low ecological importance at both landscape and local scales. Habitats recorded on site include Buildings and Artificial Surfaces (BL3), Re-colonised Bare Ground (ED3), Hedgerows (WL1), Agricultural Grassland and Amenity Grassland (GA2); a full habitat map can be found in There were no species identified on site which are invasive and subject to restrictions (Third Schedule) under Regulation 49 of the European Communities (Birds and Natural Habitats) Regulations, 2011. There were no significant habitats found directly adjacent to the site. Refer to Appendix 6.3 for further detail on habitat characteristics and descriptions.

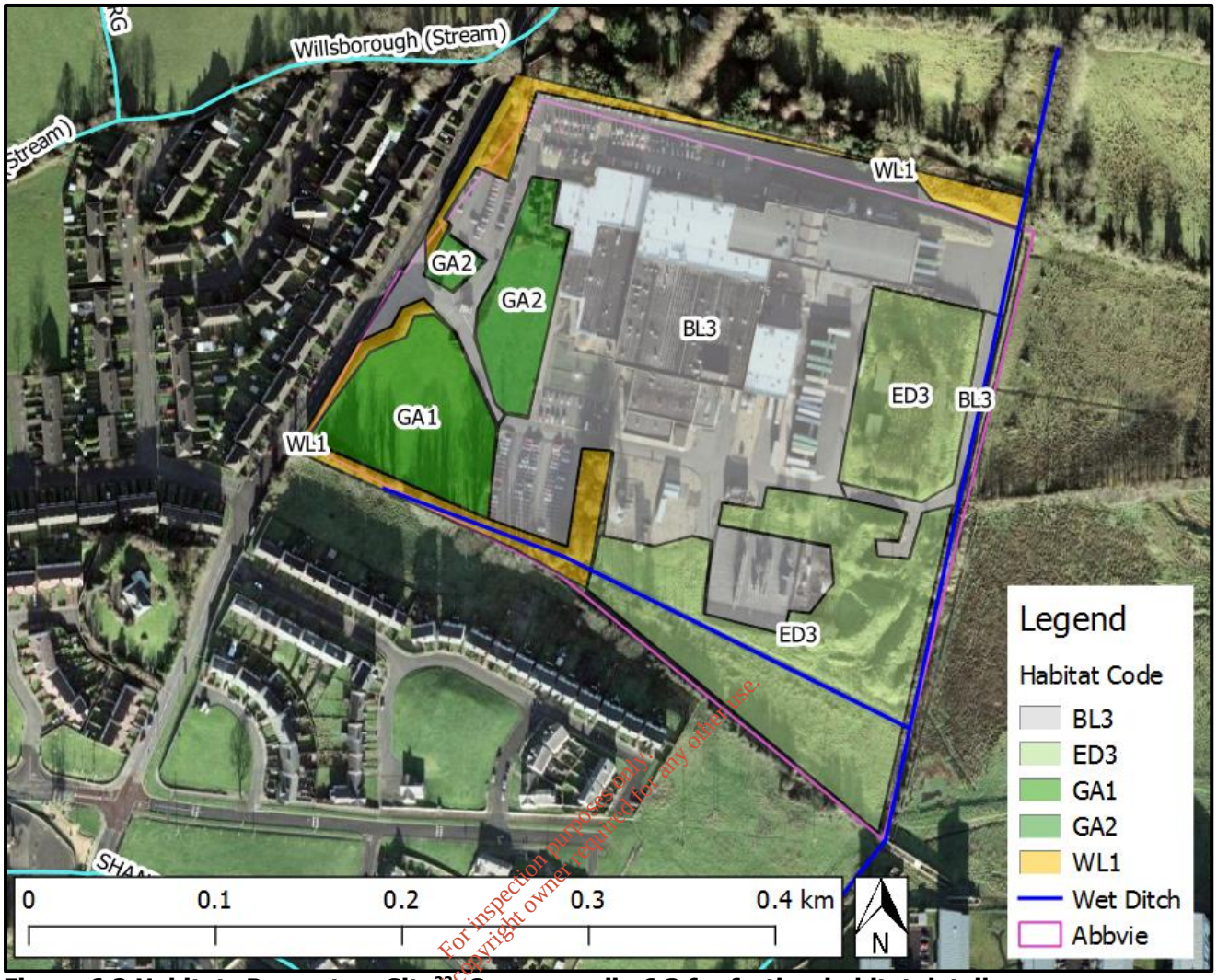

Figure 6.2 Habitats Present on Site[22]. See appendix 6.3 for further habitat details

Fauna

Mammals

There were no signs identified to indicate mammal presence on site. The site has very low potential to support mammal species including bats, with the hedgerow providing minimal cover for commuting and there are limited resources available to support large invertebrate populations. The trees present have negligible value for roosting.

Birds

There are no habitats present on site Appwith high potential for breeding birds, or any specific ecological value in relation to birds. Only common passerine species were identified on site.

Protected Fish, Amphibians & Reptiles

There are no water bodies or wetland habitats on site, however there are water courses directly adjacent to the site. There are no suitable habitats available for aquatic or amphibious species. Similarly, the site does not have suitable habitat for the common lizard. In addition, the hydrological assessment (detailed in section 8) confirmed that there will be no effects to water quality of the surrounding area.

[22] at March 2018 Habitat codes: BL3 – Building and artificial surfaces; ED3 – Recolonised bare ground; GA1 – Improved Agricultural Grassland; GA2 Amenity Grassland (improved); WL1 – Hedgerow.

6.3.6 SUMMARY OF ECOLOGICAL EVALUATION

Overall, the sites of the proposed works and contractors' compound areas can be considered as having low ecological value. The grassland and disturbed ground habitats are of negligible interest. The hedgerows, which will remain intact, are patchy and do not provide robust cover for commuting bats or other fauna.

6.4 POTENTIAL IMPACTS

Taking the baseline ecological data, the extent, the scale and the characteristics of the proposed development into account the following potential impacts have been identified:

- Impacts on Surface Water
- Earthworks – causing the mobilisation of particles
- Noise and vibration

These potential impacts are discussed in the following paragraphs.

- Impacts on Surface Water

  The CEMP details measure to prevent accidental spill offs. Interactions with surface water are therefore thought to be minimal as there are no existing water courses across the site or in the immediate vicinity. Further details on the hydrological interactions are detailed in section 8 which concludes that *Short term – Imperceptible Impact with a neutral impact on water quality* during construction phase and a *Long term- imperceptible significance with a neutral impact on water quality* during operational phase.
- Earthworks

  The CEMP dictates that a dust control strategy must be implemented for all construction works. The existing site is a construction site and there are no habitats present on site that are of any ecological value. The earthworks proposed within the project description will not have effects beyond the site boundary.
- Noise/vibration

  The construction phase and movement of heavy vehicles across the site could cause localised disturbance of breeding birds that may use the perimeter vegetation. Given the low quality of habitat available this is expected to be very low. This would be expected to have a probable, short-term impact at a local level but there is likely to be an existing degree of habituation to regular traffic on the site so this impact may not be across the whole area. Bird species are particularly sensitive to disturbance effects due to increased noise and on-site activity; no protected bird species were recorded on site. Full details of the noise pollution data can be found in section 10

An assessment of the project detail outlined in Section 4 indicates the potential impacts to biodiversity are predominantly associated with construction phase works which are temporary. The site was found to have low ecological value following the CIEEM (2016) Ecological Impact Assessment Guidelines; informed by the results of both the desktop study and the field surveys. The operational phase elements of the project are thought to have negligible impacts given the low ecological value of the existing habitats. The potential operational phase activities are consistent with the existing land use of the site.

6.4.1 POTENTIAL IMPACTS ON DESIGNATED SITES

The AA Screening Report sets out the likelihood and significance of any potential impacts on European designated sites. There are no significant adverse effects foreseen to be likely to affect the ecological integrity of any European Sites. There are no NHA's within the zone of influence of the project. The closest pNHA is the Cummeen Strand/Drumcliff Bay (Sligo Bay) which is also an SAC. The site if 0.7 km away from the proposed development and it is hydrologically connected to the site. The NPWS have not provided site specific information for this site as a pNHA as it overlaps with the SAC. This site was considered in the AA Screening Report in this regard. The site is designated for coastal habitats and species such as estuaries and mud flat habitats. The targets and attributes of the site-specific conservation objectives relate to the maintenance of the structure and function of habitat

and community dynamics. These habitat and community dynamics are vulnerable to direct interactions, and/or interactions with water quality and turbidity. The proposed works will have no direct interaction with the pNHA and there will be no direct effects to the targets or attributes of the site. The project is hydrologically connected to the pNHA. However, Section 8 of this report provides a detailed hydrological assessment that shows the proposed works will have *Short term – Imperceptible Impact with a neutral impact on water quality* during construction phase and a *Long term- imperceptible significance with a neutral impact on water quality* during operation phase. Additionally, the CEMP submitted as part of the project design details the best practice approach that will be undertaken during construction. These measures take account of possible interactions with water quality. There are no pathways for effects to any other pNHA or NHA sites.

6.5 MITIGATION MEASURES

Following the best practice management measures detailed in the project description and within the CEMP, no specific mitigation measures are required to moderate the potential impact on biodiversity.

6.6 CUMULATIVE IMPACTS

A review of planning applications in proximity to the proposed development was undertaken to assess the possibility of cumulative impact arising from proposed development at Abbvie and proposed developments in the site's environs. A development application for executive hotel apartments and student accommodation is currently under review. No other largescale developments have been identified within proximity to the Abbvie facility. The planning applications within the area relate to site use change and small single-story developments or permission retention applications. A full list of projects in the surrounding area can be found in the planning report. The receiving environment has low ecological value. The operational phase of the project is consistent with the current land use and construction impacts will be localised and temporary. These factors combined with the robust mitigation measures within the CEMP further reduce potential impacts. Therefore, the project is not expected to contribute significant cumulative impacts.

6.7 RESIDUAL IMPACTS

Given the low local ecological value of the receiving environment and the current site usage, the potential impacts to ecological processes are negligible. Following the management measures detailed in the project description and within the CEMP, potential impacts to the flora and fauna of the existing environment are foreseen to be very low. The characteristics of the development detailed above indicate any potential impacts will be localised due to the magnitude of works being undertaken. The existing site is of low ecological value, with no protected species or habitat features identified.

6.8 MONITORING

The impacts are foreseen to be very low due to the characteristics of the project, and the ecological value of the receiving environment is also low. Monitoring measures are proposed during construction phase and compliance with the CEMP; this is detailed in the policies of the plan which commit to ensure compliance with the CEMP by all contracted workers. This process is foreseen to be sufficient monitoring with regard to ecological impacts and the integrity of the wider landscape ecology.

7 LAND, SOILS, GEOLOGY & HYDROGEOLOGY

7.1 INTRODUCTION/METHODOLOGY

The following section prepared by AWN Consulting presents an assessment of the impacts of the proposed development in terms of land, soils, geology and hydrogeology of the local environment as defined in the Environmental Protection Agency (EPA, 2017) Guidelines referred to in Section 2.1. Assessment of impacts is also, in accordance with the Institute of Geologists (IGI) *'Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements'* (IGI, 2013).

In assessing likely potential and predicted impacts on the land, soils, geology and hydrogeology, account has been taken of both the importance of the attributes and the predicted scale and duration of the likely impacts.

7.1.1 METHODOLOGY

The rating of potential environmental impacts on the land, soils and geology environment is based on the matrix presented in Appendix 7.1, Table 7.1 – `Glossary of Impacts following EPA Guidance Documents' which takes account of the quality, significance, duration and type of impact characteristic identified.

In the EIAR assessment, consideration is given to both the importance of an attribute and the magnitude of the potential environmental impacts of the proposed activities on that attribute.

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

- Geological heritage sites in the vicinity of the perimeter of the subject 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 uses of soil around the site;
- Quarries or mines in the vicinity, 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 of requirement to remove it off-site as waste for disposal or recovery;
- High-yielding water supply springs/ wells in the vicinity of the site 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 perimeter area and increased risks presented to them by the proposed development associated with aspects such as for example removal of subsoil cover, removal of aquifer (in whole or part), drawdown in water levels, alteration in established flow regimes, change in groundwater quality;
- Natural hydrogeological/ karst features in the area and potential for increased risk presented by the activities at the site;
- Groundwater-fed ecosystems and the increased risk presented by operations both spatially and temporally; and,
- Loss of agricultural and amenity lands.

Sources of Information

Desk-based geological information on the substrata (both overburden deposits and bedrock geology) underlying the extent of the site was obtained through accessing databases and other 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;
- Sligo County Council - illegal landfill information; and

Site specific data was derived from the following sources;

- Various design site plans and drawings;
- Consultation with site engineers;
- Abbvie Annual Environmental Reports and Groundwater Monitoring Reports; and,
- Current site details provided by Abbvie.

7.2 THE PROPOSED DEVELOPMENT

The proposed development is described in Section 4. Specific elements relevant to this chapter are described below.

7.2.1 CONSTRUCTION PHASE

The proposed construction works are anticipated to take approximately 16 months. The proposed development is an integrated Bio-Pharmaceutical manufacturing facility sized 3,476 square meters within the building fabric of the existing Abbvie Ballytivnan Building. Full project description can be found in Section 4 – *Project Description* of the Environmental Impact Assessment Report (EIAR).

The key civil engineering works which will have potential impact on the land, soils, geology and hydrogeology environment during construction at the proposed development include:

- Minor excavation of soil and infill for levelling and foundations for construction of the single storage extension, car park, the yard based structures and utilities. Soil/hardstanding stripping and excavation is minimised as the proposed development is mostly within the existing footprint of the current plant. Overall, there will be minimal soil anticipated to be removed from site as there will be no major excavations. Soil will be removed off-site by a licenced contractor to a licenced facility.

- The existing landscape berm will be relocated to the proposed location to the southern boundary of the site and south of the land ditches on the Abbvie site. This will be discussed in greater detail in Section 8 – Water & Hydrology.

- Potential for accidental loss of hydrocarbons to ground from construction vehicles, if not adequately mitigated.

An outline construction management plan (CEMP) has been prepared for the proposed development. This CEMP will ensure effective soil and water management during construction. The CEMP will cover potentially polluting activities and include an emergency response procedure.

The specific measures included within the CEMP which are relevant to this chapter are as follows:

Soil Removal, Compaction and Disposal

Construction works will require minimal excavations of soil and addition of fill for site levelling and foundations. Temporary storage of soil will be carefully managed to prevent environmental impact, impact on soil structure and generation of dust, e.g. storing stockpiles away from any open surface water drains, managing height and slope of stockpile and minimising soil movement. Soil to be removed from site will be sampled by a suitably qualified person(s) and analysed for relevant waste acceptance criteria analysis (WAC) before removal by a licensed waste disposal contractor as required.

Fuel and Chemical Handling

Refuelling of construction vehicles, and the addition of hydraulic oils or lubricants to vehicles, will take place in a designated area (or where possible off site) which will be away from surface water gulleys 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 and made available. 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) and other CIRIA guidelines regarding good practice (CIRIA 692, 2011; CIRIA 715, 2012) will be complied with.

With respect to portable equipment containing fuel oil, drip trays or approved equipment shall be used. Adequate spill clean-up materials will be available on site at all times.

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 waste waters or contaminated storm water to the underlying subsoil. The construction trucks will be sent back to their depots for wash down as per CIRIA C648 recommendations.

Accidental Releases

Emergency response procedures for any chemical/oil leaks are outlined in the CEMP for the site. All relevant personnel working on the site will be trained in the implementation of the procedures.

7.2.2 OPERATIONAL PHASE

There will be no direct discharge to ground required for the operation of the proposed development of this facility. Water supply will be from the public water supply and domestic effluent and trade effluent (post-treatment) discharge will be to public sewer in accordance with existing infrastructure on the site. There is no significant increase to bulk chemical/waste storage as a result of this proposed redevelopment. The revised yard layout will include 2 new above ground bunded waste water holding tanks, 7 meters high with a single storey unloading area sized 110 square meters and 9 meters high and its associated tanker un-loading and two number bunded underground tanks, together with its associated walled and fenced enclosure, and an emergency generator and its associated diesel tank.

The key items which could have potential impact on the land, soils, geology and hydrogeology environment during operation of the proposed development include:

- There will be no increase (0% increase) in hardstanding i.e. all the proposed development will be within the footprint of the building and within hardstanding areas. The temporary car park will be constructed using hardcore which will simulate natural infiltration.
- The storage and management of bulk chemicals and fuels onsite and management of accidental discharges. There is no significant bulk storage required for this development. During operation, the plant will operate within the requirements of an IED Licence and construction environmental management plan (CEMP). Operating within the licencing regime requires full and adequate containment and management of potential contaminants, and adequate site-specific emergency response measures.

The area proposed for redevelopment is within land which has already been used for industrial development and therefore there is no change in current land use. No additional land take is required.

Specific mitigation measures related to land, soil and groundwater protection for the operational phase which will be included in the licence for the facility are:

Fuel and Chemical Handling

Adequate bunding and hard standing shall be provided for all bulk chemical, waste, IBC and drum storage areas. Appropriate signage will be in place at each dedicated storage unit. All chemical containers will be labelled and copies of SDS sheets shall be maintained in the storage unit. In the event of a spillage, drainage from bunded areas shall be inspected and diverted for collection and safe disposal if required. The integrity and water tightness of all bunding structures and underground pipeline lines shall be routinely tested for integrity. All fuel oil areas will have an appropriate spill apron.

In the event of a spillage, drainage from bunded areas shall be inspected and diverted for collection and safe disposal if required. The integrity and water tightness of all bunding structures shall be tested and demonstrated. All fuel oil areas will have an appropriate spill apron.

Accidental Releases

An emergency management plan including emergency response procedures for any chemical/oil leaks will operate as part of licence requirements. All relevant personnel working on the site will be trained in the implementation of the procedures.

Groundwater Monitoring

Groundwater monitoring will be undertaken as required to comply with existing and future licence requirements.

7.3 THE RECEIVING ENVIRONMENT

7.3.1 SITE AREA DESCRIPTION

The site's ground level is generally flat across the proposed development site. Regional topography gradient reduces east and south towards the coast.

7.3.2 EXISTING DRAINAGE

The existing drainage is discussed in more detail in *Section 8 Water & Hydrology.* Arterial drainage is in an eastern direction from the proposed development site. Storm water drainage from the site passes through a drainage system with petrol interceptors before joining the Sligo County Council surface water sewer.

7.3.3 LAND USE

Abbvie is located in Sligo Town between Old Bundoran Road and the N16 Carriageway. The surrounding area is primarily residential with some commercial, light industrial and industrial lands. The Abbvie Ireland Site is located 1 km east of the proposed development site – Abbvie Ballytivan site. The site has been used as for Medical Device manufacture since c.1972 and is zoned as Z-Business-Industrial-Technology which is described as "*Promote the development of office-based businesses, technology companies and industrial units in dedicated business-industrial parks at Finisklin, Oakfield, Rathbraghan/Ballytivnan and Doonally (North Fringe).*". To the south of the site is a combination of residential, commercial, industrial buildings and recreational lands. Additionally, a parcel of undeveloped land is also to the south and east of the site.

7.3.4 HISTORICAL LAND USE

There has been an industrial plant at the proposed development site since 1970's with the operation of the Abbot plant. Recently in the early 2000's, Abbvie took over the plant at the location of the proposed development site.

Prior to these activities, the site was a greenfield site and used for agricultural proposes.

7.3.5 SOILS & SUBSOILS

Reference to the GSI (2018) on-line mapping indicates the predominant subsoil type in the general area at the Abbvie site is Made Ground and limestone tills. (Figure 7.1). The Teagasc subsoil map of Ireland illustrates the natural soil covering the site to be predominantly Tills derived chiefly from limestone rocks (TNSSs).

The soils distribution across the study area is provided on the EPA/Teagasc Soils Map. The map identified podzolics, gleys and alluvium as the distinct soil types that exist in the general area. Figure 7.2 shows the soils map for the site and surrounding areas.

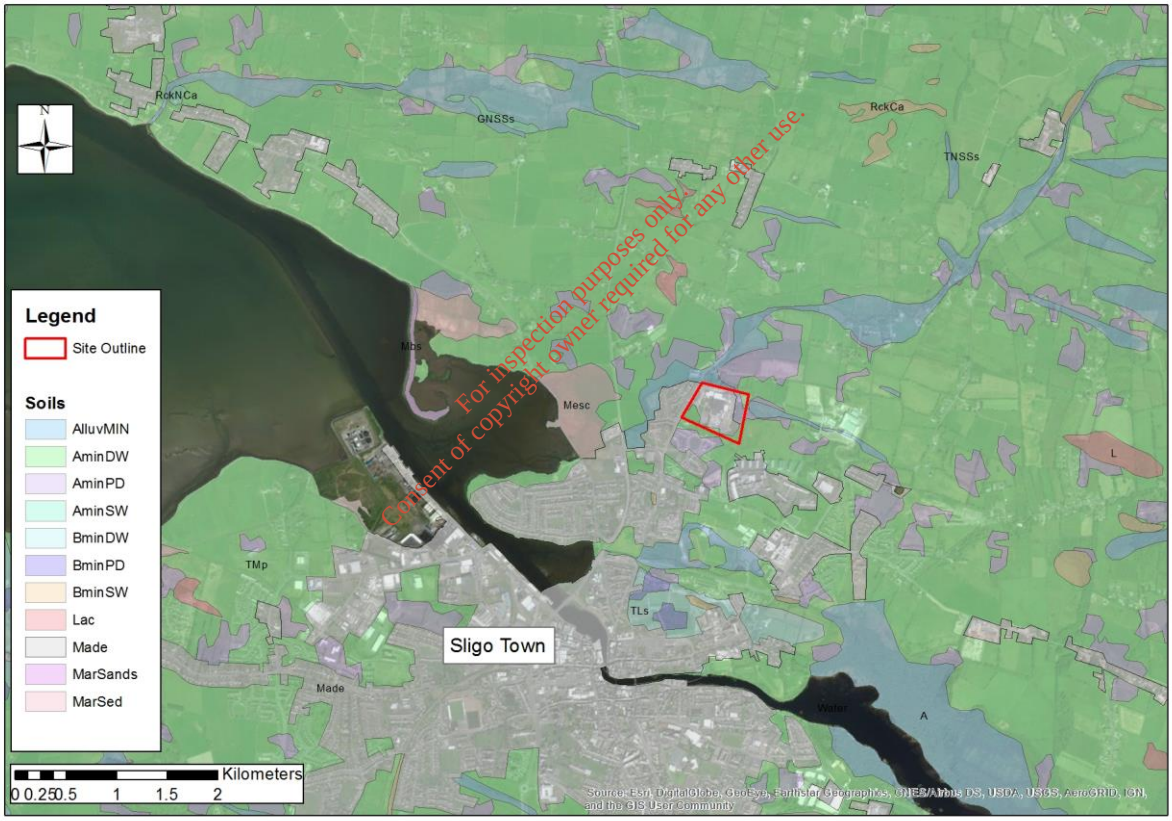

Figure 7.1 Soils Map

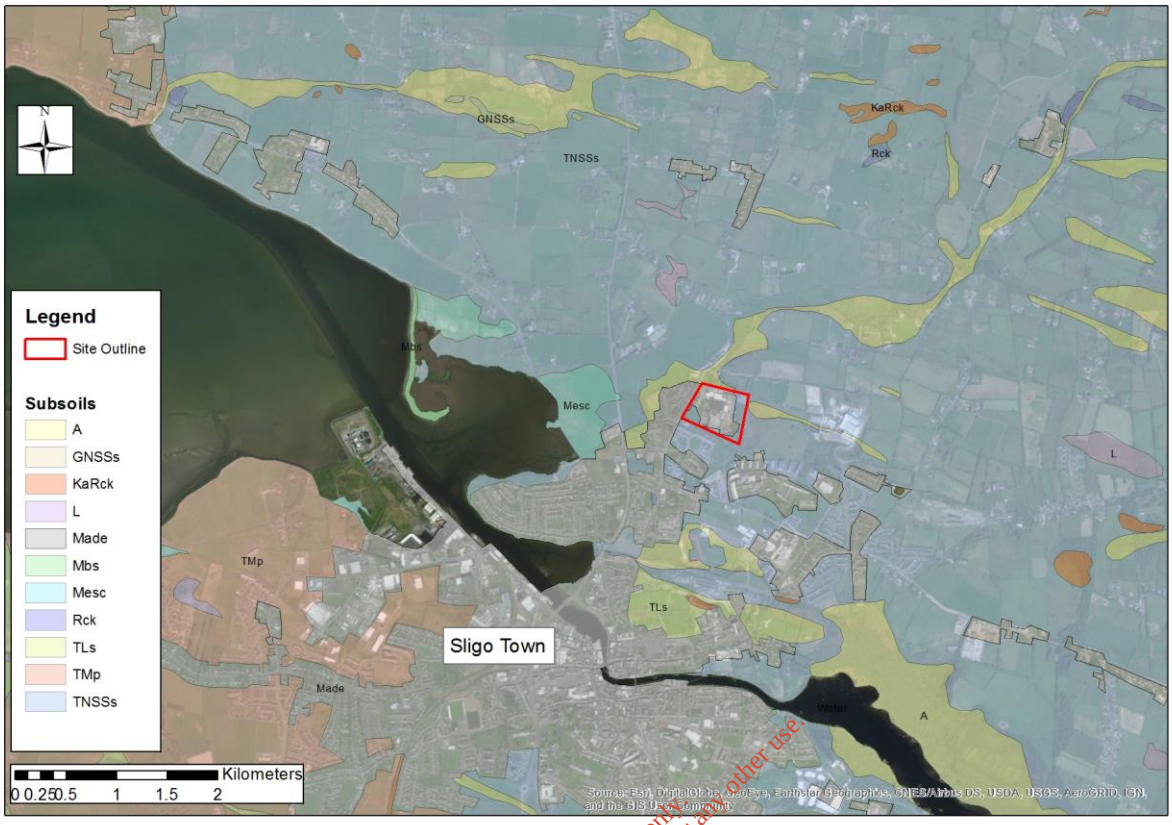

Figure 7.2 Subsoils Map

Abbvie has operated at this site as a medical device plant for the last <6 years. Previously, the site was used by Abbot since 1970's. Prior to this the site was a greenfield site.

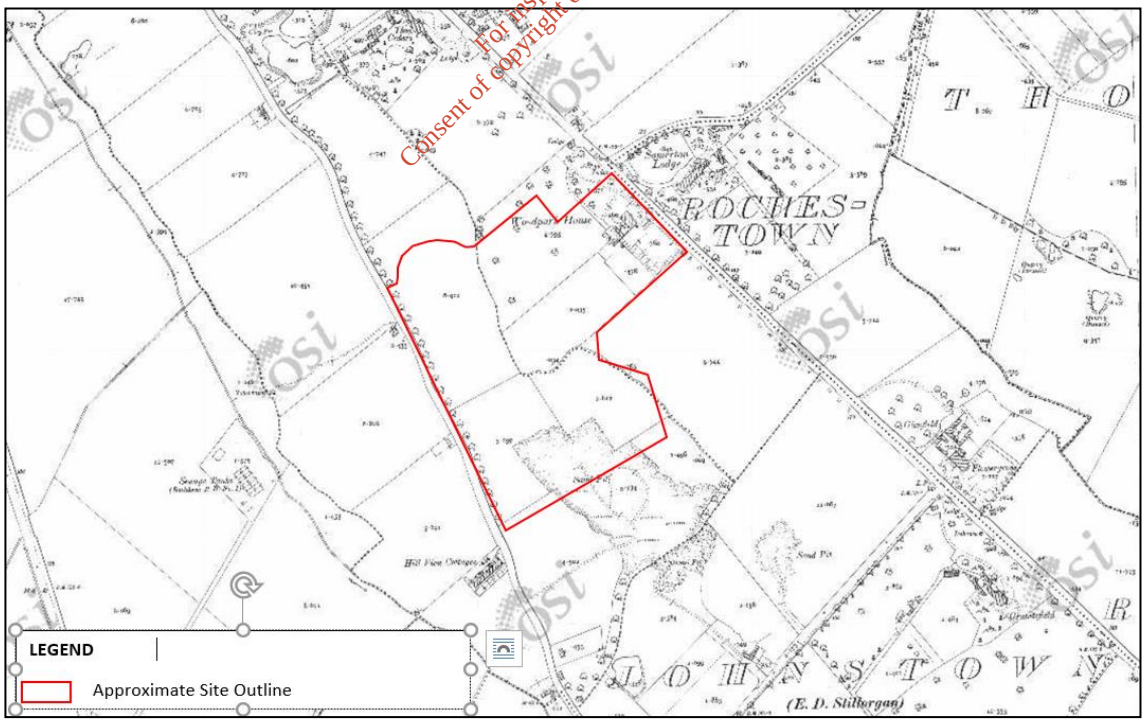

Figure 7.3 Historic 25 Inch (1888-1913) Map[23]

[23] OSI (2017) Online Mapping accessed January 2018 http://map.geohive.ie/mapviewer

7.3.6 GEOLOGY

As shown in Figure 7.4, the site is underlain by Glencar Limestone. The GSI Bedrock Geology Map for Sligo and Leitrim (Sheet 7) indicates that the site is underlain by Carboniferous limestones (Holkerian Stage) of the Glencar Limestone formation. This geological formation comprises argillaceous calcisiltite, very fine calcarenite limestone, interbedded with dark calcareous shale and is locally abundant. The GSI online database maps indicate that the site is underlain by Dinantian Upper Impure Limestones (DUIL).

There are no geological faults indicated on the GSI bedrock geology maps beneath the proposed development. However, faults are located north of the site. Geological faults in the area would be expected to influence the local hydrogeological regime to some extent because they would facilitate groundwater flow. It should be noted, however, that the location of geological faults on bedrock maps by the GSI is indicative only.

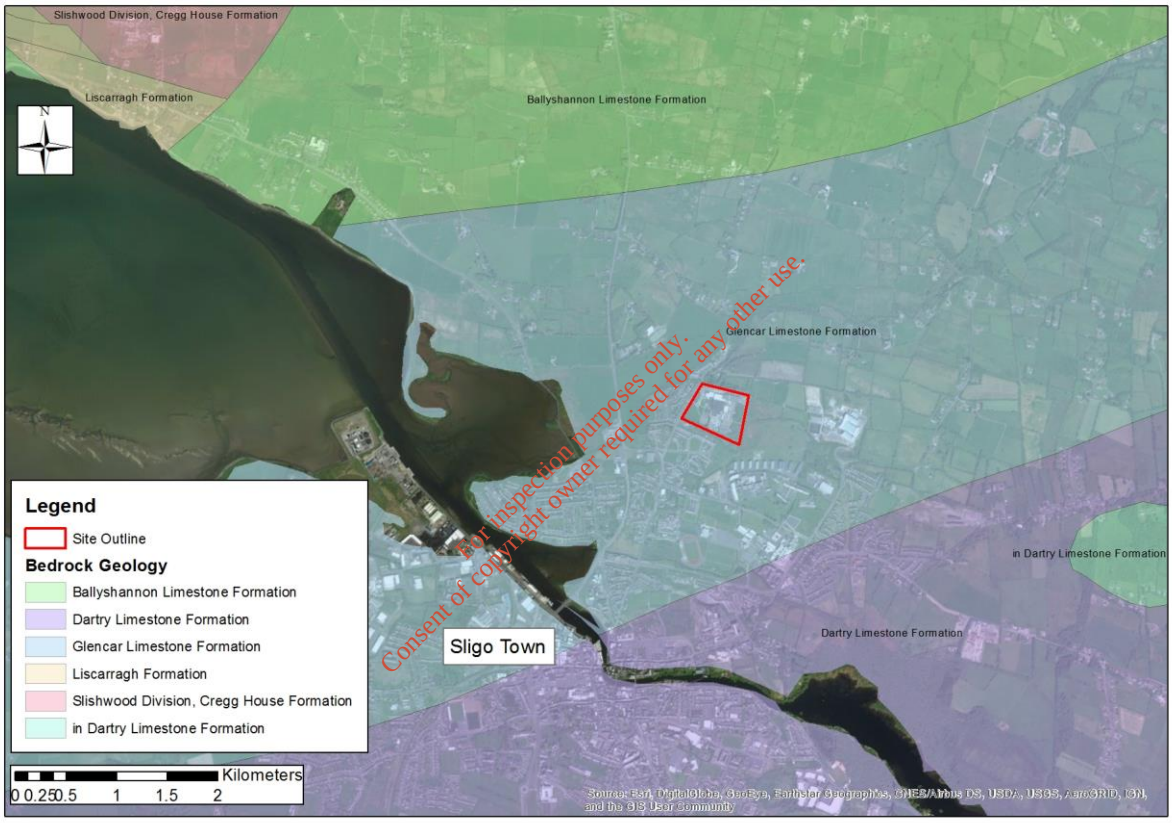

Figure 7.4 Bedrock Map

No site-specific borehole information was available for this assessment however, drilling on the nearby Abbvie site (2003), indicate that a shallow depth to bedrock of between 2.7m to 6.2m below ground level (BGL).

7.3.7 GEOLOGICAL HERITAGE

The GSI Public Viewer on-line mapping[24] was reviewed to identify sites of geological heritage for the site and surrounding area. The nearest recorded geological heritage site is Knocknarea (IGH 12), which is located >3 km southwest of the proposed development site. The Benbulben Plateau (IGH 8) is located >3km north of the site.

[24] GSI (2017) Online Mapping accessed January 2017 http://gsi.ie/Mapping.htm

7.3.8 ECONOMIC GEOLOGY

The extractive industry register[25] and the GSI mineral data base were consulted to determine whether there were any mineral sites close to the subject site. There are no active extractive or mineral sites located on the site. The nearest quarry is located 3km west of the proposed development site. The quarry (Scardon More Quarry) produces rock processed into chips and used for building stone by the process of blasting.

7.3.9 GEOHAZARDS

According to the GSI on-line database, there are no records of geo-hazards (i.e. landslides) within a 5km radius of the site. The nearest recorded landslide was recorded along the Cope's Mountain. There is no date recorded to this landslide event and rock moved approx. 110 metres from the zone of susceptibility.

7.3.10 RADON

Based on the National Reference level of 200 Becquerel (Bq)/m^3, radon concentrations for the area around the proposed development are considered high with <20% of homes in exceedance, e.g. more than twenty per cent of the homes in this 10km grid square are estimated to be above the Reference Level.

7.3.11 HYDROGEOLOGY

Aquifer Classification

Groundwater can be defined as water that is stored in, or moves through, pores and cracks in subsoils. The potential of rock to store and transport water is governed by permeability of which there are two types, inter-granular and fissure permeability. Inter-granular permeability is found in sediments, sands, gravels and clays as are also present at the subject site, and fissure permeability which is found in bedrock, where water moves through (and is stored in) cracks, fissures, fracture planes and solution openings for example.

Aquifers are generally classified as rocks or other matrices that contain sufficient void spaces and which are permeable enough to allow water to flow through them in significant quantities.

The GSI (2017) classifies the principal aquifer types in Ireland as:

Bedrock Aquifer

- Lk - Locally Important Aquifer - Karstified
- Ll - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
- Lm - Locally Important Aquifer - Bedrock which is Generally Moderately Productive
- Pl - Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones
- Pu - Poor Aquifer - Bedrock which is Generally Unproductive
- Rkd - Regionally Important Aquifer (karstified diffuse)

Gravel Aquifer

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

The GSI (2016) currently classifies the bedrock aquifer underlying the site as a (Ll) Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones. Figure 7.5 below presents the current bedrock aquifer map for the site and surrounding area.

[25] EPA (2017) Online Envision EPA Mapping accessed August 2017 http://gis.epa.ie/Envision

According to the GSI National Draft Gravel Aquifer Map for the region, the subject site is not underlain by a gravel aquifer.

The GSI mapping shows no karst features on the subject site but the mapping shows karst features approximately 4.5km east of the site in Magheraghanrush, Co. Sligo. These karst features are caves.

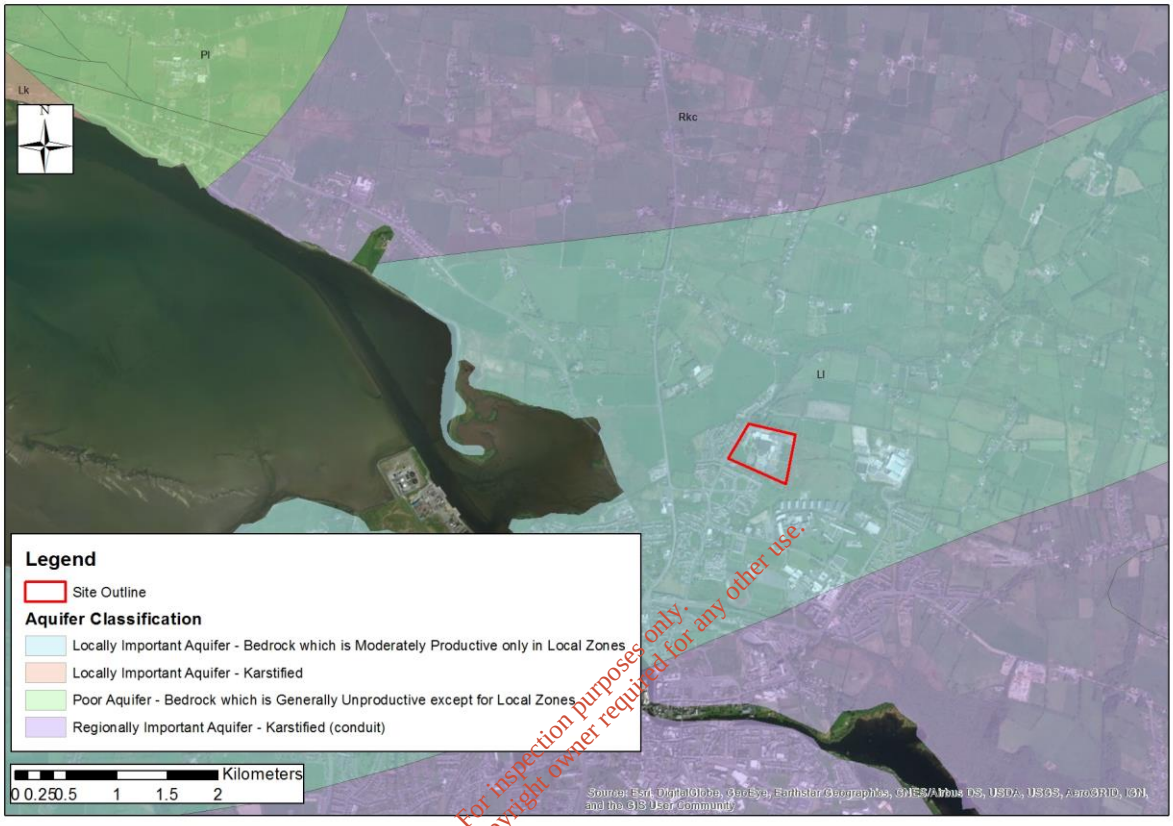

Figure 7.5 Aquifer Map

7.3.12 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/ fractures, the main feature that protects groundwater from contamination, and therefore the most important feature in the protection of groundwater, is the subsoil (which can consist solely of/ or of mixtures of peat, sand, gravel, glacial till, clays or silts).

The GSI (2016) presently classifies the bedrock aquifer in the region of the site as having (M) - Moderate Vulnerability status. A review of borehole data from the neighbouring Abbvie plant confirmed depth to bedrock of 2.7m to 6.2m below ground level (BGL).

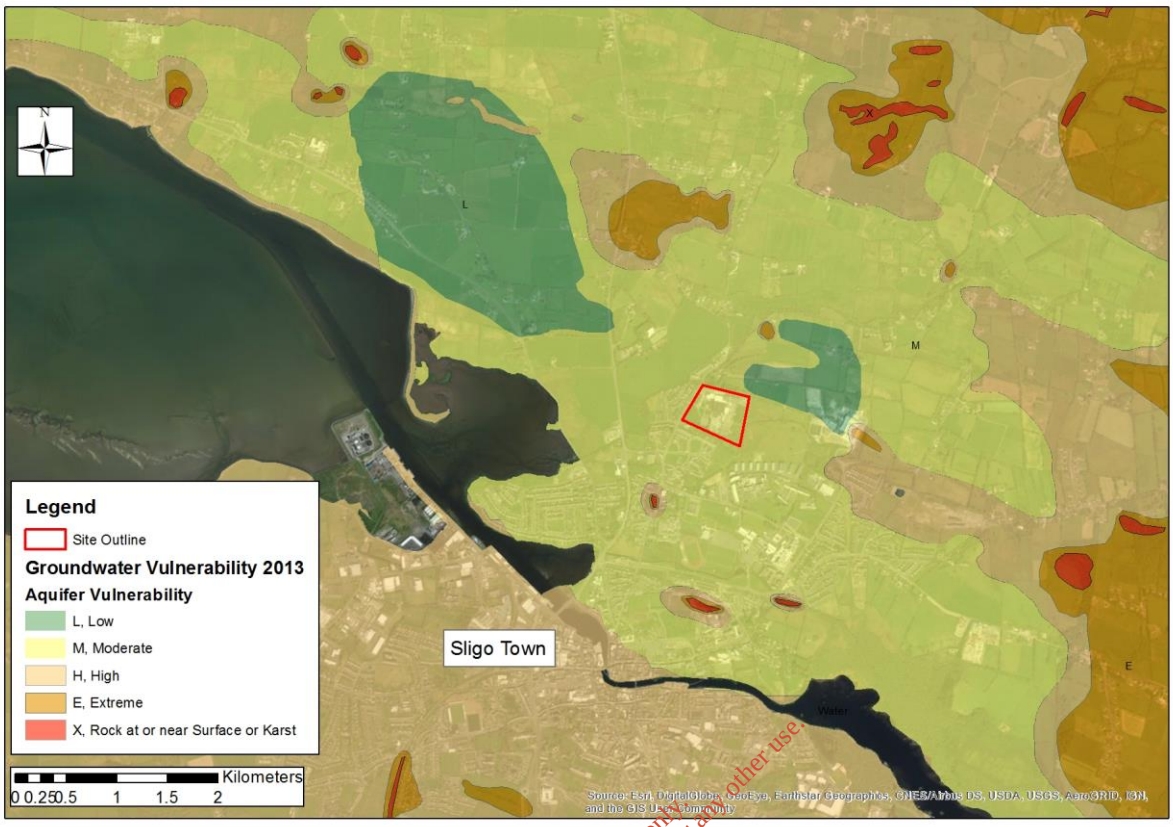

Figure 7.6 Vulnerability Map

7.3.13 GROUNDWATER QUALITY - LOCAL AND REGIONAL

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

The Groundwater Body (GWB) regionally underlying the site is the Drumcliff Strandhill GWB (EU Groundwater Body Code: IE_WE_0044). Currently, the EPA (2018) on-line mapping classifies the GWB as "under review" meaning it may or may not achieve good status.

There is no groundwater quality data for this site. However, a review of the groundwater data reported in the AER (2017) from the nearby Abbvie Ireland NL B.V. (Abbvie -Industrial Emissions (IE) Licence Reg. No. P0643-03) shows that there is some evidence of possible leaking sewers but no evidence of industrial contamination as a result of operating that facility. As the current facility has no significant solvent storage or discharge to ground the groundwater quality is not expected to have been impacted by the industrial use of the site.

7.3.14 GROUNDWATER FLOW AND LEVELS

The regional groundwater flow is believed to be north-westward towards the Willsborough stream and Sligo Bay. Based on drilling on the neighbouring Abbvie site groundwater static water levels were between 2- 3 metres below land surface and they would be expected to be similarly shallow on this site.

7.3.15 GROUNDWATER WELLS

The GSI Well Card Index is a record of wells drilled in Ireland. It is noted that this record is not comprehensive as licensing of wells is not currently a legal requirement in the Republic of Ireland. Figure 7.6 presents the recorded wells in the area of the site The GSI well search for the area surrounding the site does not identify any groundwater abstraction wells within 1.5 km of the subject site. It should be noted that the area is serviced by public water supply however agricultural wells may be present.

Figure 7.7 Wells

The wells within a close proximity of the proposed development site are detailed in the table (Table 7.1) below.

Table 7.1 Well Search Details

FID	GSINAME	SRCNAME	TYPE	Depth of borehole	Depth to Rock	DTRCONFID	EASTING	NORTHING	TOWNLAND	Water Strike
16674	1733SWW001	GSI Exploratory Drilling near Sligo Town	Borehole	52.4	5.2	Bedrock Met	170880	336950	CLEAVERAGH DEMESNE	-
16677	1733SWW007	BALLYTIVNAN, RATHBRAGHAN E.I.S	Borehole	6.2	2	Bedrock Met	170600	337390	RATHBRAGHAN	3.5
16678	1733SWW008	BALLYTIVNAN/ RATHBRAGHAN E.I.S	Borehole	9		DTB Unknown	170530	337420	RATHBRAGHAN	6.5
16679	1733SWW009	BALLYTIVNAN/RATHB RAGHAN E.I.S.	Borehole	21	6	Bedrock Met	170540	337480	RATHBRAGHAN	19
16680	1733SWW010	BALLYTIVNAN/RATHB RAGHAN E.I.S	Borehole	6.5	0.8	Bedrock Met	170100	337980	RATHBRAGHAN	6
16681	1733SWW011	BALLYTIVNAN/RATHB RAGHAN E.I.S	Borehole	6.6		DTB Unknown	170150	338050	RATHBRAGHAN	4
16682	1733SWW012	BALLYTIVNAN/RATHB RAGHAN E.I.S	Borehole	7.6		DTB Unknown	170200	337950	RATHBRAGHAN	6.5

7.3.16 AREAS OF CONSERVATION (NHAS & SACS)

The GSI and NPWS on-line databases presently list no ecological designated areas within or immediately adjacent to the proposed development site (discussed in further detail in Section 6 - ref Section 6 *Biodiversity*). The Lough Gill (site code: 0001976 SAC & site code: 004035 SPA) SAC (Special Area of Conservation) & SPA (Special Protection Area) is located approx. 1 km to the west and southwest of the proposed development site. This area is also a proposed Natural Heritage Areas (pNHA), with a site code 000627 - Cummeen Strand/Drumcliff Bay (Sligo Bay).

7.3.17 WASTE LICENCE FACILITIES

According to the EPA (2016) on-line mapping, there are no known licensed or waste sites in the vicinity of the subject site. The nearest licensed waste facility is located in Drumshanbo, >20 km southeast of the proposed development site. Phone consultation with Sligo County Council confirmed there are no known illegal landfills within this area.

7.3.18 CONCEPTUAL SITE MODEL

To summarise the current conceptual site model (CSM), a regional cross section is presented below as Figure 7.7, below. The CSM for the site is as follows:

- The site for the proposed development is located on an existing industrial site, i.e. Made Ground. There has been a production facility on this site since the late 1970s'.
- The site is underlain by Made Ground underlain by Glacial limestone derived clays with a shallow depth to rock.
- The bedrock beneath the site is Limestone; this is a (LI) Locally Important Aquifer.
- Potential environmental receptors are the underlying Locally Important Aquifer and nearby Willsborough Stream. There are no known or expected groundwater supply wells as the area is serviced by mains. The underlying bedrock of interbedded limestone and shale by nature has a high fracture index with little connectivity and therefore there is no likely hydrogeological connectivity with Lough Gill SAC located 1 km from the proposed development site or Cummeen Strand/Drumcliff Bay (Sligo Bay) pNHA.
- The footprint of the proposed development area was previously industrial in nature (Medical Device Manufacture), although there is no water quality data from the footprint, there is no likely impact on groundwater quality based on the activity on site. The EPA has given the aquifer a "good status" with a risk score of 'under review'.

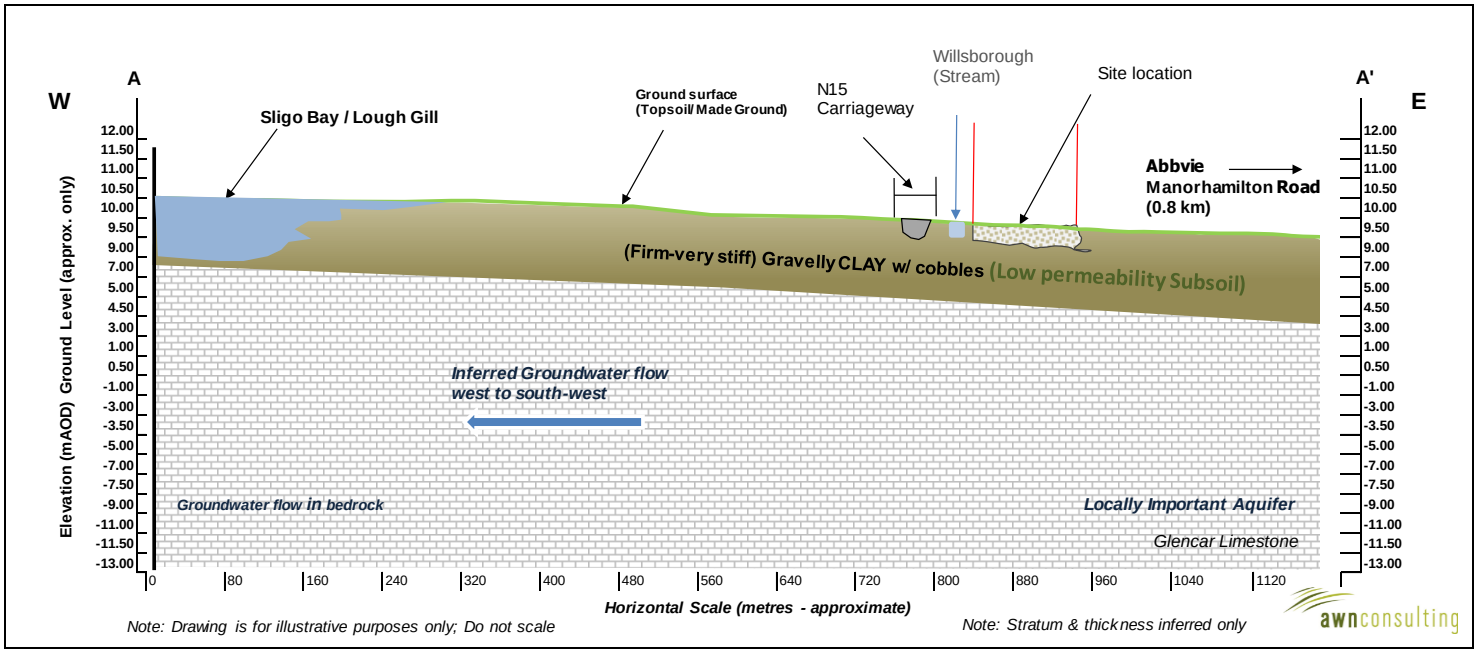

Figure 7.7 Schematic cross section of the site.

Rating of Site Importance of Geological/Hydrogeological Features

Based on the NRA and IGI methodology (refer Appendix 7.1, Table 2 and 3) and criteria for rating site importance of hydrogeological features, the importance of the hydrogeological features at this site is rated as having a **'Medium Importance'** based on the fact that the bedrock underlying the site is a Locally Important aquifer and has potential for local water supply in the vicinity. The geological attribute has a **low-quality significance or value on a local scale.**

7.4 PREDICTED IMPACTS

Predicted impacts during construction and operation are outlined below. The implementation of the mitigation measures outlined in Section 7.5 below and the design mitigation measures outlined in the CEMP will ensure that the primary potential impact of accidental release to ground during the construction phase as are minimised. These measures will ensure that the development does not impact on receiving land soil or groundwater quality.

7.4.1 CONSTRUCTION PHASE

Excavation & Infilling impact on Aquifer Vulnerability

Every development alters the local aquifer vulnerability to some extent as in order to prepare the site for development and final landscaping, some stripping of soil and hardstanding will be required. At this facility, the change in aquifer vulnerability is minimised as the proposed facility is to be constructed mostly on the footprint of the existing plant. The total excavation will be minimal, most of which will removed off site or reused on site. If soil is removed off site, a similar quantity of fill will be emplaced on site. There will be no increase in hardstanding i.e. all the proposed development will be within the footprint of the building and within hardstanding areas. The temporary car park will be constructed using hardcore which will simulate natural infiltration.

Land Use

There is no loss of soil or land resource for this proposed development. The area is already industrial in nature and is proposed for development of this nature.

Accidental Spills & Leaks

During construction, there is an increased risk of accidental pollution incidences from the following sources:

- Spillage or leakage of temporary oils and fuels stored on site for construction.
- Spillage or leakage of oils and fuels from construction machinery or site vehicles.
- Alkaline run-off from concrete and cement construction.

Accidental spillages (including any release of chemicals) may result in contamination of soils and shallow groundwater underlying the site, if not adequately mitigated. The aquifer vulnerability is likely to be high on site based on shallow depth to rock. A large section of the proposed area is already covered by hardstanding and drained to stormwater which offers protection to the underlying aquifer in these areas.

Localised Dewatering

No significant dewatering will be required during the construction phase which would result in the localised lowering of the water table. As such there is no likely impact on the natural groundwater regime.

7.4.2 OPERATIONAL PHASE

In terms of predicted specific impacts during site operation the following points are of note:

- There is no likely impact on any geological heritage, mineral locations, sensitive groundwater receptors or groundwater supplies in the vicinity of the proposed development site.
- There is no additional significant bulk chemical storage planned as part of the proposed development.
- There will be no direct discharges to groundwater or soil environment during the operational phase. As such, local impact could only occur due to accidental emissions such as localised accidental leakages from cars/vehicles in the car park areas or accidental leakage from chemical storage areas (mostly IBCs and drums), bulk diesel fuel tanks or transfer lines which are unlikely as will be double contained and regularly tested and maintained as required by licencing.
- The operation of an Environmental Management Plan (EMP) and operation within the requirements of an EPA licence will minimise the likelihood of any spill or leaks at the site.
- There will be no groundwater abstraction or licenced discharge to ground during operation of the proposed development.

7.5 MITIGATION MEASURES

A number of design stage mitigation measures have been considered and included in the design of the proposed development during construction and operational impacts. These have been included in the outline CEMP for the development and are summarised in Section 7.2 and listed below.

7.5.1 CONSTRUCTION PHASE

Design stage mitigation measures included in Section 7.2.1 cover the following risks;

- Soil Removal Compaction and Disposal
- Fuel & Chemical Handling
- Accidental Releases

7.5.2 OPERATIONAL PHASE

Compliance with standard monitoring and maintenance procedures in an EPA licence will provide adequate protection for the land soil and groundwater beneath the facility. The increase in risk to soil and groundwater environment is low as apart from fuel storage there is no increase in the bulk

chemical storage required for the proposed development There will be no underground tanks installed as part of this proposal and any transfer lines will be double contained and above ground.

7.6 MONITORING

7.6.1 CONSTRUCTION PHASE

Regular inspection of surface water run-off and sediments controls e.g. silt traps will be carried during the construction phase. Regular inspection of construction mitigation measures will be undertaken e.g. concrete pouring, refuelling etc. as part of implementation of the site CEMP.

7.6.2 OPERATIONAL PHASE

Groundwater monitoring will be undertaken if required by EPA licence requirements.

7.6.3 REINSTATEMENT

No reinstatement within public lands is anticipated with respect to the Land, Soils, Geology and Hydrogeology environment.

7.7 INTERACTIONS AND POTENTIAL CUMULATIVE IMPACTS

7.7.1 INTERACTIONS

Hydrology

As outlined in the receiving environment, there is an inter-relationship between hydrology and soils, geology and hydrogeology. The underlying aquifer is "locally important" so interconnectivity is low. Surface water run-off may have the potential to enter soil and shallow groundwater. Implementation of appropriate mitigation measures as outlined in the CEMP will eliminate the potential for the influx of surface contaminants into the underlying geology and hydrogeology which would otherwise affect its quality.

Air Quality

There is a potential for soil excavation activity to impact on air quality in terms of dust generated but the implementation of suitable mitigation measures as outlined in the Section 9 *Air Quality and* Climate and CEMP will ensure a neutral impact.

Waste

There is a requirement to dispose of soil excavated on the site. Appropriate sampling and disposal will be undertaken as outlined in the outline CEMP and Chapter 14.

7.7.2 POTENTIAL CUMULATIVE IMPACTS

The proposed development is within the boundary of the current Abbvie site. Any potential impacts on the soil environment will be within the confines of the site boundary. With the implementation of the measures highlighted above and, in the CEMP, the cumulative effect on the land, soils, geology and hydrogeology local environment with any adjacent developments is deemed to be insignificant.

7.8 RESIDUAL IMPACTS

Based on the natural conditions present and with appropriate mitigation measures included in the CEMP to reduce the potential for any impact of accidental discharges to ground during the construction phase, the potential impact on land soils, geology and hydrogeology during construction (following EPA, 2017) is considered to have a **short term, imperceptible significance**, with a **neutral** impact on quality.

There are no likely significant impacts on the land, geological or hydrogeological environment associated with the proposed operational development of the site with mitigation in place. As such the impact is considered to have a **long term, imperceptible significance** with a **neutral impact on quality** i.e. an impact capable of measurement but without noticeable consequences.

8 WATER & HYDROLOGY

8.1 INTRODUCTION/METHODOLOGY

8.1.1 INTRODUCTION

The following section presents an assessment of the impacts of the proposed development in terms of water use, waste water and hydrology to the local environment as per the guidelines and advice notes highlighted in Section 2.1 of this Environmental Impact Assessment Report (EIAR). Soils, Lands, Geology & Hydrogeology are addressed under Section 7 of this EIAR.

In assessing likely potential and predicted impacts, account is taken of both the importance of the attributes and the predicted scale and duration of the likely impacts.

8.1.2 METHODOLOGY

In addition to the EPA Guidelines and Advice Notes referred to in Section 2.1, consideration has also been given to 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). These guidelines are referenced where the methodology for assessment of impact is appropriate (refer Appendix 8.1).

The following sources of information were consulted:

- Current EPA on-line database -Envision water quality monitoring data for watercourses in the area;
- Western River Basin District (WRBD) Management Plan;
- 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);
- 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);

The attributes (and impacts) to be assessed include *inter alia* 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.

Site-specific data was derived from the following sources:

- Consultation with Jacob Engineering re design;
- Jacobs Engineering Construction Management Plan for the Proposed Extension; and,
- Abbvie Annual Environmental Report 2016.

The potential impacts in relation to surface water during construction have been assessed under the following headings:

- Increased run-off and sediment loading
- Potential for contamination of local water courses

The potential impacts in relation to water during operation have been assessed under the following headings:

- Impact on public water supply and waste water infrastructure
- Impact on storm water run-off
- Impact on water quality as a result of accidental discharge
- Impact on flooding

8.2 THE PROPOSED DEVELOPMENT

The proposed development is outlined in Section 4 *Project Description*. Due to the inter-relationship between land, soils, geology and hydrogeology and surface water some of the following potential impacts discussed are relevant to Section 7 as well as this section.

8.2.1 CONSTRUCTION PHASE

The key civil engineering works at the proposed development which could impact the water environment are (i) the minor excavation of material for foundations etc. and deliveries of imported engineering fill, crushed stone, concrete, reinforcement and other construction materials and (ii) management of surface water and foul sewer drainage (no increase in hardstanding – 0% change in hardstand) (iii) new drainage constructed as part of the extension and carpark, and (iv) temporary contractors compound constructed with granular fill to simulate natural infiltration. Other relevant construction activities include site storages of soils, cement and concrete materials, temporary oils and fuels.

A project-specific outline Construction Environmental Management Plan (CEMP) has been prepared and will be maintained by the contractors during the construction and operational phases of the proposed project. The CEMP will cover all potentially polluting activities and include an emergency response procedure. All personnel working on the site will be trained in the implementation of the procedures. At a minimum, the manual will be formulated in consideration of the standard best international practice including but not limited to the following:

- CIRIA, (2001) 'Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors', Construction Industry Research and Information Association, CIRIA reference C532, January 2001
- CIRIA, (2005). 'Environmental Good Practice on Site' (C650). London: Construction Industry Research and Information Association (CIRIA) (Connolly S. and Charles P.)
- CIRIA, (2007). 'The SUDS Manual'. London: Construction Industry Research and Information Association, CIRIA reference C697
- CIRIA, (2011). 'Environmental good practice on site'; Construction Industry Research and Information Association publication C692 (3rd Edition - an update of C650 (2005); (I. Audus, P. Charles and S. Evans)
- CIRIA, (2012). 'Environmental good practice on site' –pocket book; Construction Industry Research and Information Association publication C715 (P. Charles, and G. Wadams)
- EA, (2004) 'UK Pollution Prevention Guidelines' (PPG), Environment Agency
- Inland Fisheries Ireland (2016) Guidelines on the Protection of Fisheries During Construction Works and Adjacent to Waters.

The outline CEMP includes mitigation measures which have been integrated into the design process to allay any potential impact on the surface water environment from construction activities, these include;

Surface Water Run-off

As there is a direct pathway, there is a potential for surface water run-off to discharge directly to the local watercourses during construction. The main course of the Shannon Eighter runs along the northern half of the eastern boundary of the Abbvie site. There are two drainage ditches located within the Abbvie site. The first drainage ditch that runs west to east along southern boundary of the site. The second drainage ditch runs north to south along the northern half of the eastern boundary. Both drainage ditches drain into the Shannon Eighter. Silt traps and other measures should be used to prevent any potential surface water run-off to the two local drainage ditches. Furthermore, most of the proposed works are to the northern section of the proposed site, away from the drainage ditches. Operation of machinery in-stream should be kept to an absolute minimum. The relocation of the landscape berm is proposed to be located south to the drainage ditch located along southern boundary of the site. A buffer zone of 5-10m should be provided to prevent any siltation of this drainage ditch.

All watercourses which have to be traversed during construction projects should be effectively bridge prior to commencement of works. Clear span designs to maintain channel profile - If any new drain crossings are required please ensure that the client is aware that these watercourses/drainage ditches share hydrological links with designated sites in the wider area and the crossing methodology should avoid in stream works (or other disturbance that could lead to siltation of the watercourse) – it is recommended that a clear span bridge or oversized culvert for stream crossings. It is important to incorporate best practices into construction methods to minimise discharges of silt/suspended solids and any contaminated water to waters.

Water containing silt will be treated on site (via temporary settlement tanks or equivalent) to ensure effective silt removal. However, there are no major excavations and no dewatering will be required.

Temporary storage of soil will be carefully managed in such a way as to prevent any potential negative impact on the receiving environment as the material will be stored away from any open surface water drains. Temporary swales or silt fences may be used as appropriate. Movement of loose material will be minimised in order to reduce degradation of soil structure and generation of dust. Excavations will remain open for as little time as possible before the placement of fill/cover. This will help to minimise potential for water ingress into excavations.

Weather conditions will be taken into account when planning construction activities to minimise risk of run-off from the site and the appropriate distance of topsoil piles surface water drains to be maintained. According to the Inland Fisheries Guidance document 2016, it is recommended that a 5-10m buffer zone of mapped drains (semi-natural watercourses) on site to comply with fisheries best practice guidelines.

The temporary car park located in the south-eastern section of the site is proposed to be constructed with granular fill – hardcore – to simulate natural infiltration during rainfall events. During the reworking for the temporary contractor car park, a soil berm will be moved to the southern boundary of the site which is located in Flood Zone C.

Fuel and Chemical Handling

To minimise any impact on local receiving watercourses via onsite drainage from accidental spillages, all tank and drum storage areas required for construction will be bunded or have adequate spill containment measures in compliance with EPA standards.

Refuelling of construction vehicles, and the addition of hydraulic oils or lubricants to vehicles, will take place in a designated area (or where possible off site) which will be away from surface water gulleys or drains. In the event of a machine requiring refuelling on site, 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. Designated storage area will be shown in the project-specific outline CEMP.

Accidental Releases

As outlined in the CEMP, all personnel working on the site will be suitably trained in the implementation of the procedures. In the event of a spillage drainage from bunded areas will be inspected and diverted for collection and safe disposal if required. The contractor company will ensure adequate spill clean-up materials will be available onsite at all times.

8.2.2 OPERATIONAL PHASE

Water supply will be supplied from public mains water supply. Domestic effluent will be to public sewer. High strength trade effluent will be tankered off site. Storm water will be discharged as current.

During operation the following will apply;

Water supply

The proposed water demand for the proposed development will have sufficient supply to the facility. Drinking water will be supplied via public water main and adequate water supply is available.

Surface Water

It is proposed to continue to use current arrangements for the discharge of storm water run-off from the proposed development. Storm water from the site arises from buildings run-off, car-parks, road-ways, service yards and other developed areas of the site which discharge via petrol interceptor(s) before being combined in the outfall of the plant.

As the area proposed for development is already mostly hard standing there will be no significant change in run-off from the site and as such no change in the receiving environment. There will be no increase in hardstand (0% increase in hardstanding area). Therefore, there is no increase in surface run-off.

Foul and Process Effluent

Effluent will comprise domestic effluent from welfare facilities such as toilets, showers and canteen facilities, wash-water; reject water from water purification systems, boilers and cooling towers blow-down and process wastewater**.**

Process waste is segregated into two categories; High High Strength and Low Strength. Average wastewater for off-site disposal is expected to be in the region of 7m^3/day incl. approx. 25 litres/day solvent (DMSO/DMA).

<u>High High Strength Process Waste</u>

High High Strength Waste is waste from high containment areas or waste which has been identified that may contain some toxin or other harmful substances. This waste is considered hazardous and is not suitable for treatment by conventional WWT (Waste Water Treatment) technology.

High strength waste is routed to designated gulley in the locality by means of closed pipework from the respective users. All High High strength Process drain points are on the ground floor. The waste in the underground drainage is all double-contained, gravity drained (1:100 slope) polypropylene (PP) pipe. Drains will ordinarily run at 50% flow with a vent line at the end of each header. The main collection header is 6-inch internal diameter and enters the underground High High strength sump tank outside the building.

The High High Strength Sump tank is a stainless steel, single skin, flat bottomed, vertical cylindrical tank with an ellipsoidal top. The approximate operating volume of the tank is 7000 L. It is underground in a pit with the low strength sump tank. Level switch controlled self-priming pumps (Duty and Stand-by) on top of the tank will pump waste from the sump to the above ground storage

tank. Quick connects with valves are available for cleaning though transfer lines and spray balls, using domestic water from site services.

The High High Strength above ground storage tank is a 60,000 L flat bottomed, vertical cylindrical tank stainless steel tank with an ellipsoidal top. This tank is in the same bund as the above ground low strength waste storage tank. The high high strength storage tank is emptied routinely into a road tanker to be incinerated / disposed of off-site. Approximately two tankers a week are estimated to be required when working at maximum capacity. The containment of the process waste is subject to EPA licence conditions to minimise potential for leakage/spillage.

Low Strength Process Waste

Low Strength Waste is all other process specific waste. Including flashpot condensate drains, and waste from non-toxin / product contacting equipment e.g. autoclave & buffer prep equipment etc. There is no toxin in this waste. Low strength waste follows a similar philosophy to High High strength waste.
The drain lines from the mezzanine floor down to the ground are stainless steel with the underground drainage transitioning to double contained, gravity drained polypropylene pipe. Two collection headers feed the main 6-inch header which drains into the low strength sump tank.

The low strength sump tank is a rectangular stainless steel tank with approx. 10,000 L operating volume. It is bunded in the same underground pit as the high high strength sump tank. The waste is pumped into the above ground storage tank by two (duty and standby) submersible pumps inside the sump tank.

The above ground storage tank is a 30,000 L stainless steel tank. The waste is sampled and will generally be sent to the foul sewer (municipal waste water treatment). The facility includes for pH and temperature adjustment should there be a need for this before discharge. The waste can also be pumping into the high high strength tank or to a road tanker if there is ever a concern about the possibility of contamination of the waste.

Operation of the wastewater plant will be according to BAT (Best Available Technology) principles and in compliance with the licence for the site to ensure that inputs to, and subsequent contamination of, soil and water environments does not occur during normal and/ or emergency conditions (material spillage or fire event situations).

Fuel & Chemical Handling

Additional bulk chemical will not be required during operation of the proposed facility. One additional fuel tank is required for the emergency generator. Appropriate containment measures will be put in place as part of licence requirements for the site. Any transfer of liquid raw materials or products will be in above ground double contained lines as per licence requirements.

Any smaller volumes of chemicals will be stored in fully contained IBCs or drums or smaller appropriate containers. Storage will be within the building footprint, i.e. on an impermeable floor where any leaks or spills can be contained and easily cleaned up. Any chemicals, oils, herbicides required for site maintenance will be stored as current in suitable contained areas.

Surface Water Run-off, Monitoring and Firewater

The proposed facility will be served by the current surface water drainage network which will be expanded to cater for the proposed development and the existing development. There is no increase in hardstanding area (0% change), therefore there is no measurable increase in surface run-off. Petrol/oil interceptors are located on the outlet from the car park. These measures will prevent discharge of oils/fuels which may potentially be present in surface water run-off from the car park and main building areas and ensure that run-off discharges at greenfield run-off rates as current.

A proposed dedicated fire water system protects and collects fire water arising within the manufacturing areas.

8.3 THE RECEIVING ENVIRONMENT

8.3.1 HYDROLOGY & DRAINAGE

The study area is located within the Western River Basin District (WRBD) in Hydrometric Area No. 10 of the Irish River Network. The site is within Hydrometric Area No. 35 of the Irish River Network. It is within the Garavogue catchment area. The Garavogue River (EPA site code 35/G/01) enters Sligo Estuary/Bay which is located approximately 1.4km to the west of the site. The Willsborough Stream (IE _WE-35W0103033), also referred to as the Doonally River, rises in northern Sligo and enters Sligo Estuary/Bay. There are no significant natural watercourses occurring within the proposed development site. Figure 8.2 below presents the surrounding drainage. The main course of the Shannon Eighter runs along the northern half of the eastern boundary of the Abbvie site. There are two drainage ditches located within the Abbvie site. The first drainage ditch that runs west to east along southern boundary of the site. The second drainage ditch runs north to south along the northern half of the eastern boundary. Both drainage ditches drain into the Shannon Eighter.

Figure 8.1 Hydrological Environment

Surface Water Quality

The proposed development is located within the WRBD, as defined under the European Communities Directive 2000/60/EC, establishing a framework for community action in the field of water policy, (commonly known as the Water Framework Directive [WFD]).

The WFD requires 'Good Water Status' for all European waters by 2015, to be achieved through a system of river basin management planning and extensive monitoring. 'Good status' means both 'Good Ecological Status' and 'Good Chemical Status'. In 2009, the ERBD River Management Plan (RMP) 2009-2015 was published. In the WRBD RMP, 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.

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

- Statutory Instrument (SI) No. 293 of 1988 European Communities (Quality of Salmonid Waters) Regulations 1988;
- Local Government (Water Pollution) Acts 1977-1990;
- SI No. 258 of 1988 Water Quality Standards for Phosphorus Regulations 1998; and
- SI No. 272 of 2009 European Communities Environmental Objectives (Surface Waters) Regulations 2009

In accordance with the WFD, each river catchment within the WRBD was assessed and a water management plan detailing the programme of measures was put in place.

Q-Values are used by the EPA to express biological water quality, based on changes in the macro invertebrate communities of riffle areas brought about by organic pollution. Table 8.2 below summarises an explanation of the ratings; for example, Q1 indicates a seriously polluted water body while Q5 indicates unpolluted water of high quality.

Table 8.1 EPA Biological Q Ratings & Key

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

Available data for 2015 from the EPA on-line mapping database *EPA Maps* is presented in Table 8.2 below together with the most recent Q-Value for the watercourse at the locations closest to the site.

Table 8.2 EPA sampling locations for the Willsborough Stream

Entity Name	Willsborough Stream		
Station Name:	Bridge W of Willsborough	1.5 km W.S.W. of Willsborough	Bridge on Sligo-Bundoran Road
Station ID:	RS35W010150	RS35W010200	RS35W010300
WFD CODE:	IE_EA_35W010150	IE_EA_35W010200	IE_EA_35W010300
Type of water monitored:	River Water	River Water	River Water
River Basin District:	WRBD	WRBD	WRBD
Station Type (WFD):	Operational	Operational	Operational
Easting:	171207.22	169972	169258.31
Northing:	338306.55	337947	337375.33
Last Q Year:	2015	1990	2015
Last Q Value:	4	4	4
Q Legend:	Good	Good	Good
Q Linear Value:	4	4	4

Figure 8.2 below presents the river catchment map and water quality status (including current EPA monitoring stations).

Figure 8.2 River Catchment Map & Quality (EPA) (Site Location Red Cross)

The values listed above are for monitoring stations located both upstream and downstream of the subject site. As is shown on Figure 8.2 the downstream monitoring location (RS35W010300) has a Q Linear Value of 4 (*'Good Status')* this is similar to the upstream monitoring location (RS35W010150) which also has a Q Linear Value of 4 (*'Good Status')*. The linear value takes in account the current and previous Q-values to determine the expected Q-value for next year. The Willsborough Stream is classified as being 'Not At Risk of Achieving Good Status". The WFD status (2010-2015) is designated as Good.

EPA's *Envision* Database was also consulted to determine if any designated salmonid waters (S.I. 293/1988-European Communities (Quality of Salmonid Waters) Regulations, 1988) existed close to the site or are located so that they may be adversely impacted by the proposed development or operation of the facility. The Willsborough Stream was previously not included in the register of salmonid waters included in those regulations.

Flooding

In accordance with the guidelines produced by the Department of the Environment, Heritage and Local Government (DoEHLG) - *The Planning System and Flood Risk Management (FRM) Guidelines for Planning Authorities*, November 2009, a Stage 1 assessment has been carried out and is submitted as part of this planning application.

No historic flooding of the site has been identified from the OPW floodmaps.ie website. Soil maps were researched and indicated that the site was not underlain by alluvium soils therefore indicating that, historically flooding has not occurred onsite. CFRAM PFRA and Fluvial Flood Extent maps conclusively indicate that the site majority resides within Flood Zone C and is not at risk of flooding from any modelled flood event. A small proportion of the north-eastern and eastern boundary is modelled as having an impact by the 1 in 10 (10% AEP) year flood event which indicates that some of the existing development resides in Flood Zone A. This is due to the partly culverted Shannon Eighter watercourse located at the south-eastern boundary. The Shannon Eighter is susceptible to flooding due to the capacity of the culvert during periods of heavy rainfall and high tides. No flooding has been recorded on the site since the facility has been built in 1970's.

In keeping with the Stage 1 assessment, the review of available information has identified no flood hazards for the proposed works at the proposed development site therefore; in accordance with The Planning System and Flood Risk Management Guidelines for Planning Authorities, there is no requirement to proceed to the Stage 2 or 3 assessments. The proposed redevelopment is found within Flood Zone C, with a small proportion residing within existing development area in Flood Zone A. The development is considered a "Less Vulnerable Development" due to the nature of the development,

e.g. buildings used for industrial and non-residential institutions. The proposed development is primarily within the envelope of the existing development. There is no increase in hardstanding (0%). The proposed development works are located within Flood Zone C and are suitable development for this flood zonation. As a result, there is no expected measurable increase in run-off as a result of this development. During the reworking for the temporary contractor car park, a soil berm will be moved to the southern boundary of the site which is located within Flood Zone C.

The existing drainage systems along with those proposed ensures appropriate drainage for the site. There is inconsequential increase in hardstanding area, therefore no resultant measurable increase in surface run-off.

On Site Surface Water Drainage

The proposed development is an internal conversion within the existing Abbvie facility which has been in operation since the early 2000s' and was previously (1970's) the site of Abbot manufacturing plant. Surface water discharge from the subject site exits the plant at the western boundary, entering the Sligo County Council surface water sewer system.

The existing on-site surface water drainage network currently covers the entire site (including the proposed location of the development) and collects rainwater runoff from three distinct catchment areas;

- Site roads
- Car Park areas
- Building roofs

Mostly internal modification will be undertaken for the proposed development the overall discharge will be similar to the current stormwater discharge in terms of flow and quality.

Water Supply

The water supply for the site comes from the public water supply. It is proposed that there will be sufficient water supply for the proposed development at the Abbvie site.

Wastewater

There are two new above ground bunded wasterwater holding tanks proposed for this development at the Abbvie site. Wastewater is characterised into High High Strength and Low Strength – typical domestic waste.

Rating of Site Importance of the Hydrological Features

Based on the NRA methodology (See Appendix 8.1-Table 3), the site importance of hydrological features at this site is rated **Low Importance** based on the following:

- As per FRM Guidelines the site is located primarily within Flood Zone C, where the probability of flooding is low. A small proportion of existing development site is affected by the Shannon Eighter 1 in 10-year flood event.
- There are no surface water sources for potable water in surrounding area.

8.4 PREDICTED IMPACTS

Predicted impacts during construction and operation are outlined below. Section 8.4.1 & 8.4.2 describes the potential impacts in relation to water supply, wastewater and hydrology. The implementation of the mitigation measures outlined in the outline CEMP and Section 8.5 below will ensure that accidental releases and management of run-off during construction as well as during the operational phase are minimised. These measures will ensure that the development does not impact on receiving surface water resource.

8.4.1 CONSTRUCTION

Increased Run-Off and Sediment Loading

Surface water run-off during construction may contain increased silt levels or become polluted from construction activities. Run-off containing large amounts of silt can cause damage to surface water systems and receiving watercourses. There are two drainage ditches which lie within the site boundary. Silt traps and other measures should be used to prevent any potential surface water run-off to the two local drainage ditches. Furthermore, most of the proposed works are to the northern section of the proposed site, away from the drainage ditches. Operation of machinery in-stream should be kept to an absolute minimum. The relocation of the landscape berm is proposed to be located south to the drainage ditch located along the southern boundary of the site which discharges to the Shannon Eighter. A buffer zone of 5-10m should be provided to prevent any siltation of this drainage ditch. Silt water can arise from dewatering excavations, run-off from exposed ground, stockpiles and access roads. However, there is no proposed dewatering works and there are no large excavations proposed during the construction phase for this project.

Fuel and Chemical Handling

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

- Spillage or leakage of oils and fuels stored on site;
- Spillage or leakage of oils and fuels from construction machinery or site vehicles; and
- Run off from concrete and cement.
- Measures have been included in the indicative CEMP to minimise risks from these potential sources.

Machinery on site during the construction may result in contamination of the surface water. The potential impacts could derive from accidental spillage of fuels, oils, paints and solvents, which could impact surface water and groundwater quality if allowed to infiltrate to run-off to surface water systems and/ or receiving watercourses.

Concrete operations carried out near surface water bodies or local surface water drainage systems during construction activities could lead to a discharge of wastewater 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.

8.4.2 OPERATIONAL PHASE

In terms of predicted specific impacts during site operation the following points are of note:

- There will be no direct discharges of contaminated water to surface water or to the two local drainage ditches located within the site boundary during the operational phase. As such impact could only occur due to accidental emissions such as localised accidental leakages from cars in the car park areas or accidental leakage from the bunded areas or effluent treatment system and chemicals during refuelling or transport, if mitigation failed.
- No bulk chemicals will be stored on-site however small quantities of drums and IBCs will be stored in the on-site warehouse.
- A dedicated sprinkler/misting system will be installed in the proposed development, complete with a dedicated collection system for any ensuing fire water.
- The surface water underground attenuation pond has adequate capacity for any increase in surface run-off and if any potential flooding was to occur.
- There will be no incorporation of additional hardstanding areas (0% increase in hardstanding area). As a result of the no increase in hardstanding, there will be no measurable increase surface run-off.
- Wastewater to be discharged is relatively low strength and has similar characteristics to domestic wastewater. This will be discharged to a local waste water treatment facility or treated on site.

Fuel and Chemical Handling

There will be no direct discharges of contaminated water to surface water during the operational phase. As such, any impact could only occur due to accidental emissions such as localised accidental leakages from cars in the car park areas or accidental leakage from the bunded areas or effluent treatment system and chemicals during refuelling or transport, if mitigation failed.

There are no additional external bulk chemical storage requirements for the proposed development. All existing bunds/containment structures have passed hydraulic integrity testing and are tested every 3 years. The volume of chemicals stored on site will be relatively small and all additional transfer lines will be above ground and doubly contained.

8.5 MITIGATION MEASURES

The potential effects on the local water environment are considered to be low for this proposed development. However, the outline CEMP includes adequate measures to manage risks during construction and the site will operate under the stringent requirements of the existing EPA licence during operation.

The outline CEMP includes mitigation measure for managing risks during construction related to

- Surface Water Run off
- Fuel & Chemical Handling
- Accidental Releases

As current, during operation an environmental management plan (EMP) will be in place to ensure compliance together with stringent EPA licencing requirements. This will include full containment of potential pollutant sources, site-specific emergency response measures and management of surface water run-off and wastewater discharge from the site.

8.6 MONITORING

8.6.1 CONSTRUCTION PHASE

Regular inspection of surface water run-off and sediments controls e.g. silt traps will be carried out during the construction phase. Regular inspection of construction/mitigation measures (ref CEMP) will be undertaken e.g. concrete pouring, refuelling, storage of chemicals etc.

8.6.2 OPERATIONAL PHASE

Monitoring will be undertaken as required by the existing and future licence requirements.

8.7 RESIDUAL IMPACTS

The residual impacts are those that would occur after the mitigation measures, as outlined in Section 8.5 above have taken effect.

8.7.1 CONSTRUCTION PHASE

In relation to the construction phase the impact on the water during construction (EPA, 2017) is considered to be have a **Short term – Imperceptible Impact with a neutral impact on quality,** i.e. an impact capable of measurement but without noticeable consequences. This is based on the following assessments.

- There will be no significant increase in runoff from the site during construction and run-off quality will be mitigated if required.

8.7.2 OPERATIONAL PHASE

There are no likely significant impacts on the hydrological environment associated with the proposed development of the site. It is not anticipated that any impacts will arise following the implementation of the mitigation measures discussed in Section 8.5 above. As such the impact (EPA, 2002) is considered to have **a Long term- imperceptible significance with a neutral impact on quality** i.e. an impact capable of measurement but without noticeable consequences.

- The proposed development will not negatively impact on any surface waterbody during operation.
- There will be no increase in flood risk as result of the site operation.

The site will operate within the future licence conditions of the EPA

9 AIR QUALITY & CLIMATE

9.1 INTRODUCTION

The following section presents an assessment on the impacts of the proposed development at Abbvie, Ballytivnan, Co. Sligo, in terms of Air Quality and Climate on the local environment as defined in the guidelines referred to in Section 2.1

9.1.1 AIR QUALITY

The modelling of air emissions from the site was carried out to assess the concentrations of Nitrogen Dioxide (NO_2) and the consequent impact on human health. The air dispersion modelling input data consisted of information on the physical environment, design details for all emission points on-site and a full year of meteorological data. Using this input data, the model predicted ambient concentrations at various receptors for each hour of the meteorological year. This study adopted a worst-case approach which will lead to an over-estimation of the actual levels that will arise, in keeping with good EIA practice.

To obtain all the meteorological information required for use in the model, data collected during 2012 - 2016 from 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 a five full years of meteorological data. Using this input data the model predicted ambient ground level concentrations beyond the site boundary for each hour of the modelled meteorological year. The model post-processed the data to identify the location and maximum of the worst-case ground level concentration. This worst-case concentration was then added to the background concentration to give the worst-case predicted environmental concentration (PEC). The PEC was then compared with ambient air quality standards to assess the significance of the releases from the site. This study adopted a worst-case approach which will lead to an over-estimation of the actual levels that will arise, in keeping with good EIA practice. The worst-case assumptions are outlined below:

- All emission points were assumed to be in operation for every hour of the year; and
- Maximum predicted concentrations were reported in this study, even if no residential receptors are near the location of this maximum.

Emissions from the site have been modelled using the AERMOD dispersion model (Version 16216r) which has been developed by the U.S Environmental Protection Agency (USEPA) and the American Meteorological Society (AMS). The model 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) (2010)*"[26].

The model is a "new-generation" steady-state Gaussian plume model used to assess pollutant concentrations associated with industrial sources. The model is an enhancement of the Industrial Source Complex-Short Term 3 (ISCST3) model which has been widely used for emissions from industrial sources. Details of the model are given in Appendix 9.1. Fundamentally, the model has made significant advances in simulating the dispersion process in the boundary layer. This will lead to a more accurate reflection of real world processes and thus considerably enhance the reliability and accuracy of the model particularly under those scenarios which give rise to the highest ambient concentrations.
Due to the proximity to surrounding buildings, the PRIME Building Downwash Program (BPIP Prime) has been incorporated into the model to determine the influence (wake effects) of these buildings on dispersion in each direction considered.

The AERMOD model incorporated the following features:

[26] EPA (2010) Air Dispersion Modelling from Industrial Installations Guidance Note (AG4)

- Two receptor grids were created at which concentrations would be modelled. Receptors were mapped with sufficient resolution to ensure all localised "hot-spots" were identified without adding unduly to processing time. The receptor grids were based on Cartesian grids with the site at the centre. An outer grid measuring 8 x 8 km, with the site at the centre and concentrations calculated at 400 m intervals and an inner grid measuring 2 x 2 km, with the site at the centre and concentrations calculated at 50 m intervals were included in the model. Boundary receptor locations were also placed along the boundary of the site, at 50 m intervals giving a total of 2,236 calculation points for the model.

- All on-site buildings and significant process structures were mapped into the models 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. Meteorological data over a five year period (Shannon Airport, 2012 – 2016, Figure 9.1) was used in the models. AERMOD incorporates a meteorological pre-processor AERMET. The AERMET meteorological pre-processor requires the input of surface characteristics, including surface roughness (z_0), Bowen Ratio and albedo by sector and season, as well as hourly observations of wind speed, wind direction, cloud cover, and temperature. The values of albedo, Bowen Ratio and surface roughness depend on land-use type (e.g., urban, cultivated land etc.) and vary with seasons and wind direction. The assessment of appropriate land-use type was carried out to a distance of 10 km from the meteorological station for Bowen Ratio and albedo and to a distance of 1 km for surface roughness in line with USEPA recommendations (see Appendix 9.2).

- Detailed terrain has been mapped into the model using SRTM (Shuttle Radar Topography Mission) data with 30m resolution. The site is located in rolling terrain. For AERMOD, all terrain features have been mapped in detail into the model using the terrain pre-processor AERMAP.

Due to the proximity of the neighbouring Abbvie site and the potential for cumulative impacts on ambient air quality as a result of NO_2 emissions, a cumulative assessment with the proposed development and the neighbouring Abbvie site has been undertaken. There are three sources on the neighbouring Abbvie site with relevant NO_2 emissions: boilers A1-1 and A1-2 and thermal oxidiser A2-1c. Emission details for these three sources have been based on actual monitoring data from the site from 2016 and 2017. Details on the neighbouring Abbvie site were included in the model and emission concentrations were calculated in the same way as with the proposed development, described above.

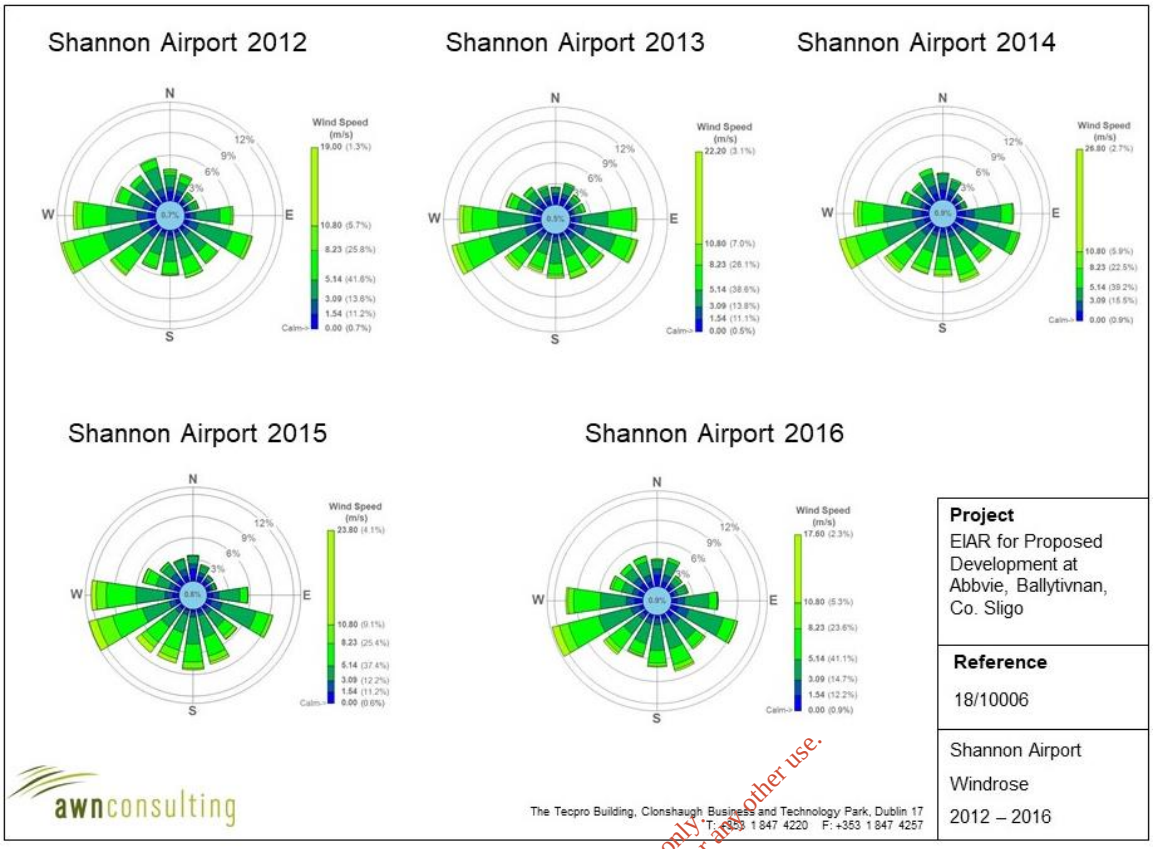

Figure 9.1 Shannon Airport Windrose 2012 – 2016

9.1.2 CRITERIA FOR RATING OF IMPACTS

In order to reduce the risk to health from poor air quality, 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 health or environmental-based levels for which additional factors may be considered. The applicable standards in Ireland include the Air Quality Standards Regulations 2011, which incorporate EU Directive 2008/50/EC. The ambient air quality standards applicable for NO_2 are outlined in this Directive (see Table 9.1). These standards have been used in the current assessment to determine the potential impact of NO_2 emissions from the proposed facility on air quality.

Table 9.1 EU Air Quality Standards[27]

Pollutant	Regulation Note 1	Limit Type	Value
Nitrogen Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	200 µg/m^3
		Annual limit for protection of human health	40 µg/m^3
		Critical load for protection of vegetation	30 µg/m^3

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

[27] based on European Commission Directive 2008/50/EC (transposed as S.I. 180 of 2011)

9.1.3 CLIMATE

Ireland ratified the United Nations Framework Convention on Climate Change (UNFCCC) in April 1994 and the Kyoto Protocol in 1997[28,29]. For the purposes of the EU burden sharing agreement under Article 4 of the Kyoto Protocol, Ireland agreed to limit the net anthropogenic growth of the six GHGs under the Kyoto Protocol to 13% above the 1990 level over the period 2008 to 2012[30]. The UNFCCC is continuing detailed negotiations in relation to GHGs reductions and in relation to technical issues such as Emission Trading and burden sharing. The most recent Conference of the Parties to the Convention (COP23) took place in Bonn, Germany from the 6th to the 17th of November 2017 and focussed on advancing the implementation of the Paris Agreement. The Paris Agreement was established at COP21 in Paris 2015 and is an important milestone in terms of international climate change agreements. The "Paris Agreement", agreed by over 200 nations, has a stated aim of limiting global temperature increases to no more than 2°C above pre-industrial levels with efforts to limit this rise to 1.5°C. The aim is to limit global GHG emissions to 40 gigatonnes as soon as possible whilst acknowledging that peaking of GHG emissions will take longer for developing countries. Contributions to greenhouse gas 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 on elevating adaption onto the same level as action to cut and curb emissions.

The EU, on the 23rd/24th of October 2014, agreed the "2030 Climate and Energy Policy Framework"[31]. The European Council endorsed a binding EU target of at least a 40% domestic reduction in greenhouse gas emissions by 2030 compared to 1990. The target will be delivered collectively by the EU in the most cost-effective manner possible, with the reductions in the ETS and non-ETS sectors amounting to 43% and 30% by 2030 compared to 2005, respectively. Secondly, it was agreed that all Member States will participate in this effort, balancing considerations of fairness and solidarity. The policy also outlines, under "Renewables and Energy Efficiency", an EU binding target of at least 27% for the share of renewable energy consumed in the EU in 2030.

In 1999, Ireland signed the Gothenburg Protocol to the 1979 UN Convention on Long Range Transboundary Air Pollution. The initial objective of the Protocol was to control and reduce emissions of Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_X), Volatile Organic Compounds (VOCs) and Ammonia (NH_3). To achieve the initial targets Ireland was obliged, by 2010, to meet national emission ceilings of 42 kt for SO_2 (67% below 2001 levels), 65 kt for NO_X (52% reduction), 55 kt for VOCs (37% reduction) and 116 kt for NH_3 (6% reduction). 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% 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).

European Commission Directive 2001/81/EC, the National Emissions Ceiling Directive (NECD), prescribes the same emission limits as the 1999 Gothenburg Protocol. A National Programme for the progressive reduction of emissions of these four transboundary pollutants has been in place since April 2005[32]. Data available from the EU in 2010 indicated that Ireland complied with the emissions ceilings for SO_2, VOCs and NH_3 but failed to comply with the ceiling for NO_X[33]. 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 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, 2020-29 emission targets are for SO_2 (65% below 2005 levels), for NO_X (49%

[28] FCCC (1997) Kyoto Protocol To The United Nations Framework Convention On Climate Change
[29] FCCC (1999) Ireland – Report on the in-depth review of the second national communication of Ireland
[30] ERM (1998) Limitation and Reduction of CO2 and Other Greenhouse Gas Emissions in Ireland
[31] EU (2014) EU 2030 Climate and Energy Framework
[32] DEHLG (2004) National Programme for Ireland under Article 6 of Directive 2001/81/EC for the Progressive Reduction of National Emissions of Transboundary Pollutants by 2010 Transport Infrastructure Ireland (2011)
[33] EEA (2012) NEC Directive Status Reports 2011

reduction), for VOCs (25% reduction), for NH_3 (1% reduction) and for $PM_{2.5}$ (18% reduction). In relation to 2030, Ireland's emission targets are for SO_2 (85% below 2005 levels), for NO_X (69% reduction), for VOCs (32% reduction), for NH_3 (5% reduction) and for $PM_{2.5}$ (41% reduction).

In relation to the EU 20-20-20 targets for CO_2, Ireland has a target of a 20% reduction in non-Emission Trading Scheme (non-ETS) greenhouse gas emissions by 2020 relative to the 2005 levels. The EPA confirmed that the 2015 levels are on target but that projections from 2016 – 2020 indicate that the target is unlikely to be met.

9.2 THE PROPOSED DEVELOPMENT

The proposed development will have two new boiler stacks which will have a height of 17.4 m above ground level. The two boilers will operate in a standby/duty mode, with only one boiler in operation at any one time, as such emissions from only one new boiler (New Boiler 1) have been included in the model. A cumulative assessment with the neighbouring Abbvie site has also been undertaken. The relevant source parameters for the neighbouring Abbvie site (emission points A1-1, A1-2 and A2-1c) are based on actual monitoring data over the past two years. The source information for the modelled emission points can be seen in Table 9.2.

Table 9.2 Summary of Source Information

Stack Reference	Location (Irish Grid Coordinates)		Height Above Ground Level (m)	Exit Diameter (m)	Temp (K) Note 1	Max Volume Flow (Nm^3/hr) Note 2	Exit Velocity (m/sec actual)	NO_2	
								NO_X Concentration (mg/Nm^3)	Mass Emission (g/s) Note 3
New Boiler 1	E169867	N337606	17.4	0.36	473	837	4.05	200	0.047
New Boiler 2	E169868	N337605	17.4	0.36	473	837	4.05	200	0.047
A1_1	E170604	N337494	26	0.75	358	1,137	0.94	166	0.052
A1_2	E170604	N337494	26	0.75	366	1,518	1.28	148	0.062
A2-1c	E170674	N337478	15	0.30	413	1,477	8.77	200	0.082

Note 1 Kelvin (K) SI Unit for Temperature

Note 2 (Nm^3/hr) Cubic Metres per Hour measured under normal temperature and pressure conditions

Note 3 (g/s) Grams per Second

9.3 THE RECEIVING ENVIRONMENT

9.3.1 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 Annual Monitoring Report 2016", 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[34]. 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, Ballytivnan is categorised as Zone C due to its proximity to Sligo town[34].

Long-term NO_2 monitoring was carried out at three Zone C locations for the period 2012 - 2016, Kilkenny, Portlaoise and Mullingar[34]. The NO_2 concentrations measured in Kilkenny and Portlaoise in 2016 were 7 $\mu g/m^3$ and 11 $\mu g/m^3$ respectively. The NO_2 annual average for this five year period

[34] *Air Quality Annual Monitoring Report 2016*, EPA, 2017

suggests an upper average limit of no more than 13 µg/m^3 (Table 9.3). Long term average concentrations are significantly below the annual average limit of 40 µg/m^3. Based on the above information, a conservative estimate of the current background NO_2 concentration in the region of the proposed development is 13 µg/m^3.

The Ozone Limiting Method (OLM) was used to model NO_2 concentrations. The OLM is a regulatory option in AERMOD which calculates ambient NO_2 concentrations by applying a background ozone concentration and an in-stack NO_2/NOx ratio to predicted NOx concentrations. An in-stack NO_2/NOx ratio of 0.1 and a background ozone concentration of 60 µg/m^3 were used for modelling.

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 9.3 Annual Mean NO_2 Concentrations in Zone C Locations (µg/m^3)

Year	Station		
	Kilkenny	**Portlaoise**	**Mullingar**
2012	4	-	7
2013	4	-	6
2014	5	16	4
2015	5	10	-
2016	7	11	-
Average	**5.0**	**12.3**	**5.7**

9.4 PREDICTED IMPACTS

9.4.1 DO NOTHING SCENARIO

The Do Nothing scenario includes retention of the current site and associated processes without the proposed development. In this scenario, ambient air quality at the site will remain as per the baseline and will change in accordance with trends within the wider area (including influences from potential new developments in the surrounding area, changes in road traffic, etc.).

9.4.2 CONSTRUCTION PHASE

Air Quality

The greatest potential impact on air quality during the construction phase of the proposed development is from construction dust emissions and the potential for nuisance dust. While construction dust tends to be deposited within 200 m of a construction site, the majority of the deposition occurs within the first 50 m. When the dust minimisation measures detailed in the mitigation section of this chapter and Appendix 9.3 are implemented, fugitive emissions of dust from the site will be short-term and insignificant and pose no nuisance at nearby receptors.

The additional traffic generated due to the construction of the proposed development may also lead to the release of air pollutants. The UK DMRB guidance[35], on which the TII guidance[36] was based, states that road links meeting one or more of the following criteria can be defined as being 'affected' by a proposed development and should be included in the local air quality assessment:

- Road alignment change of 5 metres or more;
- Daily traffic flow changes by 1,000 AADT or more;
- HDV flows change by 200 vehicles per day or more;
- Daily average speed changes by 10 km/h or more; or
- Peak hour speed changes by 20 km/h or more.

None of the road links impacted by the construction of the proposed development meet the criteria to be defined as 'affected'. Therefore, this assessment is not necessary as there is unlikely to be an air quality impact at nearby sensitive receptors as a result of traffic emissions.

Climate

There is the potential for a number of greenhouse gas emissions to the atmosphere during the construction phase of the development. Construction vehicles, generators etc., may give rise to CO_2 and NO_2 emissions impacting climate. Due to the size and nature of the construction activities, CO_2 and NO_2 emissions during construction will have a short-term and imperceptible impact on climate and will not be significant.

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 short-term and imperceptible with respect to human health.

9.4.3 OPERATIONAL PHASE

There is the potential for a number of emissions to the atmosphere during the operational phase of the development. In particular, boiler related air emissions may generate quantities of air pollutants such as NO_2. Additional traffic generated due to the opening of the proposed development may also lead to the release of air pollutants. However, the increase in traffic associated with the proposed development during the operational phase is not of the required magnitude to cause any significant impacts at nearby sensitive receptors according to TII and UK guidance outlined in Section 10.4.2.

Air Quality Impact from Process Emissions

The NO2 modelling results from the proposed boiler emissions at the worst-case off-site receptor i.e. the highest NO_2 concentrations measured off-site (including the site boundary), are detailed in Table 9.4. The results indicate that the ambient ground level concentrations are significantly below the relevant air quality standards for NO_2. For the worst-case year, emissions from the site lead to an ambient NO2 concentration (including background) which is 17% of the maximum ambient 1-hour limit value (measured as a 99.8th%ile) and 34% of the annual limit value at the worst-case off-site receptor for the worst-case years modelled (2012 and 2014). The geographical variations in the 1-hour mean (99.8th%ile) and annual mean NO_2 ground level concentrations are illustrated as concentration contours in Figure 9.2 and Figure 9.3.

[35] UK Highways Agency (2007) Design Manual for Roads and Bridges Vol 11 Chapter 3, HA 207/07 (Document & Calculation Spreadsheet)
[36] Transport Infrastructure Ireland (2011) Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes

The locations of the maximum concentrations for NO_2 are close to the boundary of the site with concentrations decreasing with distance from the facility.

Table 9.4 Dispersion Model Results – Proposed Development

Pollutant / Meteorological Year	Background ($\mu g/m^3$)	Averaging Period	Process Contribution ($\mu g/m^3$)	Predicted Emission Concentration ($\mu g/m^3$)	Standard ($\mu g/m^3$) Note 1
NO_2 / 2012	13	Annual Mean	0.76	13.76	40
	26	99.8th%ile of 1-hr means	7.83	33.83	200
NO_2 / 2013	13	Annual Mean	0.81	13.81	40
	26	99.8th%ile of 1-hr means	7.53	33.53	200
NO_2 / 2014	13	Annual Mean	0.83	13.83	40
	26	99.8th%ile of 1-hr means	7.66	33.66	200
NO_2 / 2015	13	Annual Mean	0.76	13.76	40
	26	99.8th%ile of 1-hr means	7.60	33.60	200
NO_2 / 2016	13	Annual Mean	0.78	13.78	40
	26	99.8th%ile of 1-hr means	7.60	33.60	200

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

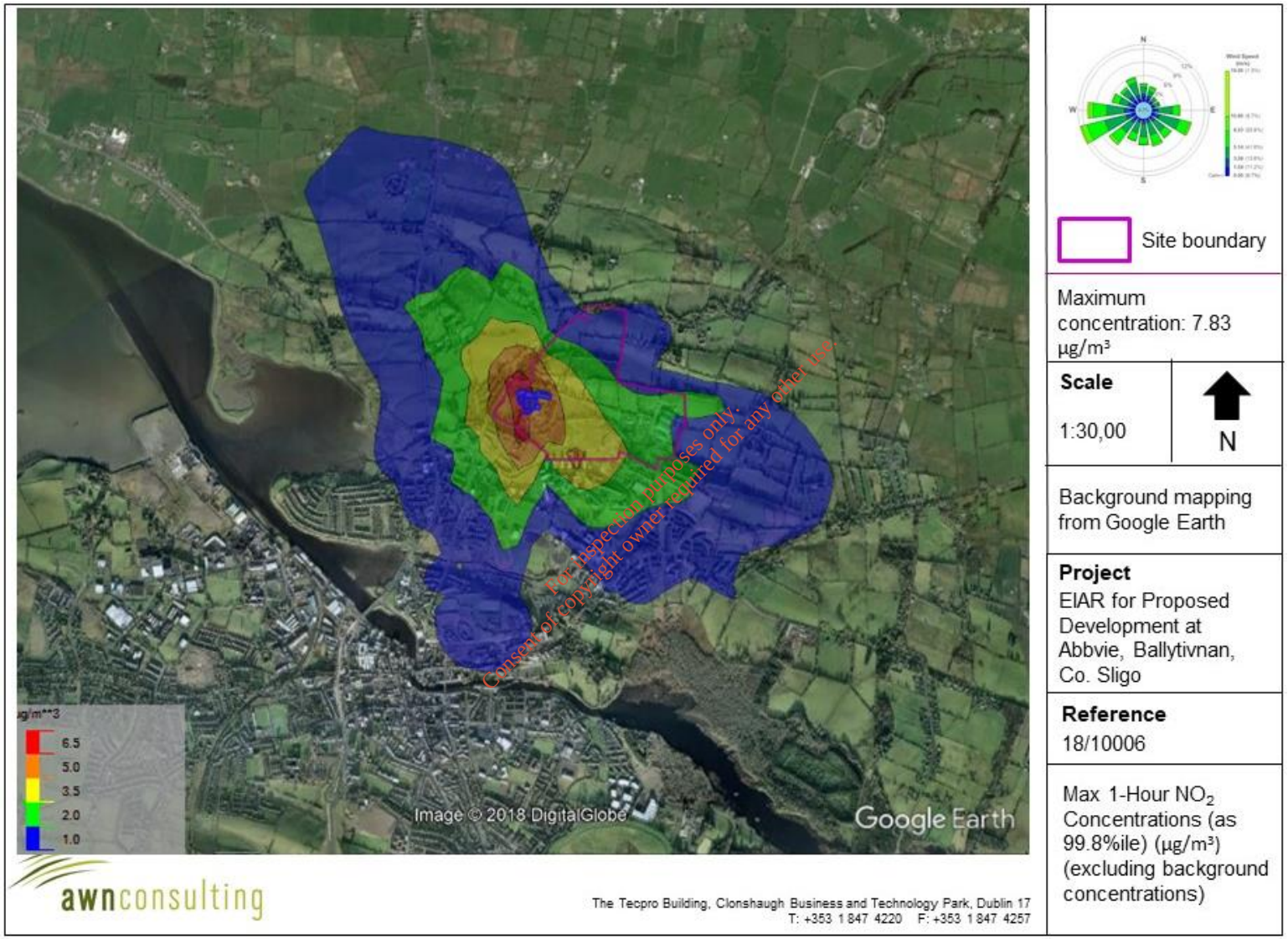

Figure 9.2 Maximum 1-Hour NO_2 Concentrations (as a 99.8th%ile) (µg/m^3)

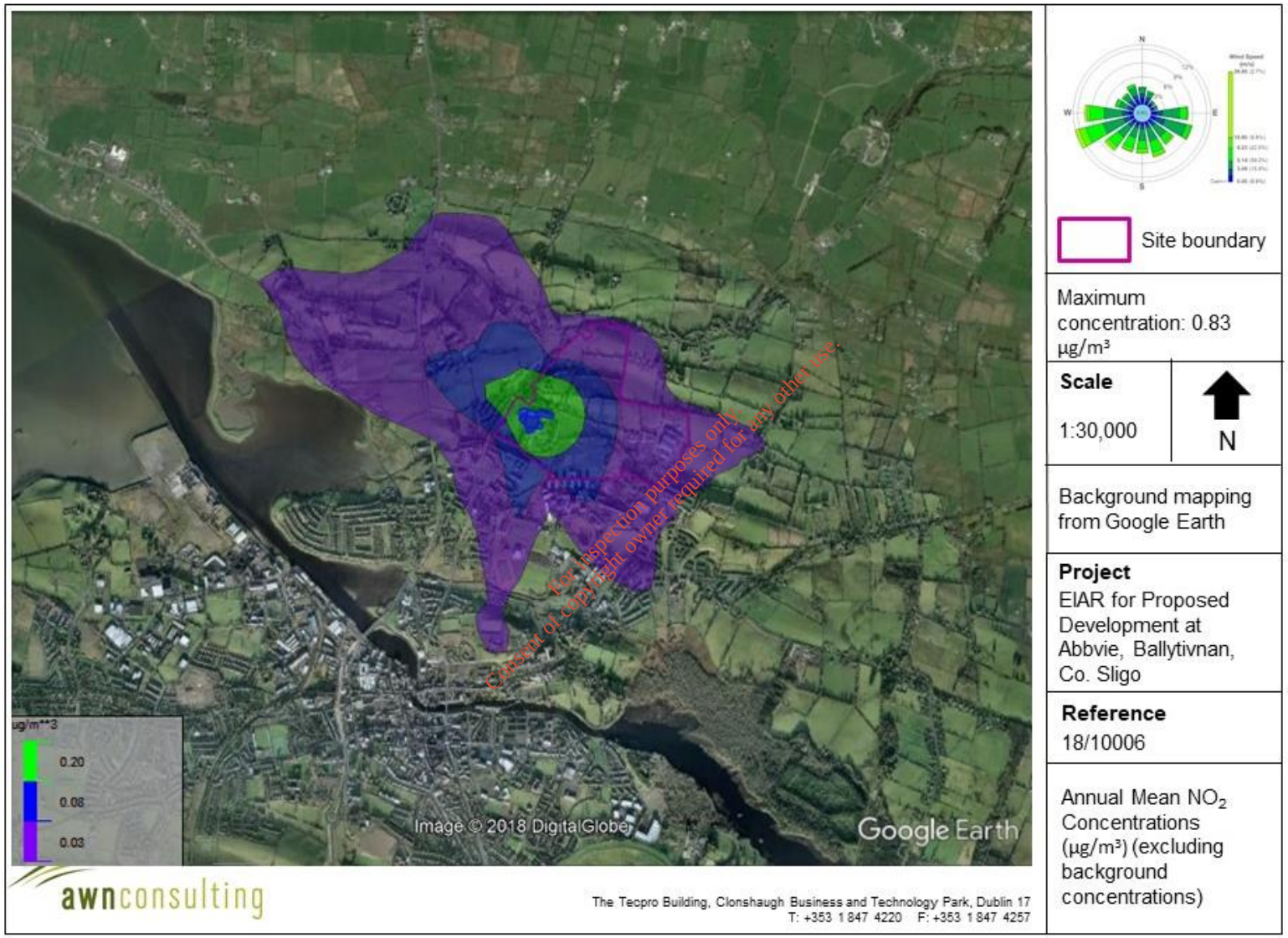

Figure 9.3 Annual Mean NO_2 Concentrations (µg/m^3)

Cumulative Assessment

The cumulative impact of process emissions of NO_2 from the proposed development and the neighbouring Abbvie facility are detailed in Table 9.5 below. The results indicate that the ambient ground level concentrations are below the relevant air quality standards for NO_2. For the worst-case year, emissions from the site lead to an ambient NO_2 concentration (including background) which is 24% of the maximum ambient 1-hour limit value (measured as a 99.8th%ile) and 37% of the annual limit value at the worst-case off-site receptor for the worst-case years modelled (2013 and 2016).

Table 9.5 Dispersion Model Results – Cumulative Assessment

Pollutant / Meteorological Year	Background (µg/m^3)	Averaging Period	Process Contribution (µg/m^3)	Predicted Emission Concentration (µg/m^3)	Standard (µg/m^3) Note 1
NO_2 / 2012	13	Annual Mean	1.72	14.72	40
	26	99.8th%ile of 1-hr means	19.74	45.74	200
NO_2 / 2013	13	Annual Mean	1.73	14.73	40
	26	99.8th%ile of 1-hr means	21.81	47.81	200
NO_2 / 2014	13	Annual Mean	1.76	14.76	40
	26	99.8th%ile of 1-hr means	20.40	46.40	200
NO_2 / 2015	13	Annual Mean	1.77	14.77	40
	26	99.8th%ile of 1-hr means	18.73	44.73	200
NO_2 / 2016	13	Annual Mean	1.65	14.65	40
	26	99.8th%ile of 1-hr means	20.75	46.75	200

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

Summary of the Modelling Assessment

The modelling assessment has found that ambient NO_2 concentrations as a result of the Proposed Development and the Cumulative Assessment are in compliance with the relevant ambient air quality limit values at all locations at or beyond the site boundary. The impacts to air quality from operation of the proposed development are therefore deemed long-term, negative and not significant.

Climatic Impact

It is not predicted that the operational phase of the development will have an impact on climate. Impacts to climate could occur indirectly through the energy requirements of the building. However, the CO_2 emissions from electricity to operate the facility will not be significant in relation to Ireland's national annual CO_2 emissions. The electricity will be supplied from the national grid. Electricity to operate the facility will be purchased from the available energy suppliers including power stations and renewable generation sources such as wind power. The Electricity Supplier for the site currently holds a Commission for Energy Regulation (CER) certified fuel mix disclosure, guaranteeing every megawatt-hour (MWh) that they supply in the market is generated from renewable sources. Therefore, the impact to climate as a result of the indirect generation of greenhouse gases due to the electricity requirements of the site is deemed long-term, imperceptible and not significant.

Human Health

Air dispersion modelling was undertaken to assess the impact of the development with reference to EU ambient air quality standards which are based on the protection of human health. As demonstrated by the dispersion modelling results, emissions from the site 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.

9.5 MITIGATION MEASURES

9.5.1 CONSTRUCTION PHASE

The pro-active control of fugitive dust will ensure the prevention of significant emissions, rather than an inefficient attempt to control them once they have been released. The main contractor will be responsible for the coordination, implementation and ongoing monitoring of the dust management plan. The key aspects of controlling dust are listed below. Full details of the dust management plan can be found in Appendix 9.3

- The specification and circulation of a dust management plan for the site and the identification of persons responsible for managing dust control and any potential 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 management plan can be monitored and assessed;
- The specification of effective measures to deal with any complaints received.

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

Construction traffic and embodied energy of construction materials are expected to be the dominant source of greenhouse gas emissions as a result of the construction phase of the development. Construction vehicles, generators etc., may give rise to some CO_2 and N_2O emissions. However, due to short-term and temporary nature of these works, the impact on climate will not be significant.

However, some site-specific mitigation measures can be implemented during the construction phase of the proposed development to ensure emissions are reduced further. In particular the prevention of on-site or delivery vehicles from leaving engines idling, even over short periods. Minimising waste of materials due to poor timing or over ordering on site will aid to minimise the embodied carbon footprint of the site.

9.5.2 OPERATIONAL PHASE

No additional mitigation measures are required as the operational phase of the proposed development is predicted to have an imperceptible impact on ambient air quality and climate.

9.6 RESIDUAL IMPACTS

Once the mitigation measures outlined in Section 9.5 are implemented, there will be no residual impacts of significance on air quality or climate from the construction or operational phases of the proposed development.

10 NOISE & VIBRATION

10.1 INTRODUCTION

This section presents an assessment into the likely noise and vibration impact associated with the construction and operation of the proposed development.

The chapter has been prepared in accordance with relevant guidance as outlined in Section 2.1.

The following methodology has been adopted for this assessment:

- Review appropriate guidance in order to identify appropriate noise criteria for the site.
- Carry out noise monitoring at a number of critical locations (e.g. in the vicinity of nearest sensitive properties) to identify existing levels of noise in the vicinity of the development.
- Predict the level of noise emissions at the nearest noise sensitive locations for both construction and operational phases.
- Assess the predicted noise levels against the appropriate criteria and existing noise levels.
- Outline required mitigation measures, where required.

Appendix 10.1 presents a glossary of the acoustic terminology used in this section.

Appendix 10.2 presents an overview of the basic fundamentals of acoustics to assist in understanding of this part of the EIAR.

10.2 THE PROPOSED DEVELOPMENT

The proposed development will mostly take place within the building fabric of the existing Abbvie Ballytivnan Building. Construction of a single story extension of circa 1000 m^3 and ancillary services, are also proposed as outlined in Section 4 *Project Description*

When considering a development of this nature, the potential noise & vibration impact on the surroundings must be considered for each of two distinct stages:

- Temporary construction phase and;
- Long term operational phase.

Although a detailed description of the development has been outlined in Section 4 - an overview of the aspects of the proposed development relevant to Noise and Vibration is provided here.

10.2.1 CONSTRUCTION PHASE

For details of the sequence activities and environmental controls associated with the construction phase please refer to the Construction and Environmental Management Plan (CEMP) document. The construction phase is expected to occur over a period of 16months

10.2.2 OPERATIONAL PHASE

The primary sources of outward noise in the operational context are deemed long term and will involve:

- Building Services and Factory Process Plant; and;
- Additional vehicular traffic on public roads.

The main operational noise sources associated with building services and factory process plant will include cooling towers, boiler stacks, air handling units (AHU's), condenser units and various rooftop mounted fan and exhaust units. It is expected that all the plant items will operate continuously 24/7.

These issues are discussed in detail in the following sections.

10.3 THE RECEIVING ENVIRONMENT

The facility is located at The Old Bundoran Road, Ballytivnan, Sligo. The site is deemed peri-urban and is situated between the N15 and N16 national roads. Approximately 1 km west of the site is the Abbvie Manorhamilton road facility (not part of this development).

In terms of noise sensitive locations (NSL's), the nearest NSL's to the facility in question are the residential properties located the west of the site boundary along the old Bundoran Road, isolated property situated to the north of the site and to the south of the site at the Glendallon housing estate.

A location map and site plan are included in Section 4. Figure 10.1 illustrates the proposed site boundary in the context of the nearest noise sensitive locations identified.

Figure 10.1 Site Context and Noise Sensitive Receivers[37]

[37] Background Imagery Source: Google Earth

10.3.1 EXISTING NOISE ENVIRONMENT

An environmental noise survey was conducted to quantify the existing noise environment in the vicinity of the site. The survey was conducted in general accordance with *ISO 1996: 2017: Acoustics — Description, measurement and assessment of environmental noise.*

Specific details are set out in the following sections.

10.3.2 CHOICE OF MEASUREMENT LOCATIONS

Four Noise Monitoring Locations (NML's) surrounding the site were selected for the noise survey; each of these locations are described in turn below.

NML 1 Situated to the south of the facility in the Glendallon housing estate close to NSL1.

NML 2 Situated to the west of the facility outside houses along the old Bundoran Road close NSL2.

NML 3 Situated to the north west of the facility, just off the old Bundoran Road at Shannon Eighter housing estate considered to be representative of background noise at NSL3.

NML 4 Situated outside NSL4 to the south of the site. This location is not considered to represent nearest sensitive locations therefore the number of measurement carried out at NSL4 were limited to obtain a snapshot of the typical noise levels at this location.

The position of each noise measurement location (NML) in relation to the boundary of the site that is subject to planning permission (indicated by the red line) are identified in Figure 10.2.

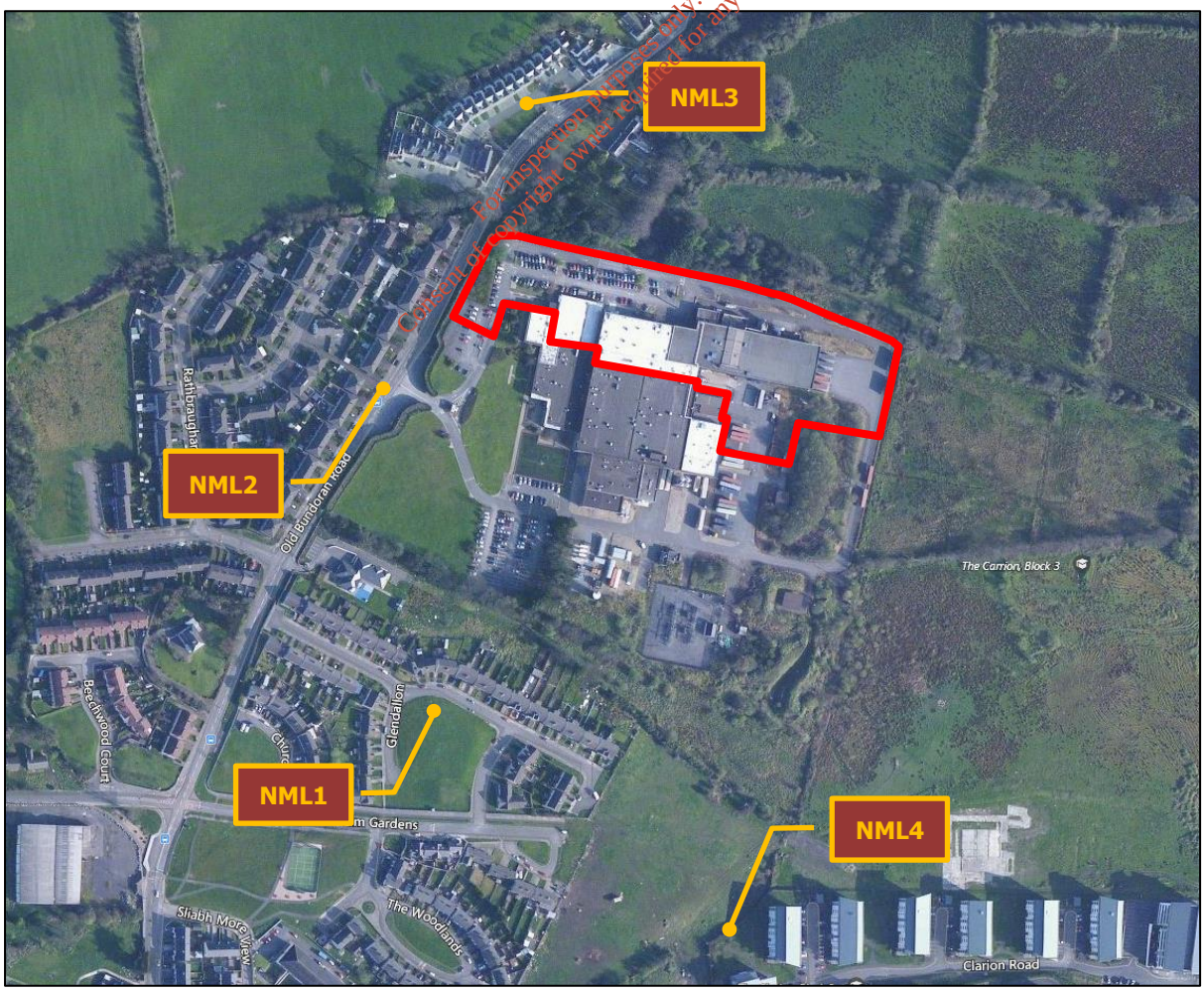

Figure 10.2 Noise Monitoring Locations

10.3.3 SURVEY PERIODS

Noise measurements were conducted over the course of three survey periods as follows:

- Daytime 10:30hrs to 14:30hrs on 11 April 2018;
- Evening 21:00hrs to 21:55hrs on 11 April 2018, and;
- Night-time 22:00hrs to 00:40hrs 11/12 April 2018.

The weather conditions during all survey periods were recorded as dry and calm.

10.3.4 PERSONNEL AND INSTRUMENTATION

AWN conducted the noise measurements during all survey periods. The attended noise measurements were performed using a Brüel & Kjaer Type 2250 Sound Level Meter (SN. 2818080). Before and after the survey the instrument was check calibrated using a Brüel & Kjær Type 4231 Sound Level Calibrator (SN. 2263026).

10.3.5 PROCEDURE

Measurements were conducted at each location on a cyclical basis. Sample periods for the noise measurements were 15 minutes during all periods. The results were noted onto a Survey Record Sheet immediately following each sample, and were also saved to the instrument memory for post analysis where appropriate. Survey personnel noted all primary noise sources contributing to noise build-up.

10.3.6 MEASUREMENT PARAMETERS

The survey results are presented in terms of the following three parameters:

L_{Aeq} is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period.

L_{AF90} is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.

L_{AF10} is the sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for road traffic noise.

The "A" suffix denotes that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing. The "F" suffix denotes that the parameter has been measured with 'Fast' time-weighting applied. All sound levels in this report are expressed in terms of decibels (dB) relative to $2x10^{-5}$ Pascal (pa).

Appendix 10.2 of this document presents an overview of the fundamentals of acoustics to assist in understanding of this part of the EIAR.

10.3.7 RESULTS AND DISCUSSION

NML 1

The survey results for NML 1 are summarised in Table 10.1.

Table 10.1 Summary of Measured Noise Levels at NML1

Period	Start Time	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)		
		$L_{Aeq,15\text{-}min}$	L_{AF10}	L_{AF90}
Daytime	11:19	46	47	40
	12:25	51	51	40
Evening / Night-time	21:40	56	53	37
	22:39	38	40	35
	00:04	42	44	37

During daytime survey periods, steady plant noise from the existing Abbvie Ballytivnan facility was audible in the background throughout along with steady distant road traffic noise, intermittent noise from local anthropological sources were noted throughout the survey periods. Daytime noise levels were in the range of 46 to 51dB L_{Aeq} and 40dB L_{A90}.

During the evening and night-time survey periods, the main source of noise was steady plant noise from the existing Abbvie Ballytivnan facility audible in the background along with distant road traffic. During the first evening measurement the measured L_{Aeq} level was elevated due to the presence of a dog barking in the vicinity. Evening time noise levels were in the range of 38 to 56dB L_{Aeq} and 35 to 37dB L_{A90}. Night-time noise levels were 42dB L_{Aeq} and 37dB L_{A90}.

No significant source of vibration was noted during the survey periods.

NML 2

The survey results for NML 2 are summarised inTable 10.2

Table 10.2 Summary of Measured Noise Levels at NML2

Period	Start Time	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)		
		$L_{Aeq,15\text{-}min}$	L_{AF10}	L_{AF90}
Daytime	10:58	63	65	48
	12:04	64	66	46
	13:08	64	69	45
Evening / Night-time	21:19	59	58	43
	22:19	56	47	43
	23:44	58	52	44

During daytime survey periods, the ambient noise in the vicinity were dominated by intermittent road traffic movements along the Old Bundoran Road and intermittent activity from the Abbvie site, noise from truck movements and the use of reverse alarms. The background noise was dominated by steady noise from the existing Abbvie Ballytivnan facility. Daytime noise levels were in the range of 63 to 64dB L_{Aeq} and 45 to 48dB L_{A90}.

During the evening and night-time survey periods, the dominant source of noise was steady plant noise from the existing Abbvie Ballytivnan facility interrupted by intermittent road traffic movements along the Old Bundoran Road. Evening time noise levels were in the range of 56 to 59dB L_{Aeq} and 43dB L_{A90}. Night-time noise levels were 58dB L_{Aeq} and 44dB L_{A90}.

No significant source of vibration was noted during the survey periods.

NML 3

The survey results for NML 3 are summarised in Table 10.3.

Table 10.3 Summary of Measured Noise Levels at NML3

Period	Start Time	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)		
		$L_{Aeq,15\text{-}min}$	L_{AF10}	L_{AF90}
Daytime	10:36	52	56	42
	11:39	53	57	42
	12:49	50	54	41
Evening / Night-time	21:00	48	52	41
	22:00	44	42	40
	23:24	45	48	40

During daytime survey periods, the ambient noise in the vicinity was dominated by intermittent road traffic movements along the Old Bundoran Road and birdsong. The background noise was dominated by steady and intermittent noise from the existing Abbvie Ballytivnan facility. Daytime noise levels were in the range of 50 to 53dB L_{Aeq} and 41 to 42dB L_{A90}.

During the evening and night-time survey periods, steady plant noise from the existing Abbvie Ballytivnan was audible facility interrupted by intermittent road traffic movements along the Old Bundoran Road and occasionally dogs barking in the area. Evening time noise levels were in the range of 44 to 48dB L_{Aeq} and 40 to 41dB L_{A90}. Night-time noise levels were 45dB L_{Aeq} and 40dB L_{A90}.

NML 4

The survey results for NML 4 are summarised in Table 10.4.

Table 10.4 Summary of Measured Noise Levels at NML4

Period	Start Time	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)		
		$L_{Aeq,15\text{-}min}$	L_{AF10}	L_{AF90}
Daytime	13:43	42	46	37
Night-time	23:02	39	42	32

During daytime, the main sources of noise noted in the area were distant plant and road traffic noise. Occasional local noise from activity in and around the apartments. The measured daytime noise levels were 42dB L_{Aeq} and 37dB L_{A90}.

During the night time, the main sources of noise were the same noted during the daytime. The measured night time noise levels were 39dB L_{Aeq} and 32dB L_{A90}.

10.4 PREDICTED IMPACTS

10.4.1 ASSESSMENT CRITERIA

Construction Phase – Noise Criteria

There is no published 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 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 in BS 5228– 1: 2009+A1:2014 calls for the designation of a noise sensitive location into a specific category (A, B or C) based on exiting ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded at this location, indicates a significant noise impact is associated with the construction activities.

The document sets out guidance on permissible noise levels relative to the existing noise environment presents the values which, when exceeded, signify a significant effect at the facades of residential receptors as recommended by BS 5228– 1: 2009+A1:2014.

Table 10.5 Example Threshold of Significant Effect at Dwellings[38]

Assessment category and threshold value period ($L_{Aeq,T}$)	Threshold value, in decibels (dB)		
	Category A[39]	Category B[40]	Category C[41]
Night-time (23:00 to 07:00hrs)	45	50	55
Evenings and weekends[42]	55	60	65
Daytime (07:00 to 19:00) and Saturdays (07:00 to 13:00)	65	70	75

For the appropriate periods (i.e. daytime, evening and night time) the ambient noise level is determined and rounded to the nearest 5dB. A review of the baseline noise survey results (ref. Section 10.3.710.3.7) would indicate that the categories detailed in Table 10.6 are appropriate in terms of the nearest noise sensitive locations being considered.

Table 10.6 Rounded Baseline Noise Levels and Appropriate Noise Limit

Period ($_T$)	Rounded Baseline Noise Level L_{Aeq} (dB)	Category	Appropriate Noise Limit (dB)
Daytime (07:00 – 19:00) Saturday (07:00 – 13:00)	≤60	A	65 $L_{Aeq,T}$

If the construction noise level exceeds the appropriate category value, then a significant effect is deemed to occur.

Construction Phase – Vibration Criteria

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 0.5mm/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 are typically tolerated at vibration levels up to 12mm/s and 5mm/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;*

[38] Source: *British Standard BS 5228 – 1: 2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise*
[39] Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.
[40] Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.
[41] Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.
[42] 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

- *British Standard BS 5228-2:2009+A1 2014: Code of practice for noise and vibration control on construction and open sites – Vibration.*

Both standards contain the same guidance relating to building damage criteria. The standards note that the risk of cosmetic damage to residential buildings starts at a Peak Particle Velocity (PPV) of 15mm/s at 4Hz rising to 20mm/s at 15Hz and 50mm/s at 40Hz and above for unreinforced or light framed structures. The standard also notes that below 12.5mm/s PPV the risk of damage tends to zero.

Taking the above into consideration the vibration criteria in Table 10.7 are recommended.

Table 10.7 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 4Hz	**15 to 40Hz**	**40Hz and above**
12 mm/s	20 mm/s	50 mm/s

Operational Phase – Noise Criteria

AbbVie will be required to apply and obtain an Industrial Emissions Directive (IED) Licence from the Environmental Protection Agency (EPA) in order to carry out the activities associated with the proposed development.

As the facility will be licenced by the EPA, reference has been made to the publication *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) 2016*, which is used to set operational noise limits from activities under the control of the EPA (manufacturing, industrial, waste management etc.). This document sets out a procedure for applying appropriate operational noise limits from this type of facility at the nearest noise sensitive receptors taking account of the background noise environment. Table 10.8 summarises the criteria applied, depending on the prevailing background noise environment.

Table 10.8 Noise Emission Limits at Sensitive Locations for EPA Licence Sites

Location	**Day, dB $L_{Ar,T}$[43] (07:00 to 19:00hrs)**	**Evening, dB $L_{Ar,T}$ (19:00 to 23:00hrs)**	**Night, dB $L_{Aeq,T}$[44] (23:00 to 07:00hrs)**
Areas of Low Background Noise	45	40	35
All Other Areas	55	50	45

In order to establish whether the noise sensitive receptors in the vicinity of the site would be considered a 'low background noise' area, 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}.

On review of the noise survey results, the noise levels measured were above the criteria for a low background noise area. In this instance, the operational noise limits for Areas of Low Background Noise are not applicable for this development.
The following noise criteria are therefore appropriate for this development at the nearest noise sensitive locations:

[43] The Rated Noise Level, $L_{A,r,T}$ is equal to the L_{Aeq} during a specified time interval (T), plus specified adjustments for tonal character and/or impulsiveness of the sound

[44] During night time periods the L_{Aeq} parameter is applicable as no tonal or impulsive noise from the facility should be clearly audible or measurable at any NSL.

Table 10.9 Proposed Operational Noise Criteria

Day (07:00 to 19:00hrs)	Evening (19:00 to 23:00hrs)	Night (23:00 to 07:00hrs)
55dB $L_{Ar\ (15mins)}$	50dB $L_{Ar\ (15mins)}$	45dB $L_{Aeq\ (15mins)}$

The noise limits stated above apply to all noise emissions from the Abbvie Ballytivnan facility. In this context this applies to all existing and proposed process plant as well as onsite mobile plant and intermittent activity.

As stated previously, up to two emergency diesel electricity generators proposed for the site. Section 4.4.1 of NG4 also contains the following comments in relation to emergency plant items:

> *"In some instances, licensed 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 55dB $L_{Aeq,T}$ on these units is appropriate in emergency scenarios.

Operational Phase – Additional Vehicular Activity on Public Roads

There are no specific guidelines or limits relating to traffic related sources along the local or surrounding roads. In this instance in order to assist with the interpretation of the noise associated with vehicular traffic on public roads, Table 10.10 offers guidance as to the likely impact associated with any particular change in traffic noise level (Source DMRB[45], 2011).

Table 10.10 Likely Impacts Associated with Change in Traffic Noise Level

Change in Sound Level (dB L_{A10})	Subjective Reaction	Magnitude of Impact
0	Inaudible	No Impact
0.1 – 2.9	Barely Perceptible	Negligible
3 – 4.9	Perceptible	Minor
5 – 9.9	Up to a doubling of loudness	Moderate
10+	Doubling of loudness and above	Major

Table 10.10 was previously presented the DMRB likely impacts associated with change in traffic noise level, the corresponding significance of impact presented in the 'EPA *Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR)*, Draft, August 2017 is presented in Table 10.11 for consistency in wording and terminology for the assessment of impact significance.

[45] *Design Manual for Roads and Bridges, Volume 11, Section 3, Part 7, HD 213/11*. 2011, Highways England

Table 10.11 Likely Impacts Associated with Change in Traffic Noise Level (Updated)

Change in Sound Level, DMRB, 2011 (dB L_{A10})	Subjective Reaction DMRB, 2011	Impact Guidelines for Noise Impact Assessment Significance (Institute of Acoustics)	Impact Guidelines on the Information to be contained in EIAR (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

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.

Operational Phase – Vibration Criteria

It is considered that the proposed development will not give rise to any significant levels of vibration in the receiving environment. Vibration criteria are therefore not deemed to be necessary for the operational phase of this development.

10.4.2 NOISE AND VIBRATION EMISSIONS

Construction Phase – Noise

The construction phase is expected to occur over a period of approximately 16 months. It is expected that any significant construction activities will be carried out between the hours of 07:00 to 19:00 Monday to Friday 08:00 to 16:00 on Saturdays.

It is possible that the building contractor may wish to carry out certain external operations outside of regular daytime hours (for example, weekends and evenings) subject to written approval from Sligo County Council. It is anticipated that any activities occurring during these times will be significantly reduced and where they do occur contractors will ensure they take place over as short a timeframe as possible and that relevant noise criteria values are not exceeded at sensitive locations.

During the construction phase of the proposed development, a variety of plant items and machinery will be in use with the potential to generate significant levels of noise. Details of the methods and procedures to be followed during the construction phase are outlined the associated Construction Environment Management Plan (CEMP) that has been prepared for the project.

Due to the scale of the construction, a detailed construction programme has not yet been advanced. In the absence of such a detailed programme it is not possible at this stage to calculate the actual magnitude of construction phase noise emissions to the local environment. However, based on the expected activities as detailed in the CEMP, it is possible to predict typical noise levels using guidance set out in *BS 5228-1: 2009+A1 2014*. Table 10.12 outlines typical plant items and associated noise levels that are anticipated at the nearest noise sensitive location to significant construction works.

The assessment assumes that significant construction activities will place at 140 metres from the nearest noise sensitive location (NSL3) noise prediction calculations have been prepared for this scenario. Predictions are based on the utilisation of construction associated plant for a minimum of 66% of a working day (i.e. 8hrs of a 12hr day). The results of this assessment are presented in Table 10.12.

Table 10.12 Predicted Noise Emission Levels at Nearest NSL during Construction Phase

Phase	Plant Item (BS 5228 Ref.)	Plant Noise Level at 10m Distance[46] (dB L_{Aeq})	Predicted Construction Noise Level at NSL 3[47] (dB $L_{Aeq,12hr}$)
Site Preparation	Tracked excavator (C2.22)	72	52
	Dump Truck (C4.2)	78	
	Wheeled Lorry Loader (D3.1)	75	
Excavations & Foundations	Sheet Pile (C12.31)	81	59
	Compressor (D7 6)	77	
	Poker Vibrator (C4 33)	78	
	Concrete Mixer Truck (C4.20)	80	
	Concrete Pump (C3.24)	78	
	Concrete Mixer Truck (C4.20)	80	
Structural Steel Erection	Wheeled Mobile Crane (C4.38)	78	53
	Articulated lorry (C11.10)	77	
	Tower Crane (C4.48)	76	
Shell Construction	Compressor (D7 6)	77	55
	Diesel Hoist (C7.98)	76	
	Articulated lorry (C11.10)	77	
	Pneumatic Circular Saw (D7.79)	75	
	Generator (C4.84)	74	

The assessment demonstrates that the noise levels from typical construction activities at the nearest noise sensitive receptors should be well below the recommended construction noise limits outlined in Table 10.6.

The predicted noise levels referred to in this section are indicative only and are intended to demonstrate that it will be possible for the contractor to comply with current best practice guidance. The impact on the noise environment due to construction activities will be transient in nature and significant impacts at the noise sensitive locations are not expected. Notwithstanding this, good practice measures will be implemented to minimise any potential impacts from construction activities on the noise environment. These measures will also reduce the noise impact on the wider surrounding environment.

Construction Traffic

Section 13 - *Traffic & Transportation* presents the expected increase in traffic number during both the construction and operational phases on the surrounding road network. Calculations have been performed based on the assessment of the AADT traffic data. In terms of the additional traffic on local roads that will be generated during the construction phase of this development the following comment is presented.

It is important to note that in order to increase traffic noise levels by 1dB traffic volumes would need to increase by the order of 25%.

AADT flows with and without construction traffic have been assessed. The additional traffic introduced onto the local road network due to this development will result in an increase of traffic volumes of far less than 25% at all locations.

The resultant change in noise level due to road traffic is less than 1dB at all locations which is an imperceptible change.

[46] All plant noise levels are derived from BS 5228: Part 1
[47] Assumes the methods for noise reduction outlined in Annex F of BS5228: Part 1

Construction Phase – Vibration

With respect to the potential vibration impact, the only significant source of vibration is expected to be due to excavations and foundation activities. However, the distance between the areas where these activities are to occur and the nearest noise sensitive locations are such that all vibration transmission would be both imperceptible and well below recommended guideline criteria.

Operational Phase – Noise

There are two expected primary sources of noise in the operational context.

- Building services and factory process plant, and;
- Additional vehicular traffic on public roads.

Each of these primary noise sources is addressed in turn in the following sections.

Building Services and Factory Process Plant

There are a number of plant items associated with the operation of the proposed development. Most of this plant will be capable of generating noise to some degree. Noisy plant items located externally will potentially have the greatest impact on the receiving environment. The following assessment is based upon the preliminary information which will be developed further during the detailed design phase in accordance with the requisite operational noise criteria.

In this instance the existing prevailing background noise level measured during the noise survey ranges from 32 to 43dB L_{A90} during the most sensitive night-time period. Making the assumption that the majority of mechanical plant serving the development will operate 24/7 the mechanical plant noise emissions must be designed to achieve the specified criteria during the night-time period taking into account the cumulative impact of the existing noise environment.

Most of the noise generating plant items will be located within fully enclosed plant rooms or ventilated plant enclosures louvered with attenuation such that the noise emission level at a distance of 1 m from these louvres will be a maximum of 65dB L_{Aeq}.

All air handling units, will be hard ducted to louvres or will have noise attenuation in series, therefore noise breakout will be minimal. Appropriate louvres (standard weatherproofing or acoustic) will be provided such that the noise emission level at a distance of 1 m from these louvres will be a maximum of 65dB L_{Aeq}.

It is understood that 3 no. Cooling Towers will be located externally. We have assumed for the purpose of this preliminary assessment that all three Cooling Towers will be operational and the noise emission level at a distance of 10 m from individual cooling towers will be 55dB L_{Aeq}.

In addition, all plant will be selected such that there are no tonal or impulsive emissions.

Based on the noise levels listed here and taking into account the distance to the nearest noise sensitive locations the plant noise levels at the nearest sensitive locations will be in the range of 26dB to 39dB L_{Aeq}. This is within the adopted criteria of 45dB L_{Aeq} during the most sensitive night-time period.

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 being operational, the following comment is presented.

AADT flows with and without development for the years 2020, 2030 and 2035 have been assessed. The additional traffic introduced onto the local road network due to this development will result in an increase of traffic volumes of far less than 25% at all locations.

The resultant change in noise level due to road traffic is less than 1dB at all locations which is an imperceptible change.

In Combination Effects

Note that due to the imperceptible impacts associated with additional vehicular traffic on the public roads there will be no additional in combination effect due to multiple sources operating simultaneously. The operational noise impact will in effect be limited to the noise emissions from building services plant as assessed here.

Operational Phase – Vibration Emissions

It should be noted that the proposed development will not give rise to any significant levels of vibration off site and therefore the associated impact is not significant.

10.4.3 CUMULATIVE IMPACTS

Existing Developments

The baseline surveys take account of noise emissions from existing developments.
Table 10.13 presents the predicted cumulative noise level associated with the proposed development at the nearest noise sensitive locations during night time periods when any potential impact will be greatest.

Table 10.13 Review of Predicted Changes in Existing Noise Levels

Location	Predicted dB $L_{Aeq,T}$	Typical Background Level dB $L_{A90,T}$	Cumulative Noise Level (dB(A))	EPA Noise Limit for Licenced Sites
NSL 1	28	35	36	45
NSL 2	32	43	43	45
NSL 3	39	40	43	45
NSL 4	26	28	30	45

Review of the predicted increases in noise level at the nearest noise sensitive locations conclude that the change would be typically inaudible during the operational phase. In the context of the overall cumulative noise the levels are well below the adopted criteria. Any change to the overall noise level is likely to be imperceptible and will not affect the character of the noise environment significantly at these locations.

The baseline noise environment consists of noise from the existing Abbvie Ballytivnan facility in addition to other noise sources and facilities in the environment. The noise limits stated above will apply to all noise emissions from the Abbvie Ballytivnan facility; this applies to all existing and proposed noise sources.

Other Permitted Future Developments

There is no information available at present as to the potential noise emissions from future developments at the nearby noise sensitive locations when, or should, these developments become operational.

With consideration of the operational noise criteria discussed in Section 10.4, it can be assumed that the worst case allowable noise emissions at the nearest noise sensitive locations from any other developments will be 45dB $L_{Aeq,T}$ during night time periods. Given that the worst case predicted noise levels from the proposed development assessed here are in the order of 39dB $L_{Aeq,T,}$ it can therefore be concluded that there is the potential for some cumulative noise impacts in the future. Noise from any future developments should be limited such that the overall cumulative noise levels do not exceed

45dB $L_{Aeq,T}$ at the nearest noise sensitive receivers to ensure that the cumulative noise levels stay within the relevant operational noise criteria.

10.5 MITIGATION MEASURES

In order to sufficiently ameliorate the potential noise impact from this site, a schedule of control measures has been formulated.

10.5.1 CONSTRUCTION PHASE

The impact assessment has found that predicted levels of construction noise at nearby noise sensitive locations is likely to be well below the proposed criterion levels. However, mitigation measures are recommended as a precautionary approach in order to minimise any potential nuisance.

Reference is made to BS 5228-1:2009+A1:2014 and BS 5228-2:2009+A1:2014, which offers 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 the specific details will be set out in the Noise and Vibration Management Plan included as an Appendix to the CEMP to be adopted by the contractor. Specific examples of such measures are:

- 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 sensitive locations, and;
- All site access roads will be kept even so as to mitigate the potential for vibration from lorries.

Furthermore, it is envisaged that a variety of practicable noise control measures will be employed. These may include:

- 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.

Vibration from construction activities to off-site residences should be limited to the values set out in Table 10.7. 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.

10.5.2 OPERATIONAL PHASE

Building Services and Factory Process Plant

The impact assessment has found that predicted noise levels associated with the day to day operations of the site will be well within the proposed criteria applicable to a site of this nature. Notwithstanding this due consideration as part of the detailed design process will ensure that the new development will operate within the noise limits stipulated in the site IED licence issued by the EPA.

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 imperceptible.

10.6 RESIDUAL IMPACTS

This section summarises the likely noise and vibration impact associated with the proposed development, taking account of the mitigation measures outlined in Section 10.5.

10.6.1 CONSTRUCTION PHASE

During the construction phase of the project there may be some slight impacts on nearby noise sensitive properties due to noise emissions from site traffic and other activities. The application of noise limits and hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration impacts are kept to a minimum.

The probability of effects from construction noise are considered unlikely and a description of the effects are summarised in Table 10.14 for the nearest noise sensitive location (NSL3).

Table 10.14 Description of Construction Phase Effects

Quality	Significance	Duration
Negative	Slight	Short-term

10.6.2 OPERATIONAL PHASE

Building Services and Factory Process Plant

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 any nearby noise sensitive locations. In addition, noise emissions should be broadband in nature and should not contain any tonal or impulsive elements. The probability of effects from the operational phase of the developments are likely and a description of effects are summarised in Table 10.15.

Table 10.15 Description of Operational Phase Effects

Quality	Significance	Duration
Negative	Slight	Long-term

Additional Vehicular Traffic on Public Roads

Any change in noise levels associated with vehicles at road junctions in the vicinity of the proposed development are expected to be neutral and imperceptible with the probability of effects unlikely.

11 LANDSCAPE & VISUAL IMPACT

11.1 INTRODUCTION

11.1.1 BACKGROUND

This landscape and visual impact assessment has been prepared to identify and assess the effects on the appearance and character on the local environs arising from the proposed development.

It analyses the existing landscape character and significance, and provides an evaluation of the potential for landscape and visual impacts of the development. The assessment is made having regard to the vulnerability of the landscape to change and to the location of visual receptors relative to the proposed development.

The main landscape features and landscape character areas were identified through a combination of site visit and documentation surveys.

Landscape impacts were analysed based on:

- The capacity of the existing landscape to absorb the proposed development;
- Effects on landscape character and features (e.g. removal or alteration);
- Proximity of sensitive viewpoints (e.g. routes) and visual receptors;
- The details of the development.

Visual impacts are evaluated taking account of:

- The potential level of visual intrusion (i.e. effect impinged upon a view);
- The potential for visual impact dependant on the proximity and elevation of structures to a sensitive viewpoint/visual receptor.

The County Development Plan was consulted to identify Landscape Character Areas and significant landscape features as well as designated Scenic Routes and Landscape. Related provisions of the Plan – such as the proximity of Protected Structures to the site, were also considered.

11.2 THE PROPOSED DEVELOPMENT

A full development description is included in Section 4 *Project Description* of this document. The majority of the works consist of re-purposing internal manufacturing areas. The majority of the external works – which constitute a very small increase in the floor area of the existing facility - are concentrated along the northern edge of a large and long-established facility with an industrial appearance. A small area of existing grassed and mounded earth near the south eastern boundary will also be re-configured.

In summary, the aspects of the proposed development that have a potential to give rise to landscape of visual impacts consists of:

- New external structures located to the north of the existing facility
- New small berms located to the south-east of the existing facility

All of this work – with the exception of the small berm – will take place in a visually enclosed area, located between the existing facility and the steeply rising ground that lies of the north of the existing facility.

11.3 RECEIVING ENVIRONMENT

The proposed development will take place within an area with a long-established industrial character that lies along the transition between the urban fabric of Sligo town and the rural areas that lie to the north. This landscape is designated as 'Normal Rural Landscape' that has no sensitivity or significance.

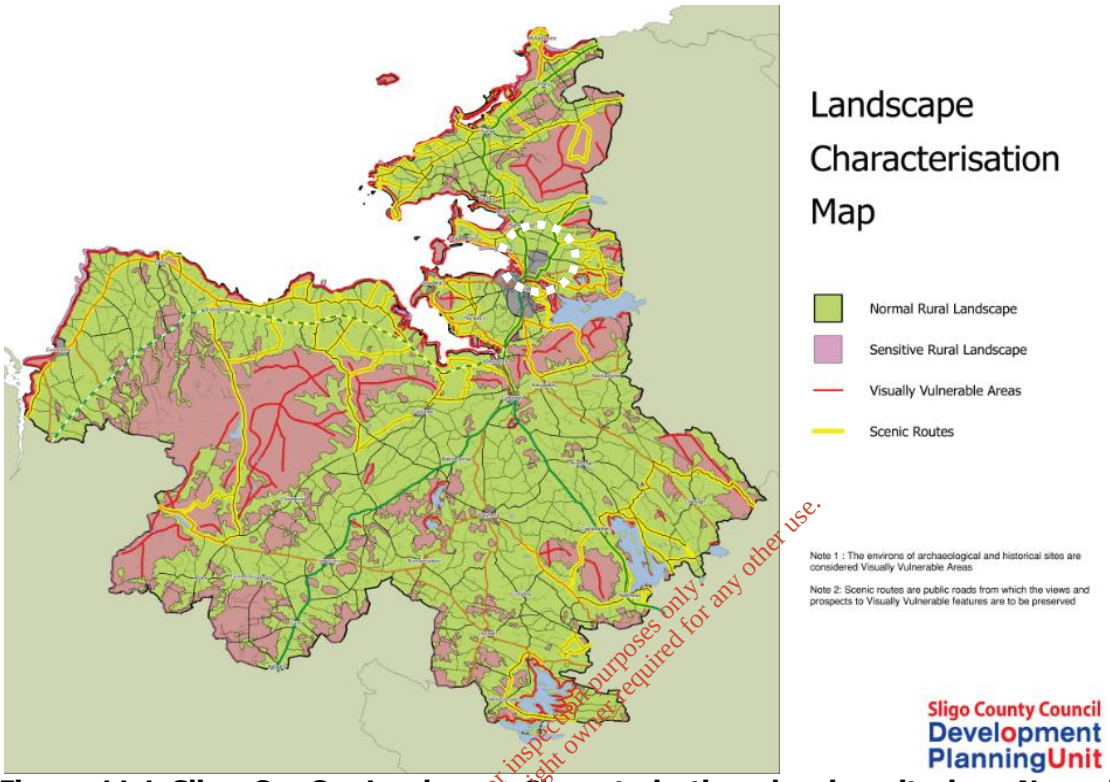

Figure 11.1 Sligo Co. Co. Landscape Characterisation showing site in a Normal Rural Landscape[48]

Figure 11.2 Aerial Photograph of Sligo with Site on Boundary of Rural Environs

[48] Sligo County Development Plan 2017 - 2023

11.4 CHARACTER & APPEARANCE

The local environs have a highly varied character that arises because of locally undulating topography combined with a mixture of land-uses. Long-established residential, institutional, industrial and agricultural uses all occur in close proximity, these, in turn, comprise a mixture of older and newer developments.

The steeply undulating topography combines with tall hedgerows and mature trees to create discrete enclosures within the landscape. Visibility of low-lying developments, generally, tends to be confined within such enclosures.

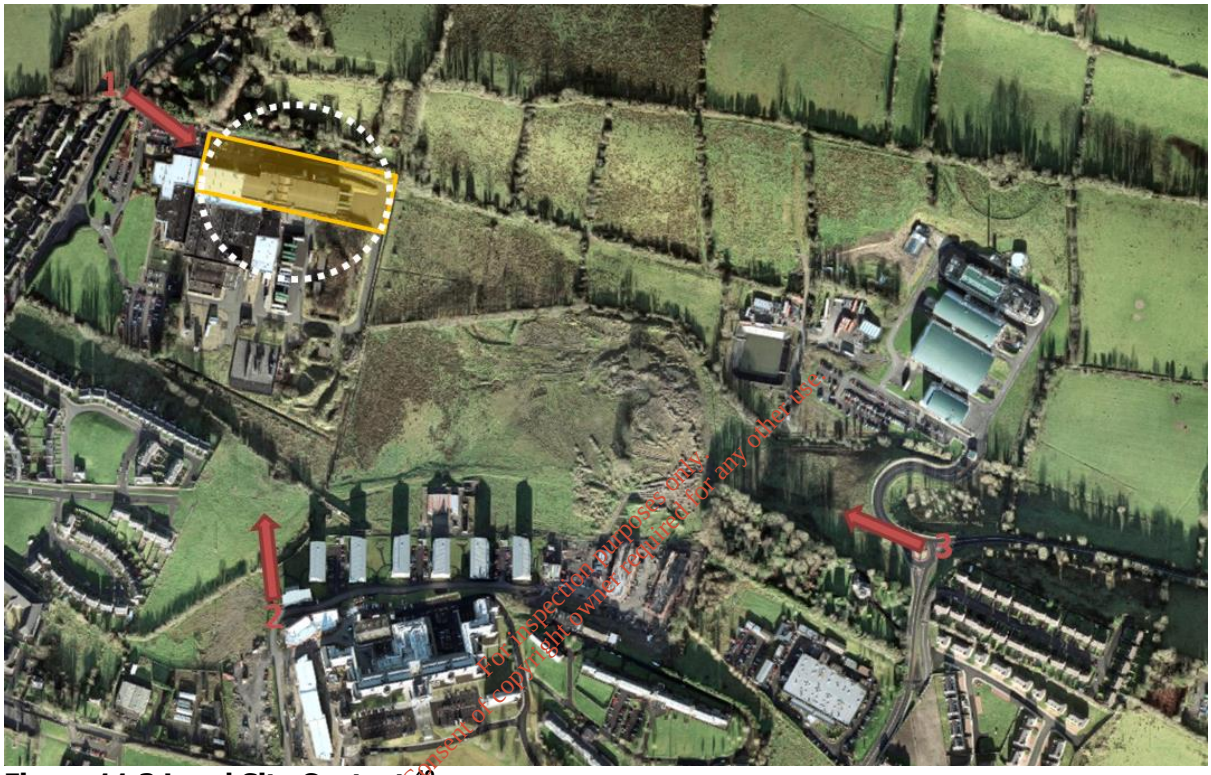

Figure 11.3 Local Site Context[49]

11.4.1 SIGNIFICANCE AND SENSITIVITY

Sligo is a county that is renowned for its natural beauty – particularly in the vicinity of Ben Bulben and King's Mountain – which are located about 5 km north of Sligo town. These are designated as Sensitive Rural Areas, containing Visually Vulnerable areas.

The location of the proposed development and its environs lie in lands that have no designations, though all of the major north-south routes in the vicinity [including the N16 0.5 km east of the site] are mapped as Scenic Routes that connect the town with these upland areas.

The local environs contain localised concentrations of established and recent housing. Some housing on higher ground to the south and south-east have elevated views towards the site.

The landscape in the immediate environs has a high capacity to absorb development without significant loss or change of character. This arises on account to the highly varied and enclosing topography, as well as on account of the density of mature, trees and scrub vegetation. Both of these factors enclose and limit views in the area.

[49] The location of the proposed development is, generally, indicated by the yellow rectangle. The locations of the closest potential viewing points are illustrated by red arrows [1 – 3]

11.5 PREDICTED IMPACTS

The potential impacts have been predicted by examining public views from the three closest locations – as identified in section 11.3. Each of these illustrate that the existing facility [screened at centre of photo] has no significant visibility on account of distance from the viewing point, combined with existing layers of mature planting.

On the basis of this analysis there is no potential for any of the proposed development to give rise to any effects on the appearance or character of the surrounding landscape, nor will it be visible from any views from any public roads.

Figure 11.4 View 1

View 1 from the Old Bundoran Road showing distant location of proposed development screened by layers of mature planting

Figure 11.5 View 2

View 2 from the Ballytivnan Student Housing showing distant location of proposed development screened by layers of mature planting

Figure 11.6 View 3

View 3 N16 Farranacardy Roundabout showing distant location of proposed development screened by layers of mature planting

11.6 MITIGATION MEASURE

The assessment has indicated that there will be no likelihood of adverse effects on the appearance or character of the landscape, nor will it be visible from any views from any public roads, accordingly no mitigation measures are required.

For the avoidance of doubt, this assessment assumes that the following existing mitigation factors will be sustained, namely:

- The development will be carried out in accordance with the design and detail submitted with this application.
- New materials and finishes will be consistent with those already employed at the site.
- Existing mature tree and shrubs at property boundaries will be retained and replaced as required.

12 MATERIAL ASSETS

12.1 INTRODUCTION

The prescribed environmental factor of Material Assets is described in 2002 in the EPA Guidelines as including Architectural, Archaeological and Cultural Heritage, Designed Landscapes, Natural Resources of Economic Value, Building & Structures and Infrastructure. Subsequent regulations together with evolution of practice in EIA have led to most of these subjects normally being covered under other headings. These headings typically include Cultural Heritage, Landscape, Water and Traffic.

In this EIAR the impacts on the various material assets described above are addressed in various sections, principally:

Section 8 *Land, Soils, Geology & Hydrogeology*
Section 9 *Water & Hydrology*
Section 11 *Landscape & Visual Impact*
Section 13 *Traffic & Transportation*
Section 14 *Waste Management*
Section 15 *Cultural Heritage*

This section covers the proposals for services- comprising surface water, electrical supply, water supply, wastewater, telecommunications and gas supply.

The draft revised EPA Guidelines (ref section 2.1) support this approach, confirming that 'Material assets can now be taken to mean built services and infrastructure'.

12.2 ELECTRICAL SUPPLY

The change in electrical demand will continue to be fed from the existing the high voltage substation located in the South East of the site. An extended electrical substation to the North side of the site is included in the proposal. This will not affect the high voltage substation which is on the opposite side of the site. ESB Networks confirm that the local network has adequate capacity for the additional demand.

12.3 GAS CONNECTION

The site is currently serviced by an existing tank of propane gas with distribution pipework. The tank will increase in size as part of the proposed development.

12.4 WATER

The water supply and waste water discharge needs of the proposed development will be met through the infrastructure that serves the existing site. Ongoing discussions with Irish Water indicate adequate availability in the capacity of the public foul sewer and water supply networks to supply water and to receive the proposed volume of wastewater from the development.

The levels of the changes in demand for these services relative to available network capacities are further discussed in Section 8 *Water & Hydrology*.

The surface water design for the proposal is detailed in Section 8 *Water & Hydrology*.

12.5 TELECOMS

The telecoms requirements of the extension will be met through the existing on-site network. Telecoms providers have confirmed that existing connections to the site have adequate capacity to cater for the demand of the extension.

13 TRAFFIC & TRANSPORTATION

13.1 INTRODUCTION/METHODOLOGY

This section presents an assessment of the impact of the proposed Abbvie redevelopment of its premises on local traffic and transport operations. The assessment focuses on the effects of increased traffic on the local road network during construction of the development and also the post construction (operational) situation. The volume and type of traffic generation in relation to the development and the likely effects of this traffic have been considered within this section. The assessment considers the impact of the development traffic on the baseline traffic levels. While this chapter should be read in conjunction with the standalone Traffic and Transport Assessment (TTA), this assessment has been undertaken to meet the requirements of '*EPA Guidelines on the information to be contained in Environmental Impact Statements'.*

The Abbvie development site is located approximately 1.5 km to the north of Sligo city centre, within the boundary of the Sligo County Council (SCC) administrative area. The site is bounded by the Old Bundoran Road to the west and predominantly greenfield land to the north and east. Residential uses are prominent to the south. A second Abbvie plant (not the subject of this application) lies approximately 700 m to the east at Manorhamilton.

The application is currently occupied by two separate companies specialising in the pharmaceutical and healthcare industry. Abbott – a company that specialises in enteral feeding occupies the portion of the building to the north. Abbvie – a global research and development-based biopharmaceutical company- occupies the southern portion of the site. To facilitate the future expansion of both companies, Abbott is relocating from the Ballytivnan plant to the IDA plant located at Finisklin to the south of Sligo. Abbvie will subsequently occupy the portion of the plant left by Abbott with primarily internal modifications to the existing building needed to upgrade the plant to meet future requirements.

A summary of the existing sustainable infrastructure and services is provided below. Further detail on baseline accessibility is contained within the TTA.

13.1.1 WALKING

A 30-minute walking catchment area of the Abbvie site includes the majority of the city centre area and a number of Sligo's residential catchment including the Gateway, Rathbraughan and Cartron. The Abbvie site itself is located within a good proximity to local amenities in the wider Sligo northern suburban areas. Land uses on the Old Bundoran Road are predominantly residential with agricultural uses more prominent in the northern section. Uses in the southern section where it joins the Ballytivnan Road are more varied and include schools, hospitals and places of worship.

The majority of these amenities are located within a feasible walking distance of the site whilst an on-site canteen provides a viable option to reduce the need to travel during work-hours and an opportunity to avoid travelling at peak times.

Pedestrian facilities have been greatly improved in the vicinity of the plant through the cooperation of Sligo County Council and Abbvie in recent years. A new 2-metre-wide footpath is evident along the site boundary providing a continuous link with the existing footpath to the south. Footpaths on the western side of the road are long established, continuous and have street lighting.

13.1.2 CYCLING

Cycling as a means of travelling to work is an increasingly popular mode in Ireland with the last Census in 2016 showing a 42.8% increase in cycling to work from the 2011 Census. Sligo city has a growing cycle mode share of 2.83% (up from 2% for work and college in Census 2011). A number of radial routes to the town centre and Sligo IT from Carraroe, Cleveragh and the Finisklin Business Park were developed through the Urban Cycle Sligo project in recent years.

An indicative 30-minute cycling catchment (5-kilometre radius) which is widely-considered to be a reasonable cycle journey time from the site includes a number of residential areas including the entire city boundary area, Rosses Point, Cranmore and Ballybeg and near Strandhill. A number of linked trips with public transport are possible through the provision of cycle parking at Sligo bus station and the recent introduction of Bleeperbike dockless bikes distributed throughout the site's catchment area.

13.1.3 PUBLIC TRANSPORT

Bus Provision

Bus Eireann operates two bus routes within Sligo city centre, the S1 and the S2. The S1 route operates on a 30-minute frequency in a north-south direction and serves a number of residential areas, Sligo city centre, Sligo Hospital and IT Sligo. The S1 stops directly opposite the Abbvie entrance on the Old Bundoran Road (Abbotts stop offering direct service to the plant).

The S2 serves a much wider area from Rosses Point in the north via the town centre to Strandhill in the south. The S2 is an hourly service beginning at 08:05 from Rosses Point and ends at 20:05. The S2 does not offer a direct service to the factory with the nearest stop available on the Clarion Road near the junction with Ballytivnan Road, approximately a 10-minute walk to the south of the plant.

Rail

Sligo rail station (MacDiarmada station) lies within the walking catchment of the site. The train station offers a number of connections to Dublin Connolly on a roughly 2-hour schedule. Connections to many of Sligo's commuter towns and villages including Boyle, Carrick-on-Shannon, Ballymote and Collooney are available on this route.

However, the earliest trains on this route to Sligo arrive at 11:09 and 14:13 rendering it unsuitable for the Abbvie dayshift. Similarly, the earliest that the Galway to Sligo Expressway arrives is 08.25, which is also too late for the daytime shift.

13.2 THE PROPOSED DEVELOPMENT

Abbvie wish to apply for planning permission for Development located at our existing facility at The Old Bundoran Road, Ballytivnan, Sligo, Co. Sligo. The proposed development consists of the following:

- Internal alterations to construct an integrated Bio-Chemical manufacturing facility sized 3,476 square meters within the building fabric of the existing Abbvie Ballytivnan Building.
- The construction of additional plant room internal mezzanines, sized 645 square meters within the existing building and an external single storey extension sized 20 square meters and 9 meters high, located to the North of the existing facility.
- A revised yard layout, located to the north of the existing facility including a new single storey electrical extension sized 155 square meters and 6.7 meters high, the enclosure of an existing walled yard area with a new roof and cladding sized 190 square meters to house chillers, the addition of 4 no. new boiler flues, 17.5 meters high above ground level and 500 mm

diameter, 2 new above ground bunded waste water holding tanks, 7 meters high housed in a building sized 110 square meters and 9 meters high and its associated tanker un-loading and one bunded underground tank housed in a building sized 75 square meters and 4 meters high, 3 no. cooling towers 9 meters high, a nitrogen tank sized 8 meters high and 2 meters diameter and an emergency generator and its associated diesel tank and its 10 meter stack.

- Site works include revised road and car parking layouts, additional temporary contractor related car parking for 109 cars located to the east of the existing H.T. substation, underground and overground utilities, landscaping and minor elevational changes to existing buildings including roof mounted plant and equipment and a single storey sprinkler pumphouse sized 24 square meters and 6 meters high and site fencing.

There are around 271 staff employed at the existing site across both the Abbott and Abbvie plants. Of this total, there are 179 employed at Abbvie and 92 at Abbott. All Abbott staff will relocate to a new purpose-built facility at the Finisklin IDA Business Park to the south-west of Sligo city centre imminently reducing impact on the local road network. A proposed maximum number of 100 staff will be employed at the enlarged Abbvie plant over the next few years, many of whom will be working on a shift basis. The net increase of a maximum of 8 staff on-site is considered to have negligible impact on the local highway network.

13.2.1 CONSTRUCTION PHASE

The construction programme for the new development will have duration of approximately 16 months and assessment of the impacts of the construction phase vehicles is based on daily traffic movements above the baseline level. Based upon a conservative, 'worst case' scenario, it is predicted, during the peak month of construction, that a maximum of 250 contractors on-site will generate approximately 208 daily construction trips, above the baseline level. A significant proportion of these trips will be off-set by the reduction of Abbott related staff and HGV and LGV delivery and servicing trips.

Construction traffic distribution will be managed through a Construction Traffic Management Plan. For the purposes of this assessment, construction traffic distribution has been based on existing turning movements. The Construction Management Plan will also consider the timing of HGV trips to ensure that these occur outside of the peak periods.

It is proposed that construction staff will park within the existing Abbott car parking area and a new temporary 109 space contractor car park at the eastern end of the plant close to where the existing HGV deliveries take place. All car parks will continue to be accessed via the existing staff entrance. Additional resilience can be provided by the 55 space existing visitor car park if needed. These car parking areas can comfortably accommodate the peak levels of construction traffic associated with the proposed development.

13.2.2 OPERATIONAL PHASE

A year of opening of 2020 is forecast for the operational phase of the proposed development. At this time the proposed development will include an additional 100 staff, bringing the total Abbvie staff roll to 279. Therefore, this equates to a site net increase of eight due to the 92 Abbott staff leaving the site in April 2018. In keeping with the Abbvie shift patterns a significant proportion of the 100 new staff will arrive on site for a 08:00 start time thereby reducing the impact on the local network. The operational traffic is predicted to route through the local road network in line with existing distributions, derived from junction turning count data.

It is proposed that existing car parking spaces will be used to accommodate the additional staff that the proposals will generate. In all, once the proposed development becomes operational, a total permanent parking provision of 338 spaces (283 excluding the visitor and security staff parking area) will be in place to accommodate a maximum of 279 staff, which is appropriate for the needs of the Abbvie site. This level of permanent car parking is consistent with the Sligo County Development Management Plan minimum car parking standards. Any excessive car parking space will be reduced in the short-medium term through the use of a Mobility Management Plan (MMP).

The more detailed aspects of the Construction Environment Management Plan (CEMP) will be agreed in consultation with Sligo County Council. For the operational phase, a Mobility Management Plan will be adopted, with the aim of reducing single occupancy vehicular traffic and promoting sustainable modes.

The objectives of the draft MMP are as follows:

1. Improve sustainable transport options to the site in the short and long term;
2. Promote and encourage active travel;
3. Promote and increase public transport use;
4. Promote and increase car sharing; and
5. Reduce the need for unnecessary travel.

There are a number of secondary and additional benefits of having a robust Mobility Management Plan. These include but are not limited to;

- Assisting in increasing accessibility to a site while reducing congestion;
- Reducing the amount of single occupancy cars on the transport network;
- Improving local air pollution, reducing greenhouse gases and noise;
- Increasing business efficiency and equality;
- Reducing the carbon footprint of the organisation / development;
- Reducing traffic impact on the local highway network;
- Reducing adverse impacts on local residents and businesses; and
- Improving the health and wellbeing of the workforce through the formation of active travel patterns.

Some of the measures to be promoted within the Mobility Management Plan include the following,

Travel Plan Survey

- Undertake a Travel Plan survey within 2 months of receiving planning permission to inform the development of the draft MMP; and
- Ultimately put in place a plan to gradually reduce the amount of on-site car parking to facilitate mode shift to more sustainable forms of travel.

Walking & Cycling

- Significantly upgrade the amount of cycle parking on-site;
- Review cycleways and footpaths in the immediate vicinity of the site to assess surfacing, lighting, safety etc. Inform the relevant local authorities of any instances of poor pedestrian and cyclist infrastructure;
- Review and seek to upgrade any internal footpaths that are poorly maintained, including for appropriate crossing points and street lighting;
- Review existing cycle space provision, location and safety. Cycle parking provision should be increased within the site as interim targets are met; and
- Review quality and quantity of existing changing and shower facilities within the Abbvie site and seek to improve on where required.

Public Transport

- Promotion of the Leap card and mobile top-up service for new employees;
- Promotion of the S1 and S2 local bus services to all staff, contractors and visitors;
- Ensure that any new bus services or bus infrastructure proposed in the vicinity of site is suitable for Abbvie users, considering aspects such as accessibility, timetabling and staff home locations; and
- Liaison with local authorities and public transport operators to examine opportunities to re-route services in order to better serve Abbvie staff, contractors and visitors.

Promotion of Sustainable and Active Travel

- Provision of a Travel Options Leaflet for the site, available in hard and electronic formats;
- Provide and promote an on-site Green Travel Day;
- Promote the staff Cycle to Work scheme, while ensuring the process is as efficient as possible in terms of administration;
- Provision of an on-site emergency cycle repair kit and schedule visits from the 'Bike Doctor'; and
- Investigate the feasibility of providing dedicated carpooling spaces.

Promotion of Smarter Working Measures

- Review staff travel policy to include criteria to encourage tele-video conferencing use; and
- Provide training for tele-video-conferencing facility use.

Electric Vehicle Charge Points (EVCP)

- Support the uptake of electric cars through provision of 2 active EVCP and passive electric vehicle charging points to be enacted as demand requires.

13.3 THE RECEIVING ENVIRONMENT

Traffic surveys in the form of junction turning counts were undertaken over a 24-hour period between 5pm Wednesday 21 March 2018 to 5pm Thursday 22 March 2018. These dates were considered to be appropriate in terms of measuring traffic volumes under as normal circumstances as possible. Schools are open, it is outside of the holiday period and traffic is generally considered to be operating under typical conditions.

The days between Tuesday and Thursday are considered as normal workdays as Monday and Friday are observed to have skewed traffic behaviour. The survey was conducted on Wednesday and Thursday and therefore within normal workday range. Four junctions within the vicinity of the site were included within the scope of the assessment:

- Site 1: Old Bundoran Road / Abbvie entrance;
- Site 2: Avondale / Elm Gardens;
- Site 3: Ballytivnan Road / Clarion Road / housing cul-de sac; and
- Site 4: Ballytivnan Road / N16

Traffic growth for the surrounding road network, for future year scenarios is based on the central growth rates for Sligo obtained from Project Appraisal Guidelines Unit 5.3, Table 5.3.2: Link-Based Growth Rates: Annual Growth Factors. Central growth rates for the Border region have been applied to the base flows for the following scenarios:

- Baseline and Construction (2018);
- Opening year (2020);
- Opening year + 5 (2025); and
- Opening year + 15 (2035)

Applied growth rates are shown in Table 13.1 below:

Table 13.1 Growth Rates for the Border Area (Sligo)

Years	Central Growth for Light Vehicles	Central Growth for Heavy Vehicles
2013 – 2030	1.0114	1.0237
2030 – 2050	1.0030	1.0176

13.3.1 BASELINE AND CONSTRUCTION START (2018)

The baseline that is utilised in the assessment has been established from observed Classified Junction Turning Count (JTC) surveys taken at four junctions on 21st and 22nd March 2018. These 24 hour surveys were conducted between the hours of 5pm to 5pm.

The baseline (2-way) Annual Average Daily Traffic (AADT) flows for 2018 are detailed in the Table 13.2 below. These were taken directly from the 24-hour JTC counts and use to assess the future impacts of construction.

Table 13.2 Baseline (2-way) AADT 2018

	Link	Baseline Traffic Flows 2018		
		AADT	HGVs & Bus	% HGV
JTC Site 1	Old Bundoran Road (North)	1,722	25	1.5%
	Abbvie access (East)	858	10	1.2%
	Old Bundoran Rd (South)	2,500	103	4.1%
JTC Site 2	Old Bundoran Road (North)	3,181	101	3.2%
	Elm Gardens (West)	4,151	37	0.9%
	Elm Gardens (East)	977	0	0%
	Avondale (South)	4,219	104	2.5%
JTC Site 3	Avondale (North)	4,280	103	2.4%
	Clarion Rd (East)	4,549	117	2.6%
	Housing (West)	271	0	0%
	Ballytivnan Rd (South)	4,032	110	2.7%
JTC Site 4	Ballytivnan Rd (North)	4,441	98	2.2%
	N16 (West)	12,955	247	1.9%
	N16 (East)	10,854	171	1.6%
	Holborn Hill (South)	3,050	11	0.4%

13.3.2 OPENING YEAR (2020)

It has been assumed that operational traffic will route through the local traffic network via a variety of routes, in line with current traffic distribution observed at the site. These routes are detailed below in Table 13.3. As traffic survey data is for 2018, and the opening assessment year is 2020, the observed traffic counts were factored in line with factors in Table 13.1.

Table 13.3 Opening Year (2-way) AADT 2020

	Link	Baseline Traffic Flows 2020		
		AADT	HGVs & Bus	% HGV
JTC Site 1	Old Bundoran Road (North)	1,761	26	1.5%
	Abbvie access (East)	878	10	1.2%
	Old Bundoran Rd (South)	2,557	108	4.2%
JTC Site 2	Old Bundoran Road (North)	3,254	106	3.3%
	Elm Gardens (West)	4,246	39	0.9%
	Elm Gardens (East)	999	0	0%
	Avondale (South)	4,315	109	2.5%
JTC Site 3	Avondale (North)	4,378	108	2.5%
	Clarion Rd (East)	4,653	123	2.6%
	Housing (West)	277	0	0%
	Ballytivnan Rd (South)	4,124	115	2.8%
JTC Site 4	Ballytivnan Rd (North)	4,542	103	2.3%
	N16 (West)	13,250	259	2%
	N16 (east)	11,101	179	1.6%
	Holborn Hill	3,120	12	0.4%

13.3.3 OPENING YEAR + 5 (2025)

The forecast 2025 Design Year (Opening Year + 5) AADT levels are detailed in the Table 13.4 below.

Table 13.4 Opening Year + 5 (2-way) AADT 2025

	Link	Baseline Traffic Flows 2025		
		AADT	HGVs & Bus	% HGV
JTC Site 1	Old Bundoran Road (North)	1,859	29	1.6%
	Abbvie access (East)	926	12	1.3%
	Old Bundoran Rd (South)	2,700	120	4.4%
JTC Site 2	Old Bundoran Road (North)	3,435	118	3.4%
	Elm Gardens (West)	4,482	43	1%
	Elm Gardens (East)	1,055	0	0%
	Avondale (South)	4,556	121	27%
JTC Site 3	Avondale (North)	4,622	120	2.6%
	Clarion Rd (East)	4,912	136	2.78%
	Housing (West)	293	0	0%
	Ballytivnan Rd (South)	4,354	128	2.9%
JTC Site 4	Ballytivnan Rd (North)	4,795	114	2.4%
	N16 (West)	13,989	288	2.1%
	N16 (east)	11,720	199	1.7%
	Holborn Hill	3,293	13	0.4%

13.3.4 OPENING YEAR + 15 (2035)

The forecast 2035 Design Year (Opening Year + 15) AADT levels are detailed in the Table 13.5 below.

Table 13.5 Opening Year + 15 (2-way) AADT 2035

	Link	Baseline Traffic Flows 2035		
		AADT	HGVs & Bus	% HGV
JTC Site 1	Old Bundoran Road (North)	1,983	34	1.7%
	Abbvie access (East)	988	14	1.4%
	Old Bundoran Rd (South)	2,880	141	4.9%
JTC Site 2	Old Bundoran Road (North)	3,664	139	3.8%
	Elm Gardens (West)	4,781	51	1.1%
	Elm Gardens (East)	1,125	0	0%
	Avondale (South)	4,859	143	2.9%
JTC Site 3	Avondale (North)	4,930	141	2.9%
	Clarion Rd (East)	5,240	161	3.1%
	Housing (West)	312	0	0%
	Ballytivnan Rd (South)	4,644	151	3.3%
JTC Site 4	Ballytivnan Rd (North)	5,115	134	2.6%
	N16 (West)	14,922	339	2.3%
	N16 (east)	12,502	235	1.9%
	Holborn Hill	3,513	15	0.4%

13.4 PREDICTED IMPACTS

In terms of the transport review, the effects that may result from an increase in traffic volume without mitigation measures may include;

- Congestion;
- Air pollution;
- Journey delays; and
- Reduction in safety levels.

The most discernible environmental effects of traffic may be noise, severance, pedestrian delay and intimidation. The effects of noise are detailed within Chapter 10 Noise & Vibration of this EIAR. Pedestrian delay and intimidation relate to the impact on pedestrian movement and the perceived difficulty and discomfort in crossing a road.

Severance, which is the perception of communities and facilities being divided by a road, is not predicted to be an environmental effect given the nature of the existing local road network in the vicinity of the site. Air pollution effects are addressed along with effects of greenhouse gas emissions in Chapter 9 Air Quality & Climate.

The traffic volumes forecast during each phase (during construction and post construction) of the proposed development are described below.

13.4.1 CONSTRUCTION PHASE - DEVELOPMENT IMPACT

This scenario identifies and assesses the impact of the proposed daily construction traffic on the baseline traffic levels on the links and volumes detailed in Table 13.2. The TTA has assessed the impact of the proposed development on key junctions on the local road network. The TTA, which should be read in conjunction with this chapter, considers the operation of these junctions for all assessment scenarios and provides commentary on any capacity, queuing and delay issues.

The overall construction period duration for the proposed development is estimated to be approximately 16 months. Construction traffic impact will be temporary for this duration. Details on the predicted traffic levels during the peak hours are summarised below.

During construction, potential impacts may include:

- Increased vehicle movements associated with construction staff and management travelling to / from the site;
- Increased vehicle movements consisting of HGVs and construction plant that may result in traffic congestion on roads;
- Increased queuing and congestion;
- Increased conflict between pedestrians / cyclists and vehicle traffic; and
- Severance of pedestrian and cycle routes.

In addition to the aforementioned temporary impacts, there is the potential for impacts on air quality, noise and vibration to occur as a result of construction traffic. These potential impacts and any associated mitigation measures are considered separately within the relevant sections.

Table 13.6 details a comparison of the forecast construction traffic levels against baseline traffic levels.

Table 13.6 Traffic Impact Associated with the Development Construction AADT (2-way)

	Link	Baseline Traffic Flows 2018		Construction Traffic 2018		Base 2018 + Const.		Increase (% of Baseline)	
		AADT	HGVs	AADT	HGVs	AADT	HGVs	AADT	HGVs
JTC Site 1	Old Bundoran Rd (N)	1,722	25	48	3	1,770	28	2.79%	12.0%
	Abbvie access (East)	858	10	317	20	1,175	30	36.95%	200.0%
	Old Bundoran Road (S)	2,500	103	269	17	2,684	120	10.76%	16.5%
JTC Site 2	Old Bundoran Road (N)	3,181	101	269	17	3,365	118	8.46%	16.5%
	Elm Gardens (W)	4,151	37	157	10	4,258	47	3.78%	27.0%
	Elm Gardens (E)	977	0	7	0	982	0	0.71%	0.0%
	Avondale (S)	4,219	104	105	7	4,291	111	2.49%	67.3%
JTC Site 3	Avondale (N)	4,280	103	105	7	4,352	110	2.49%	6.8%
	Housing (W)	271	0	3	0	273	0	1.1%	0.0%
	Clarion Road (E)	4,549	117	65	4	4,594	121	1.43%	3.4%
	Ballytivnan Road (S)	4,032	110	37	3	4,057	113	0.92%	2.7%
JTC Site 4	Ballytivnan Road (N)	4,441	98	37	3	4,466	101	0.83%	3.1%
	N16 (W)	12,955	247	17	2	12,967	249	0.13%	0.8%
	N16 (E)	10,854	171	3	0	10,856	171	0.03%	0.0%
	Holborn Hill (S)	3,050	11	16	1	3,061	12	0.52%	9.1%

During the busiest phase of construction, the anticipated increases in trips occur at the Abbvie entrance with an additional 216 two-way vehicles over the course of an entire day. This equates to a worst case percentage increase of 36.95% increase in vehicles and a 200% increase in (HGV) movements respectively on the eastern side of the Abbvie junction. These high percentage increases can be explained by the relatively low baseline figures and it is noted that this construction impact will be temporary.

A Construction Traffic Management Plan to be agreed with Sligo County Council will help to mitigate traffic impacts and ensure that the majority of HGV deliveries can take place at off-peak parts of the day.

13.4.2 POST CONSTRUCTION PHASE - DEVELOPMENT IMPACT

Following completion of the proposed development, the construction trips will be removed from the network. These will be replaced, however, by trips associated with permanent staff, over and above the current traffic baseline level. The impact of these trips against the opening year baseline (2020), opening year +5-year baseline (2025) and opening year +15 years baseline (2035) are detailed in Table 13.7 to Table 13.9 below.

Table 13.7 Traffic Increase against 2020 Opening Year Baseline AADT (2-way)

	Link	Baseline Traffic Flows 2020		Operational Traffic		Base 2020 + Operational		Increase (% of Baseline)	
		AADT	HGVs	AADT	HGVs	AADT	HGVs	AADT	HGVs
JTC Site 1	Old Bundoran Rd (N)	1,761	26	3	2	1,764	28	0.2%	7.7%
	Abbvie access (East)	878	10	17	10	894	20	1.8%	100.0%
	Old Bundoran Road (S)	2,557	108	14	9	2,571	116	0.5%	7.4%
JTC Site 2	Old Bundoran Road (N)	3,254	106	14	9	3,268	114	0.4%	7.5%
	Elm Gardens (W)	4,246	39	8	5	4,254	44	0.2%	12.8%
	Elm Gardens (E)	999	0	0	0	1,000	0	0.1%	0.0%
	Avondale (S)	4,315	109	6	4	4,321	113	0.1%	3.7%
JTC Site 3	Avondale (N)	4,378	108	6	4	4,383	112	0.1%	3.7%
	Housing (W)	277	0	0	0	277	0	0.0%	0.0%
	Clarion Road (E)	4,653	123	3	3	4,656	126	0.1%	2.4%
	Ballytivnan Road (S)	4,124	115	2	1	4,126	116	0.0%	0.9%
JTC Site 4	Ballytivnan Road (N)	4,542	103	2	1	4,544	104	0.0%	1.0%
	N16 (W)	13,250	259	1	1	13,251	260	0.0%	0.4%
	N16 (E)	11,101	179	0	0	11,102	179	0.0%	0.0%
	Holborn Hill (S)	3,120	12	1	0	3,120	12	0.0%	0.0%

Table 13.8 Traffic Increase against 2025 Opening Year +5 Baseline AADT (2-way)

	Link	Baseline Traffic Flows 2025		Operational Traffic		Base 2025 + Operational		Increase (% of Baseline)	
		AADT	HGVs	AADT	HGVs	AADT	HGVs	AADT	HGVs
JTC Site 1	Old Bundoran Rd (N)	1,859	29	3	2	1,862	31	0.2%	6.9%
	Abbvie access (East)	926	12	17	10	943	22	1.8%	83.3%
	Old Bundoran Road (S)	2,700	120	14	9	2,714	129	0.5%	7.5%
JTC Site 2	Old Bundoran Road (N)	3,435	118	14	9	3,449	126	0.4%	6.8%
	Elm Gardens (W)	4,482	43	8	5	4,491	48	0.2%	11.6%
	Elm Gardens (E)	1,055	0	0	0	1,055	0	0.0%	0.0%
	Avondale (S)	4,556	121	6	4	4,561	125	0.1%	3.3%
JTC Site 3	Avondale (N)	4,622	120	6	4	4,627	124	0.1%	3.3%
	Housing (W)	293	0	0	0	293	0	0.0%	0.0%
	Clarion Road (E)	4,912	136	3	3	4,915	139	0.1%	2.2%
	Ballytivnan Road (S)	4,354	128	2	1	4,356	129	0.0%	0.8%
JTC Site 4	Ballytivnan Road (N)	4,795	114	2	1	4,797	115	0.0%	0.9%
	N16 (W)	13,989	288	1	1	13,990	289	0.0%	0.3%
	N16 (E)	11,720	199	0	0	11,720	199	0.0%	0.0%
	Holborn Hill (S)	3,293	13	1	0	3,294	13	0.0%	0.0%

Table 13.9 Traffic Increase against 2035 Opening Year +15 Baseline AADT (2-way)

	Link	Baseline Traffic Flows 2035		Operational Traffic		Base 2035 + Operational		Increase (% of Baseline)	
		AADT	HGVs	AADT	HGVs	AADT	HGVs	AADT	HGVs
JTC Site 1	Old Bundoran Rd (N)	1,983	34	3	2	1,986	36	0.2%	5.9%
	Abbvie access (East)	988	14	17	10	1,005	24	1.7%	71.4%
	Old Bundoran Road (S)	2,880	141	14	9	2,894	150	0.5%	6.4%
JTC Site 2	Old Bundoran Road (N)	3,664	139	14	9	3,678	147	0.4%	5.8%
	Elm Gardens (W)	4,781	51	8	5	4,789	56	0.2%	9.8%
	Elm Gardens (E)	1,125	0	0	0	1,126	0	0.1%	0.0%
	Avondale (S)	4,859	143	6	4	4,865	147	0.1%	2.8%
JTC Site 3	Avondale (N)	4,930	141	6	4	4,935	145	0.1%	2.8%
	Housing (W)	312	0	0	0	312	0	0.0%	0.0%
	Clarion Road (E)	5,240	161	3	3	5,243	164	0.1%	1.9%
	Ballytivnan Road (S)	4,644	151	2	1	4,646	152	0.0%	0.7%
JTC Site 4	Ballytivnan Road (N)	5,115	134	2	1	5,117	135	0.0%	0.7%
	N16 (W)	14,922	339	1	1	14,922	340	0.0%	0.3%
	N16 (E)	12,502	235	0	0	12,502	235	0.0%	0.0%
	Holborn Hill (S)	3,513	15	1	0	3,514	15	0.0%	0.0%

The main traffic impact in 2020, 2025 and 2035 is again forecast at the Abbvie site entrance on the Old Bundoran Road. These high percentage increases can be explained by the relatively low baseline figures.

As the traffic distributes through the traffic network the impact decreases and the overall impact is considered negligible. Furthermore, the shift pattern nature of work on the site and introduction of a robust Mobility Management Plan will help to reduce impact at peak times.

13.5 MITIGATION MEASURES

It is considered that the predicted increases in network traffic as a result of construction and operational development will be of negligible impact and therefore no intervention or physical mitigation is required. Notwithstanding this, the Construction Traffic Management Plan will mitigate traffic impact through:

- Programming deliveries outside of peak periods; and
- Ensuring construction vehicles route to site via agreed routes.

A Mobility Management Plan is a continuous and evolving document requiring monitoring, review and revision to ensure that it remains relevant to all users of the site. The Mobility Management Plan contains more details on the requirement for the appointment of a Mobility Management Plan co-ordinator, to deal with promotion, engagement and monitoring of the effectiveness of the implemented measures.

Baseline staff surveys will be carried out within 6 months of the opening of the development. Travel surveys will subsequently be undertaken by new staff and on a bi-annual basis. These will be carried out in order to monitor the impact of the Mobility Management Plan and to establish how successful it has been in inducing modal shift. The measures implemented will be reviewed so that they can be adjusted and new measures introduced, where necessary.

Monitoring reports will be submitted to Sligo County Council at an agreed frequency and these reports and revised versions of the Mobility Management Plan can be made available as required. On-going monitoring will take place via the Mobility Management Plan Coordinator Jim Leahy who will collect any feedback and suggestions from users at site about the Mobility Management Plan and its measures.

13.6 RESIDUAL IMPACTS

13.6.1 CONSTRUCTION

Considering that the nature of traffic increase will be short term, the mitigation measures outlined previously will ensure that there will be no significant residual impacts. A summary justification is as follows:

- A Construction Traffic Management Plan will minimise, as far as practicable, traffic impacts during construction;
- The maximum traffic increases as a result of construction related traffic will be temporary; and
- The environmental effects identified previously will be managed through the mitigation measures outlined above, thus ensuring the impacts are not significant.

13.6.2 OPERATION

The mitigation measures outlined previously will ensure that there will be no significant residual impacts. A summary justification is as follows:

- A Mobility Management Plan will be implemented which will reduce vehicular traffic and promote sustainable modes.

14 WASTE MANAGEMENT

14.1 INTRODUCTION / METHODOLOGY

This section of the EIAR has been prepared to address the potential impacts associated with waste management during the construction and operational phases of the proposed development.

The assessment has been conducted in the context of current relevant standards and guidance as described in Section 1 *Introduction* and identifies any requirements or possibilities for mitigation.

The assessment of the impacts of the proposed development arising from the generation of waste materials was carried out taking into account the methodology specified in the 'Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports' (EPA, August 2017), along with an extensive document review to assist in identifying current and future requirements for waste management including Directives, national and regional waste policy, waste strategies, management plans and relevant reports.

This Section is based on the project description, as described in Section 4 *Project Description* and considers the following aspects:

- The legislative context;
- The construction phase (including excavation); and
- The operational phase.

A desk study was carried out which includes the following tasks:

- 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.

The waste types are based on published data by the EPA in National Waste Reports, data recorded from similar previous developments, Irish and US EPA waste generation research and other available research.

Mitigation measures are proposed to minimise the effect of the proposed development on the environment during the construction and demolition and operational phases, to promote efficient waste segregation and to reduce the quantity of waste requiring final disposal. Design mitigation measures are included in the description of the proposed development in Sections 14.2.1 and 14.2.2 and other mitigation measures are presented in Section 14.5 Mitigation Measures.

A detailed review of the existing ground conditions on a regional, local and site-specific scale are presented in Section 7 *Land, Soils, Geology and Hydrogeology*. The direct and indirect effects of waste related transport are considered in Section 13 *Traffic and Transportation*.

14.1.1 LEGISLATION AND GUIDANCE

Waste management in Ireland is subject to EU, national and regional waste legislation which defines how waste materials must be managed, transported and treated. The overarching EU legislation is

the Waste Framework Directive (2008/98/EC)[50] which is transposed into national legislation in Ireland. The cornerstone of Irish waste legislation is the Waste Management Act 1996 [51] (as amended).

In addition, the Irish government issues regular policy documents which outline measures aimed 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 *A Resource Opportunity – Waste Management Policy in Ireland* [52] was published in 2012 and stresses the environmental and economic benefits of better waste management, particularly in relation to waste prevention.

The strategy for the management of waste from the construction phase is carried out in line with the requirements of the *Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects* [53] published in 2006. The guidance document *Construction and Demolition Waste Management: A handbook for Contractors and Site Managers* [54] 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, British Standards and other relevant studies and reports.

14.2 THE PROPOSED DEVELOPMENT

The proposed development is outlined in Section 4. With regard to waste management, the proposed development will generate waste materials during the construction and demolition phase and when the new building is operational.

14.2.1 DEMOLITION PHASE

A small amount of demolition waste is expected to be generated from the removal of a wall of the current building. The section of the existing building which is to be demolished is constructed primarily of insulated cladding and steel. Other small quantities of demolition waste expected to be generated at this stage include concrete, metal, timber and some miscellaneous waste.

The Connacht-Ulster Region Waste Management Plan specifies a target for recycling/reuse of at least 70% of C&D waste. Therefore the contractor will have to ensure that the above referenced waste is managed appropriately to ensure the above target is met, as a minimum.

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

[50] European Union, (2008) Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives.
[51] Irish Gov., (1996) Waste Management Act 1996 (No. 10 of 1996) as amended.
[52] Department of Environment, Communities and Local Government (DoECLG), A Resource Opportunity - Waste Management Policy in Ireland (2012).
[53] Department of the Environment, Heritage and Local Government (DoEHLG), Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects (2006).
[54] FÁS and the Construction Industry Federation (CIF), Construction and Demolition Waste Management – a handbook for Contractors and Site Managers (2002).

14.2.2 CONSTRUCTION PHASE

Construction Waste Streams

Hardstanding, made ground yards will be excavated during the construction phase to facilitate construction of the new building, carpark and related services. The proposed development has been designed to minimise the quantity of material that is required to be excavated and removed off-site. Consequently, the new building sits primarily within the footprint of the current building and this results in an expected smaller quantity of construction waste to be generated than might otherwise be the case.

Management of Construction Waste Streams

It is noted that there will be few opportunities for reuse of suitable excavated materials on the site and it is expected all of the excavated materials will be removed off site as waste.

A watching brief and discovery procedure for contaminated material will be prepared and adopted by the contractor prior to excavation works commencing on site. In the event that any potentially contaminated material is encountered, it will be segregated from clean/inert material, tested and classified as non-hazardous or hazardous using the HazWasteOnline application (or similar approved method), and then classified as inert, non-hazardous or hazardous in accordance with the European Communities (EC) Council Decision 2003/33/EC, which establishes criteria for the acceptance of waste at landfills.

Throughout the construction phase, waste will be produced from surplus materials such as broken or off-cuts of cladding, steel, timber, concrete, tiles, bricks, etc. Waste from packaging (cardboard, plastic, timber) and oversupply of materials are also likely to be generated. The contractor will be required to ensure that oversupply of materials is kept to a minimum and that opportunities for reuse of suitable materials is maximised. If the material 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 by the receiving facility.

The estimated construction waste amounts are presented in Table 14.1.

Table 14.1 Estimated on and off-site Reuse, Recycling and Disposal Rates for Construction Waste

	Tonnes	Reuse/Recovery		Recycle		Disposal	
		%	Tonnes	%	Tonnes	%	Tonnes
Mixed C&D	10.2	10	1.0	80	8.1	10	1.0
Timber	7.4	40	3.0	55	4.1	5	0.3
Metals	3.4	5	0.1	90	3.1	5	0.2
Concrete, Bricks, Tiles, Ceramics	1.6	30	0.5	65	1.0	5	0.1
Other	4.0	20	0.8	60	2.4	20	0.8
Total	26.5		5.4		18.7		2.4

A Construction & Demolition (C&D) Waste Management Plan (WMP) has been prepared for the proposed works (included as Appendix 14.1) which provides an outline for the management of waste materials generated during the construction phase. The correct segregation, storage, handling and transport of waste in accordance with this C&DWMP will ensure litter is not generated at the

proposed Abbvie facility or neighbouring areas and does not become a nuisance to the public. These measures include:

- On-site segregation of non-hazardous construction waste materials into appropriate categories, where possible, including (but not limited to):
  - Excavated hardstanding, made ground and subsoils- which will be classified appropriately as detailed above;
  - Concrete, bricks, tiles, ceramics;
  - Plasterboard;
  - Metals; and
  - Timber.
- On-site segregation of all construction related hazardous waste materials into appropriate categories including:
  - Contaminated soils (if encountered);
  - Waste oil and fuels; and
  - Paints, glues, adhesives and other known hazardous substances.
- Segregation of all wastes at source, where possible;
- Storage of all waste materials in skips or other suitable receptacles in designated areas of the site. Appropriate signage will be used to identify each waste type and all construction staff will be notified of the waste storage areas on commencement of the project;
- Left over materials (e.g. timber off-cuts) and any suitable construction materials shall be reused on site where possible;
- Maximum reuse, recycling or recovery of all waste leaving the site;
- All waste leaving the site will be transported by suitably permitted contractors and taken to appropriately registered, permitted or licensed facilities; and
- All waste leaving the site will be recorded and copies of relevant documentation maintained.

The use of authorised waste hauliers and permitted/licensed facilities will ensure compliant management of waste materials and the avoidance of potential off-site environmental impacts/pollution. It is essential that all waste materials are dealt with in accordance with regional and national legislation as outlined in section 14.3, and that adequate time and resources are dedicated to ensuring efficient waste management practices in line with the C&DWMP.

In addition, the Outline Construction Environment Management Plan (CEMP) prepared by Jacobs Engineering [55] details the key waste management responsibilities for the construction contractors.

14.2.3 OPERATIONAL PHASE

Operational Waste Streams

The proposed development will give rise to a variety of waste streams when the project is completed and manufacturing processes are fully operational. The waste will be generated from process and non-process related activities.

The process in the new pharmaceutical manufacturing operation is expected to generate two categories of waste - hazardous and non-hazardous waste. Hazardous process waste will consist of both a liquid and solid waste stream. Liquid waste will consist of washwater. Solid hazardous waste will consist of waste streams that will include storage bags, drum liners, tubes and hoses, filter cartridges and support implements such as spatulas, probes and funnels.
Typical non-process hazardous waste generated in this type of setting usually consists of lead batteries, WEEE and fluorescent light tubes.

[55] Jacobs Engineering, Construction Management Plan for the proposed Abbvie Ireland Internal Alterations to Construct an Integrated Critical Manufacturing Facility (2018).

Non-hazardous, non-process waste expected to be generated on site includes:

- Paper (confidential and non-confidential)
- Cardboard
- Plastic
- Glass
- Timber
- Metal
- Compostable food waste
- Empty toner cartridges
- Waste batteries (non-hazardous)
- WEEE (non-hazardous)
- Mixed non-recyclables

Management of Operational Waste Streams

Process and non-process non-hazardous waste will be segregated for recycling/recovery/disposal. Waste stations for these wastes will be located throughout the building. Other non-hazardous wastes that will be generated on site in smaller quantities will include textiles (rags), cleaning products, aerosols, paints and furniture.

Non-process hazardous waste will be segregated at source and will be packaged, labelled and transferred to a designated Waste Storage Area (WSA) by assigned Abbvie personnel.

The liquid waste to be produced from the new manufacturing process will consist of first-rinse wash water. This is expected to be high strength and will be retained in an assigned storage tank and removed off site by tanker as a hazardous waste. It is estimated that approximately 60m^3 high strength liquid waste will be generated weekly on site, which will be removed off site weekly by tanker. Remaining low strength wash water will be discharged to sewer and this is discussed further in Section 8 *Water & Hydrology*. A hazardous solid waste stream will also be generated in the new process. This will be required to be stored in appropriate waste receptacles and removed off site by a permitted hazardous waste contractor.

Waste management companies, as authorised by Abbvie, will be responsible for the transfer of all waste off site to authorised recovery/disposal facilities.

Abbvie will develop waste management procedures to provide instruction on the management of the new pharmaceutical hazardous waste. The development design will incorporate facilities for the handling and storage of expected new waste streams. The correct management and storage of waste will avoid litter or pollution issues at the proposed development, at the neighbouring private dwellings and surrounding area. Appropriate litter control reduces the likelihood of the presence of vermin within the overall site and surrounding areas.

In addition, the following measures will be implemented to minimise potential impacts from waste generation:

- Storage of the main waste materials will be undertaken in appropriately labelled bins or other suitable receptacles in the designated WSAs. Bins will be clearly identified with the approved waste type to ensure there is no cross contamination of waste materials; and
- Records and copies of relevant documentation of all waste leaving the site will be maintained on file.

All waste types generated on site will be managed according to facility procedures which will comply with Irish and European waste management legislation and the waste management hierarchy.

Abbvie will ensure that all waste contractors and all recovery/disposal outlets used by the facility in its entirety are appropriately permitted and authorised to transport and receive the waste types being removed off site.

14.3 THE RECEIVING ENVIRONMENT

With regard to waste management, the waste environment is largely defined by Sligo County Council (SCC) – as the local authority responsible for administering waste management activities in the area in which the proposed development is located.

The *Connacht-Ulster Region Waste Management Plan 2015 – 2021* [56] is the current regional waste management plan for the SCC area. The plan specifically includes a mandatory target of recycling and reuse of 70% of C&D waste (excluding soil and stones) within the six-year timeframe of the plan in line with the requirements of the Waste Framework Directive (WFD). Other mandatory targets set in the Plan relevant to this proposed development include:

- Achieve a reuse/recycling rate of 50% of municipal waste by 2020; and
- Reduce to 0% the direct disposal of residual municipal waste to landfill (from 2016 onwards) in favour of higher value pre-treatment processes and indigenous recovery practices.

Future targets set in the Plan for 2030 include:

- Preparing for reuse/recycling rate of 60-70% of municipal waste by 2030; and
- Reducing and where possible eliminating the landfilling of all major waste streams including municipal, industrial and construction and demolition wastes in favour of the recovery of residual wastes.

Municipal landfill charges in Ireland are based on the weight of waste disposed. Landfill charges are approximately €115-120 per tonne of waste which includes a €75 per tonne landfill levy introduced under the *Waste Management (Landfill Levy) (Amendment) Regulations 2012.*

The *Sligo County Development Plan 2016 – 2023* [57] sets out a number of waste policies for Sligo County, in line with the policy and objectives of the regional waste management plan. The plan identifies the Council's commitment to the promotion of the Waste Hierarchy. Waste policies with a particular relevance to the proposed development are:

P-WM-1: Promote the development of facilities in accordance with the waste hierarchy principle, which involves a shift towards prevention and waste minimisation measures, while developing recycling and reuse, disposal with energy recovery and, as the last option, disposal of residual waste to landfill.

P-WM-3: *Require the preparation of Waste Management Plans for the construction stages of developments where deemed necessary.*

P-WM-8: Development proposals on brownfield sites – such as former petrol stations, fuel/chemical storage areas and similar sites – shall be required to undertake an assessment if the potential for contaminated materials, soils etc. to be unearthed during demolition/construction works, and the associated environmental risks. Where any environmental risk is identified, appropriate investigations shall be undertaken to determine the nature and extent of any materials or contaminated soils on the proposed development sites. A site-specific remediation plan shall be prepared to ensure that the construction and operation phases of development do not result in risk to human health, water quality, biodiversity, fisheries, air quality etc.

With regard to C&D waste specifically the Development Plan states that the Council will seek to promote the recycling and reuse of C&D waste. It will examine the scope for the recovery of C&D waste from local authority projects as well as the use of recycled

[56] Connacht-Ulster Region Waste Management Plan 2015 – 2021 (2015)
[57] Sligo County Council (SCC), County Development Plan 2017-2023 Volume 1 (2017)

construction materials in site development, road building and other infrastructural projects.

14.4 PREDICTED IMPACTS

This section details the predicted waste impacts associated with the proposed development for both construction and demolition and operational phases.

14.4.1 CONSTRUCTION AND DEMOLITION PHASE

The construction and demolition stages of the project will generate a range of non-hazardous and hazardous waste materials. The C&DWMP (Appendix 14.1) has been prepared to provide an outline for the management of waste from construction and demolition activities which will ensure that there are no significant impacts from waste generated throughout the project.

The use of authorised waste hauliers and permitted/licensed waste facilities, as discussed in section 14.2 will ensure that the waste materials generated from construction and demolition activities are appropriately managed off site. The potential impacts of handling and treatment of waste off site at permitted/licensed facilities are considered in the authorisation of these waste facilities.

The demolition required for this development is minimal and is expected to generate very small quantities of waste material. The construction footprint for the new building is also relatively small and it is estimated approximately 26.5 tonnes of construction waste will be generated.

The proposed development requires the excavation of a small area of hardstanding, made ground and subsoils during the construction phase. It is anticipated that all excavated material will be removed off site as a waste.

The predicted impacts on the environment from waste generation during the construction and demolition phase are expected to be neutral, short term and imperceptible.

14.4.2 OPERATIONAL PHASE

The management of waste generated from the new development will be carried out in accordance with waste management procedures at the facility which will be developed to ensure all waste will be appropriately managed. The legal requirements for storage and recording of waste generated at the facility will be managed in accordance with the site's future IED Licence. Adherence to these existing procedures and future licence requirements once the new facility is operational will ensure there are no significant impacts from waste generated at the facility.

The requirements of the *Sligo County Development Plan 2016 – 2023* and the targets outlined in the *Connacht-Ulster Region Waste Management Plan 2015 – 2021* will also be followed.

The predicted impacts on the environment from waste generation during the operational phase are expected to be neutral, long term and imperceptible.

14.5 MITIGATION MEASURES

A number of mitigation measures have been considered at the design stage to reduce the predicted impacts from waste generation at the proposed development. These are discussed in Section 14.2.1 and 14.2.2. Specific mitigation measures for the predicted impacts outlined in Section 14.4 are presented here:

14.5.1 CONSTRUCTION AND DEMOLITION PHASE

The C&DWMP (Appendix 14.1) has been prepared at this design stage of the project in accordance with the *Best Practice Guidelines for the Preparation of Waste Management Plans for Construction*

and Demolition Projects. The C&DWMP will be fully implemented to ensure effective waste management and reuse, recycling, recovery and disposal of waste material generated at the site.

Any nearby sites requiring clean fill material will be contacted to investigate reuse opportunities for clean and inert excavated materials. If any of the material is to be reused on another site as by-product (and not as a waste), this will be done in accordance with Article 27 of the *EC (Waste Directive) Regulations (2011)* as detailed in the C&DWMP. The construction contractor will ensure that recycling and recovery opportunities for excavated materials are sought rather than disposal, where appropriate. This will reduce the off-site impact of the management of these waste types and can provide recycled aggregates to the construction industry in place of raw materials.

In the event that localised contamination is encountered, excavated material will be segregated from clean material, tested, classified as non-hazardous or hazardous and managed appropriately. Controlled and bunded temporary stockpiling areas will be established, as required, to ensure any contaminated material does not mix with clean material and to ensure that run-off from contaminated material does not enter the site drainage network.

Monitoring of construction waste generated during the project will be undertaken in the form of an audit as described in Section 8 of Appendix 14.1. Each material type will be examined, in order to see where the largest percentage waste generation is occurring. The waste management methods for each material type will be reviewed in order to highlight how the target for reuse/recycling/recovery can be achieved.

Waste legislation will also be consulted on a regular basis in case of any changes which may impact on waste management procedures.

14.6 RESIDUAL IMPACTS

The implementation of the mitigation measures outlined in Sections 14.2 and 14.5 will ensure that a high rate of reuse, recovery and recycling is achieved at the development during the construction and demolition phase as well as during the operational phase. 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. Primarily, implementation of the C&DWMP during the construction and demolition phase and compliance with the site's waste management procedures during the operational phase will minimise the volume of waste requiring disposal at landfill.

14.6.1 CONSTRUCTION AND DEMOLITION PHASE

Implementation and adherence to the C&DWMP will ensure that waste generated during the construction and demolition phase of the project will be done in accordance with best practice and relevant legislation.

Recovery or disposal of excavated materials off-site at licensed/permitted facilities will ensure that the deposition of excavated materials is appropriately controlled.

Provided the mitigation measures outlined are followed, the residual effect of the construction phase on the environment will be neutral, short term and imperceptible.

14.6.2 OPERATIONAL PHASE

During the operational phase, implementation of Abbvie's waste management procedures and compliance with the facility's future IED licence will ensure that all waste materials are segregated and collected from the facility in accordance with best practice and relevant legislation.
Provided the mitigation measures are implemented and a high rate of reuse, recycling and recovery is achieved, the predicted effect of the operational phase on the environment will be neutral, long term and imperceptible.

15 CULTURAL HERITAGE

15.1 INTRODUCTION

The proposed development is located within the existing Abbvie facility on lands that have largely been previously disturbed. The project includes the following elements associated with groundworks – a revised yard layout, located to the north of the existing facility, including a new single storey electrical extension, above ground bunded waste water holding tanks and one bunded underground tank housed in a building, as well as additional temporary contractor- related car parking for 109 cars located to the east of the existing H.T.substation.

15.2 METHODOLOGY

15.2.1 DOCUMENTARY SOURCES

This assessment draws on the following sources:

- Sites & Monuments Record (SMR)
- Record of Monuments & Places (RMP)
- Excavation Bulletins
- Aerial Photographs
- Sligo County Development Plan 2017 - 2023

The following sources were consulted in order to identify and map archaeological sites within and adjacent to the proposed development site:

Sites and Monuments Record (SMR) and Record of Monuments & Places (RMP)

A primary cartographic source and base-line data for the assessment was the consultation of the Sites and Monuments Record (SMR) and Record of Monuments and Places (RMP). All known recorded archaeological monuments are indicated on 6 inch Ordnance Survey (OS) maps and are listed in this record. The SMR/RMP is not a complete record of all monuments as newly discovered sites may not appear in the list or accompanying maps. In conjunction with the consultation of the SMR and RMP, the electronic database of recorded monuments which may be accessed on their website[58], was also consulted.

National Monuments

List of Monuments covered by Preservation Orders and List of National Monuments in the ownership / guardianship of the Minister for Arts, Heritage and the Gaeltacht.

National Monuments in the ownership / guardianship of the Minister for Arts, Heritage, Regional, Rural and Gaeltacht Affairs are listed on the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs website[59]

[58] www.webgis.archaeology.ie/historicenvironment
[59] www.archaeology.ie.

Excavations Database[60]

The excavations database is an annual account of all excavations carried out under license. The database includes excavations from 1970 to present. This database was consulted as part of the desktop research for this assessment to establish if any archaeological excavations had been carried out on or near to the proposed development area.

Topographical Files, National Museum of Ireland

The topographical files of the National Museum of Ireland contain information pertaining to archaeological finds (mainly artefactual) and excavations in numerous townlands throughout the country which were reported to the museum from the 1920s. While many of these find spots are not recorded monuments, they can provide an indication of archaeological activity in a townland and consequently add to the archaeological potential of an area.

Sligo County Development Plan 2017-2023

The County Development Plan lists protected structures.

15.3 THE PROPOSED DEVELOPMENT

A full description of the proposed development is given in Section 4 *Project Description* The proposed development impacts on two specific areas; the existing plant and yard to the northand the area located to the east of the existing H.T. substation on previously disturbed lands to be utilised as additional long term temporary contractor car parking.

15.4 THE RECEIVING ENVIRONMENT

The area proposed for development comprises of hard standing ground underlain by predominantly made ground. The existing facility consists of a large assembly area, a warehouse and manufacturing support area, a utility building, service yards, and car parking spaces.

While there are no recorded archaeological monuments within the area of the proposed development, a number of recorded sites are present in the surrounding landscape.

15.4.1 NATIONAL MONUMENTS

The term 'National Monument' is defined by the National Monuments Act (1930) as being 'a monument or the remains of a monument the preservation of which is a matter of national importance by reason of the historical, architectural, traditional, artistic, or archaeological interest attaching thereto'. The aforementioned Act states that the consent of the Minister is required for archaeological works at or near a national monument in the ownership or guardianship of the Minister or a local authority or to which a preservation order applies. The Minister is required to consult with the Director of the National Museum of Ireland in relation to such an application for consent.

No National Monuments are located on or within close proximity to the proposed development site.

[60] www.excavations.ie

15.4.2 RECORDED MONUMENTS

The site of the proposed development does not contain any recorded monuments. Three recorded monuments SL014-023, SL014-024 and SL014-025 are located outside of the site. The following is a description of the recorded monuments directly adjacent to the site of the proposed development.

SL014-023

Class: Mill - unclassified
Townland: Rathbraghan
Scheduled for inclusion in the next revision of the RMP: Yes
Description: Described in 1633-6 as a 'good English mill here, one of the best in the country' (Wood-Martin 1889, 151) the mill is situated in a narrow plot of ground between the W base of a steep hill and a stream. The mill has largely been demolished, with only a short section (15 m N-S; H 2m) of the lower courses of the E wall of the monument surviving. To the W of the surviving wall, which is built into the base of the hill, are grass-covered rubble mounds.

SL014-024

Class: Ringfort - rath
Townland: Rathbraghan
Scheduled for inclusion in the next revision of the RMP: Yes
Description: On a natural hill in gentle undulating pasture. A circular area (diam. 29.6m) is enclosed by a bank (int. H 0.25m; ext. H 1.53m; Wth. 0.53m) to the N and by a scarp (H 1.35m) to the S. There is no trace of a fosse or an original entrance feature. The fort was refortified during the Cromwellian wars and was used again by the Williamite army in 1691 as a base camp for attacking Sligo (Wood-Martin 1892, 134).

SL014-025

Class: Ringfort - rath
Townland: Rathbraghan
Scheduled for inclusion in the next revision of the RMP: Yes
Description: N/A

The following is a list of the nearest recorded monuments:

Table 15.1 Recorded monuments within 2 km of the development site

RMP	CLASSIFICATION	TOWNLAND
SL008-142----	Road - road/trackway	MAGHERAGILLERNEEVE OR SPRINGFIELD
SL008-148----	Ringfort - rath	TEESAN
SL008-149----	Ringfort - unclassified	TEESAN
SL008-152----	Ringfort - rath	CARNCASH
SL014-011----	Earthwork	LISNALURG
SL014-012001-	Embanked enclosure	LISNALURG
SL014-012002-	Souterrain	LISNALURG
SL014-012003-	Enclosure	LISNALURG
SL014-013----	Midden	BALLINCAR
SL014-014----	Ringfort - rath	BALLINCAR
SL014-015----	Fortification	LISNALURG
SL014-016001-	Burial ground	LISNALURG,SHANNON EIGHTER
SL014-016002-	Burnt spread	LISNALURG
SL014-017----	Enclosure	LISNALURG
SL014-017001-	Gateway	TEESAN
SL014-018----	Enclosure	TEESAN

SL014-019----	Ringfort - rath	CARNCASH
SL014-020----	Ringfort - cashel	CARNCASH
SL014-021----	Ringfort - rath	SHANNON OUGHTER
SL014-022----	Ringfort - rath	SHANNON OUGHTER
SL014-023----	Mill - unclassified	RATHBRAGHAN
SL014-024----	Ringfort - rath	RATHBRAGHAN
SL014-025----	Ringfort - rath	RATHBRAGHAN
SL014-026----	Ringfort - rath	BARROE
SL014-064----	Ringfort - rath	SHANNON EIGHTER
SL014-065----	Historic town	KNOCKNAGANNY,ABBEYQUARTER NORTH,ABBEYQUARTER SOUTH,KNAPPAGH BEG,MAGHERABOY,RATHEDMOND,RATHQUARTER
SL014-065003-	Hospital	MAGHERABOY
SL014-065006-	Castle - Anglo-Norman masonry castle	RATHEDMOND
SL014-065007-	Bastioned fort	RATHEDMOND
SL014-065008-	Religious house - Dominican friars	ABBEYQUARTER NORTH
SL014-065010-	Church	MAGHERABOY
SL014-065014-	Bastioned fort	RATHQUARTER
SL014-065023-	Cross - Market cross	ABBEYQUARTER SOUTH,MAGHERABOY
SL014-065024-	Redundant record	ABBEYQUARTER NORTH,ABBEYQUARTER SOUTH,KNAPPAGH BEG,MAGHERABOY,RATHEDMOND
SL014-065025-	Redundant record	RATHEDMOND,ABBEYQUARTER NORTH,ABBEYQUARTER SOUTH,KNAPPAGH BEG,MAGHERABOY
SL014-065026-	Fortification	RATHQUARTER
SL014-066----	Redundant record	BALLYTIVNAN
SL014-067----	Ringfort - rath	FARRANACARDY
SL014-128----	Crannog	GARVOGE RIVER
SL014-240----	Anomalous stone group	MAGHERABOY
SL014-266----	Megalithic tomb - passage tomb	ABBEYQUARTER NORTH
SL014-281----	Enclosure	BALLYTIVNAN
SL014-283----	Enclosure	BELLANODE
SL014-284001-	Cross-slab (present location)	RATHQUARTER
SL014-284002-	Cross-slab (present location)	RATHQUARTER
SL014-284003-	Cross-slab (present location)	RATHQUARTER
SL014-284004-	Cross-slab (present location)	RATHQUARTER
SL014-284005-	Cross-slab (present location)	RATHQUARTER
SL014-284006-	Cross-slab (present location)	RATHQUARTER
SL014-284007-	Cross-slab (present location)	RATHQUARTER
SL014-284008-	Memorial stone (present location)	RATHQUARTER
SL014-284009-	Redundant record	RATHQUARTER
SL014-284010-	Rock art (present location)	RATHQUARTER
SL014-292----	Wall monument	ABBEYQUARTER NORTH
SL015-001----	Enclosure	DOONALLY (Carbury By., Drumcliff East ED)

SL015-002----	Ringfort - rath	BARROE
SL015-022----	Ringfort - rath	BARROE
SL015-104----	Designed landscape - tree-ring	HAZELWOOD DEMESNE
SL015-105----	Designed landscape - tree-ring	HAZELWOOD DEMESNE
SL015-106----	Designed landscape - tree-ring	HAZELWOOD DEMESNE

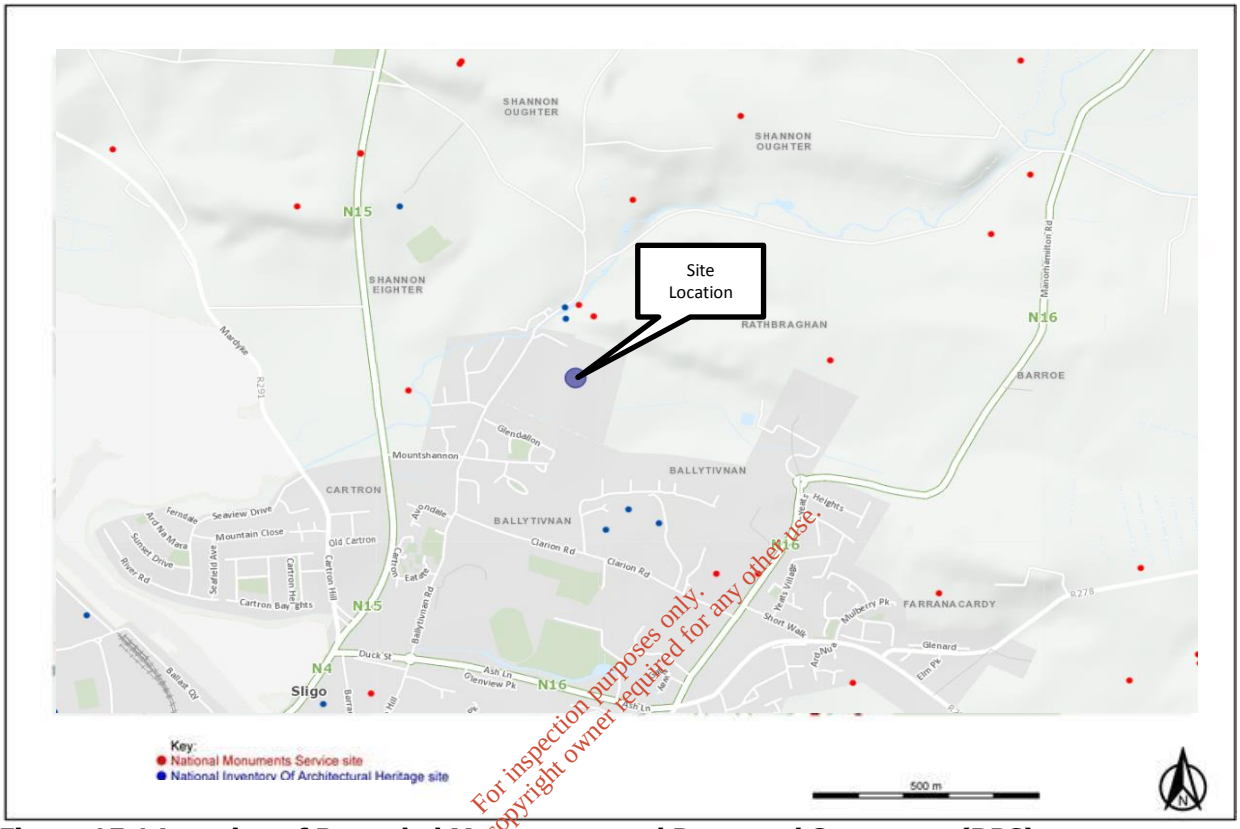

Figure 15.1 Location of Recorded Monuments and Protected Structures (RPS).

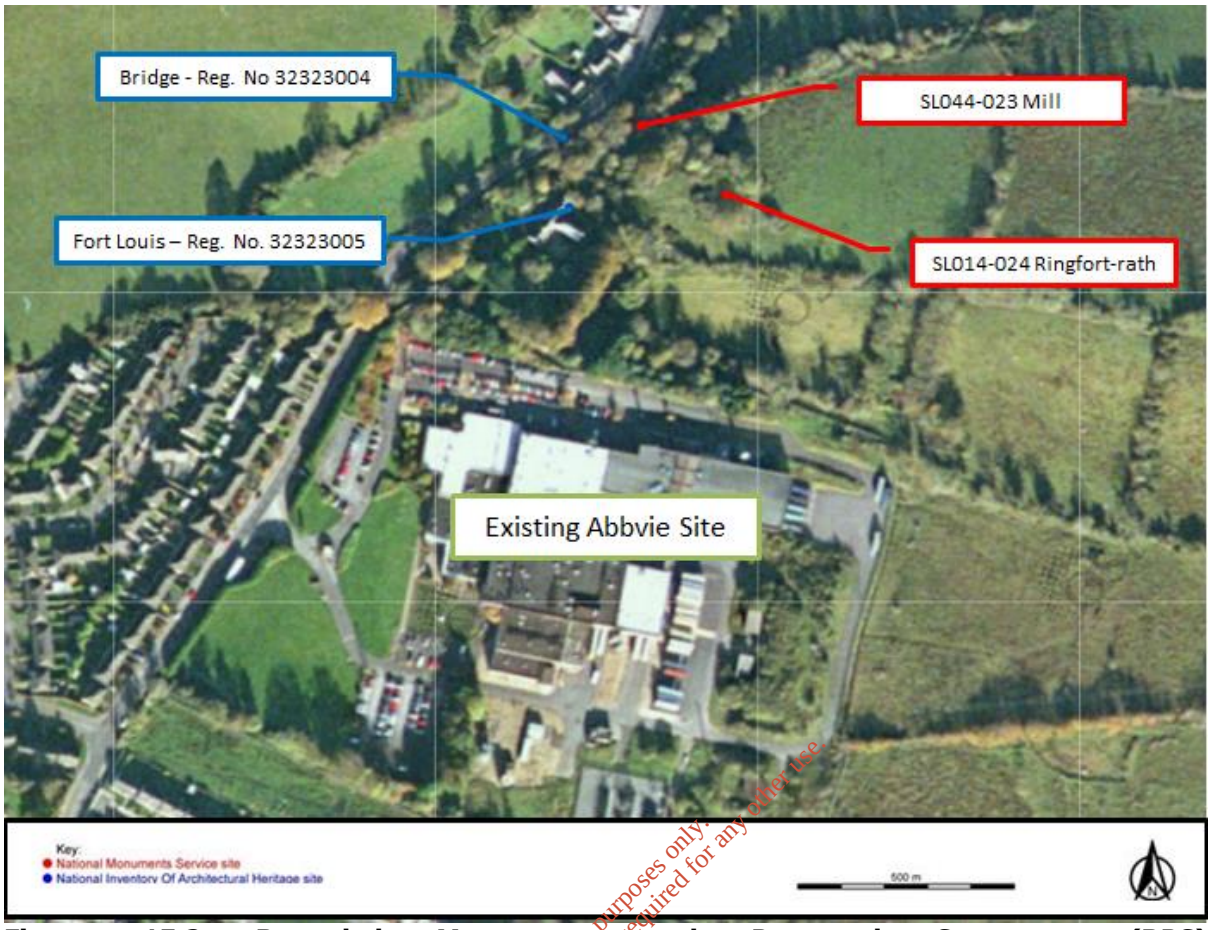

Figure 15.2 Recorded Monuments and Protected Structures (RPS) Directly Adjacent to Site

15.4.3 SITES REPORTED IN THE EXCAVATIONS DATABASE

The Excavations Bulletin is both a published annual directory and an on-line database that provides summary accounts of all the excavations carried out on the island of Ireland from 1970 to the present. Brief summaries of the archaeological excavations carried out in the vicinity of the proposed development in Ballytivnan townland in recent years are provided in the following paragraphs.

Ballytivnan Excavation Licence No. 01E1174

Nine test-trenches were opened on a greenfield site on the outskirts of Sligo town. The pre-construction testing works were carried out in advance of construction of student accommodation for a nearby third-level educational institution. Testing revealed no archaeological remains. The area under investigation had been primarily used as pasture and, with the exception of modern field boundaries, a modern lime extraction pit and abandoned farm buildings, it had not been utilised for any other purposes[61].

Ballytivnan Excavation Licence No. 11E0170

The site of a proposed car park comprises a sub rectangular plot measuring 120 m east–west by 70m, located in the south-western corner of a larger sub rectangular field on the edge of Sligo Town, adjacent to the Institute of Technology and St Columba's Mental Hospital. SL014-066 (Earthwork) and SL014-281 (Enclosure/Earthwork) are situated within the larger greenfield site but are located outside the proposed development site. SL046-066 is listed as a redundant record and SL014-281, an indistinct cluster of low-visibility earthworks, is located in the north-east corner of the site, more than 100 m from the edge of the proposed car park.

[61] Henry, M. 2001 Searchable database of Excavations. www.excavations.ie

Five test trenches were excavated across the proposed development site, with one measuring 100 m by 1.8 m and the remainder 4.5 m by 1.8 m. No archaeological features were revealed in any of the trenches, with the majority of the site being covered by a layer of dumped material, 0.2–0.35 m deep and filled with late 19th/early 20th-century debris and a few lithics. It is believed this material was probably deposited during the construction of the mental hospital further up the hill.[62]

St. John's Hospital Ballytivnan Excavation Licence No. 11E0170

A programme of monitoring was undertaken at the Old Convent, St John's Hospital, Ballytivnan, Sligo between 3 and 9 of January 2013. These works were undertaken on behalf of the Health Service Executive (HSE). The development at the site consists of a change of use of the old convent building from residential to office accommodation. The archaeological programme consisted of monitoring all groundworks associated with the insertion of sewerage lines, storm drains and accompanying attenuation pits.

Human remains of 19th-century date were encountered within a service trench during the initial ground investigation undertaken. The National Museum of Ireland (NMI) was contacted for advice regarding how to deal with the remains and subsequently a method statement was drawn up in consultation with the Department of Arts, Heritage and Gaeltacht (DoAHG) and the NMI. The regulatory bodies specified that, given the fact the area where the human remains were identified was not going to be impacted on further, it would suffice to analyse the bones already lifted and to clean and fully record any further remains in situ.

The burials were represented by an older child (Skeleton 1) and an adult male (Skeleton 2). The disarticulated material contained the minimum number of individuals (MNI) of one – a younger child. In total for this site there was a MNI of three individuals excavated.

No further archaeological deposits or features were identified during the ancillary works associated with the development.[63]

Ballytivnan (Duck Street, Ash Lane & Barracks Street, Sligo), Cartron (Carbury By.), Farranacardy Rathquarter, Sligo Excavation No. 16E0082

Moore Group was commissioned to carry out a programme of archaeological monitoring of the Sligo City Watermains Rehabilitation Works at Sligo Town, Co. Sligo on behalf of Ryan Hanley Consulting Engineers for Sligo County Council. The groundworks were undertaken between 9 February and 14 March 2016. The site investigation works were located in the vicinity of a number of recorded archaeological monuments, architectural heritage buildings and in proximity to the zone of archaeological potential for Sligo (SL014-065 Historic Town).

Works involved the excavation of 40 slit trenches in the townlands of Ballytivnan, Cartron (Carbury By.), Farranacardy and Rathquarter. Some slit trenches were located in existing roads at Ash Lane, Duck Street and Barracks Street. The stratigraphy on Duck Street, Ash Lane and Barracks Street exposed the road surface overlying redeposited road fill, no natural ground was uncovered. Stone culverts were located in three different trenches, two on Duck Street and one on Barracks Street. No further material of an archaeological nature was found in any of the slit trenches located in roads.

Green field areas in the townland of Ballytivnan in proximity to the Clarion Hotel, the former Sligo and Leitrim District Lunatic Asylum did not reveal any archaeological material. The ground was quite disturbed by existing services and the demolition of previous buildings associated with the asylum. Several architectural pieces of dressed were found in a nearby field. There were no finds or features of archaeological significance noted in the slit trenches in the townland of Ballytivnan or Farranacardy.

[62] Reed, C. 2011 Searchable database of Excavations. www.excavations.ie
[63] Hession, J. 2013 Searchable database of Excavations. www.excavations.ie

Further slit trenches excavated into grass verges at Ash Lane, Duck Street, Ballytivnan (at the rear of the present FAS building); at the pedestrian walk to Old Cartron and at the Rosses Point junction did not reveal any archaeological finds or features[64]

15.4.4 RECORD OF PROTECTED STRUCTURES.

The Sligo County Development Plan 2017-2023 and the National Inventory of Architectural Heritage[65] were consulted to determine if any protected structures were present within the proposed development site. The site contains no recorded protected structure listed, the nearest recorded protected structures to the proposed development are that of Fort Louis, a detached nine-bay single-storey rendered house, built c.1740, located approximately 94 m to the north west. As well as a triple-span stone road-over-river bridge built c. 1750, located approximately 132 m to the north west of the proposed site.

15.5 PREDICTED IMPACTS

15.5.1 DIRECT IMPACTS ON RECORDED ARCHAEOLOGICAL MONUMENTS

No direct impacts on recorded archaeological monuments are predicted as a result of the proposed development.

15.5.2 DIRECT IMPACTS ON KNOWN AND POTENTIAL ARCHAEOLOGICAL FEATURES

There is low potential for direct impact on known and potential archaeological features as the proposed works are mostly to take place on previously disturbed lands within the existing Abbvie facility.

15.5.3 INDIRECT IMPACTS

Indirect impacts here are those which may have a negative (or positive) effect on the archaeological landscape after the construction phase of the development (i.e. operational).

The nearest recorded standing monuments are SL014-023, SL014-024 and SL014-025. Due to the existing development in the area and the nature of the proposed development there will be no likely indirect impacts on archaeology in the area.

Indirect impacts may include visual impact on the surrounding archaeological landscape.

The nearest recorded protected structure is Fort Louis (Reg No. 32323005). Clear views of this structure are not possible from the proposed development area given the presence of intervening field boundaries and associated screening of the existing Abbvie development. The introduction of the proposed development to the area will not result in a change to the general setting of this monument, provided the aforementioned screening is maintained.

15.6 MITIGATION MEASURES

Pre-development testing will be carried out on the previously undisturbed greenfield areas followed by archaeological monitoring, licenced by and in consultation with the Department of Culture, Heritage and the Gaeltacht as appropriate.

In the event that any previously unidentified subsurface archaeological features or artefacts are uncovered, appropriate measures will be implemented in consultation with the Department and in accordance with licence conditions.

[64] McHugh, T. 2016 Searchable database of Excavations. www.excavations.ie
[65] www.buildingsofireland.ie

15.7 RESIDUAL IMPACTS

No residual impacts on Cultural Heritage are predicted as a result of the proposed development.

16 INTERACTIONS & CUMULATIVE EFFECTS

16.1 INTRODUCTION

This section of the EIAR identifies and outlines where and how interactions between the various impacts identified in the different sections have been addressed in this EIAR. This covers both the construction and operational phases of the proposed development.

The project team, in conjunction with the assistance of a variety of specialist environmental consultants, each one an expert in their chosen field, assessed the potential impact arising from the construction and operation of the proposed development. The interaction of environmental aspects was clearly identified at an early stage in the project to be an important factor to be considered in the full evaluation of the environmental impacts associated with the proposed development.

In the interests of clarity, significant interactions and inter-dependencies have been taken into consideration, and are addressed, under each specialist heading in the EIAR. We refer the reader to the relevant sections.

16.2 MATRIX OF INTERACTIONS

This section of the EIAR provides a simple matrix identifying environmental components and recording where interactions are identified. These are then expanded upon in the text that follows, with cross references made to the more detailed assessments outlined in the relevant chapters of the EIAR.

Again, for detailed descriptions and accounts, we refer the reader to the relevant sections of the EIAR.

Table 16.1 Matrix of Interactions

Interaction	Population & Human Health		Biodiversity		Soils, Geology & Hydro-geology		Water & Hydrology		Air Quality & Climate		Noise & Vibration		Landscape & Visual		Material Assets		Traffic & Transport		Waste Manage-ment		Archaeology & Cultural Heritage	
	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.
Population & Human Health			×	×	×	×	×	×	×	×	✓	✓	×	×	×	×	✓	✓	×	×	×	×
Biodiversity					×	×	×	×	×	×	✓	✓	×	×	×	×	×	×	×	×	×	×
Soils, Geology & Hydro-geology							✓	✓	✓	✓	×	×	×	×	×	×	×	×	✓	×	×	×
Water & Hydrology									×	×	×	×	×	×	×	×	×	×	×	×	×	×
Air Quality & Climate											×	×	×	×	×	×	✓	✓	✓	✓	×	×
Noise & Vibration													×	×	×	×	✓	✓	×	×	×	×
Landscape & Visual															×	×	×	×	×	×	✓	✓
Material Assets																	×	×	×	×	×	×
Traffic & Transport																			×	×	×	×
Waste Manage-ment																					×	×
Archaeology & Cultural Heritage																						

×	No Interaction
✓	Weak Interaction
✓	Some Interaction
✓	Strong Interaction

Con. ⇨ construction phase

Op. ⇨ operational phase

See following pages for descriptions of interactions and cumulative that correspond to grid boxes marked with a 'tick'.

Boxes with an 'x' indicate that no interactions or cumulative effects are likely to occur.

16.3 INTERACTIONS AND CUMLUATIVE EFFECTS

16.3.1 POPULATION & HUMAN HEALTH

Noise & Vibration

During the construction phase of the project there may be some slight impacts on nearby noise sensitive properties due to noise emissions from site traffic and other activities. The application of noise limits and hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration impacts are kept to a minimum.

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 any nearby noise sensitive locations. In addition, noise emissions should be broadband in nature and should not contain any tonal or impulsive elements.

Traffic & Transportation

It is considered that the predicted increases in network traffic as a result of construction and operational development will be neutral and imperceptible with the probability of effects unlikely.
This is also addressed in Section 13.

16.3.2 BIODIVERSITY

Noise & Vibration

Increasing industrial activity has the potential to increase ambient noise levels which could affect sensitive fauna. Noise and vibration mitigation measures (see Section 10.5 address this potential effect. Cumulative noise effects are predicted in Section 10.6 to be imperceptible.

16.3.3 SOILS, GEOLOGY AND HYDROGEOLOGY

Water & Hydrology

The underlying aquifer is "locally important" so interconnectivity is low. Surface water run-off may have the potential to enter soil and shallow groundwater. Implementation of appropriate mitigation measures as outlined in the CEMP will eliminate the potential for the influx of surface contaminants into the underlying geology and hydrogeology which would otherwise affect its quality. The mitigation measures in sections 7.5 ensure that potential significant cumulative effects are avoided.

Air Quality

There is a potential for soil excavation activity to impact on air quality in terms of dust generated but the implementation of suitable mitigation measures as outlined in the Section 9 *Air Quality and* Climate and CEMP will ensure a neutral impact. The mitigation measures in section 9.5 ensure that potential significant cumulative effects are avoided.

Waste

There is a requirement to dispose of soil excavated on the site. Appropriate sampling and disposal will be undertaken as outlined in the outline CEMP and Section 14. The mitigation measures in Section 14.5 and the outline CEMP ensure that potential significant cumulative effects are avoided.

16.3.4 NOISE & VIBRATION

The potential interaction between Noise & Vibration and other Sections in the EIAR is primarily limited to Section 5 - *Population & Human Health*, Section 13 - *Traffic & Transportation* and Section 4 – *Project Description*. This Noise & Vibration Section has been prepared in consideration of and in conjunction with the relevant outputs of these Sections.

16.3.5 LANDSCAPE & VISUAL ASSESSMENT

Cultural Heritage

A potential effect on Cultural Heritage includes t a change to the general setting of the nearest recorded protected structure, Fort Louis (Reg No. 32323005). Clear views of this structure are not possible from the proposed development area given the presence of intervening field boundaries and associated screening of the existing Abbvie development. The introduction of the proposed development to the area will not result in a change to the general setting of this monument, provided the screening is maintained.

16.3.6 WASTE MANAGEMENT

Population and Human Health

The potential effects on human beings in relation to the generation of waste during the construction and demolition and operational phases are that incorrect management of waste could result in littering which could cause a nuisance to the public and attract vermin. A carefully planned approach to waste management and adherence to the project specific C&DWMP and CEMP will ensure appropriate management of waste and avoid any negative effects on the local population.

Land, Soils, Geology and Hydrogeology

A potential effect on the land, soils, geological and hydrogeological environment includes the excavation and removal of soil and stone and the reuse/recovery/disposal of this material off-site. Mitigation includes controlled excavations managed by a suitably qualified person who will identify if there is any contamination present in the excavated material and organise appropriate management of such material as outlined in section 14.2.2

In addition, incorrect storage and management of waste or the use of unauthorised waste hauliers and/or receiving facilities could give rise to inappropriate management of waste and result in negative environmental effects on the soil and hydrogeological environments off site. Implementation of the project specific C&DWMP and the use of permitted hauliers and authorised receiving facilities will ensure appropriate management of waste.

Transportation

Local traffic and transportation will be impacted by the additional vehicle movements generated by removal of waste from the site during the construction phase of the development. The suitability of receiving facilities to accept the waste will be subject to available capacity and testing requirements but there are a number of facilities which can be utilised for inert and non-hazardous waste. The increase in vehicle movements as a result of waste generated during the construction phase will be temporary in duration.

There will be a slight increase in vehicle movements in the area as a result of waste collections during the operational phase. This increase will primarily be related to the removal of liquid waste by tanker. Otherwise, the site is already serviced by waste contractors for other hazardous and non-hazardous waste collections. Traffic impacts of the proposed development are addressed in Section 13.4