FASSAROE PHASE 1 SHD APPLICATION ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Volume 2 - Main EIAR

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1 INTRODUCTION AND NEED FOR EIAR

1.1 Brief Description of Development Proposed

Cosgrave Property Group is proposing a Strategic Housing Development at Fassaroe, Bray, Co. Wicklow which comprises a residential mix of houses and apartments as well as supporting services and amenities including neighbourhood centre uses, a district park, a creche, roads infrastructure, a pedestrian / cycle bridge over the N11 to Dargle Road and associated services and infrastructural works. The application also seeks planning permission for the remediation of 5 no. historic landfill sites within the application site previously operated by Wicklow County Council and for which the EPA has already issued consent by way of Certificates of Authorisation. The project is described in detail in **Chapter 2 Description of Development** however a brief description is provided below.

This chapter serves to describe the planning context of the development and the need for the scheme. It sets out the reason for the EIAR and the methodology adopted for the preparation and delivery of the EIAR.

The subject lands on which the development is proposed currently comprise of agricultural lands to the west of the N11 at Bray. The lands are zoned for development under the Bray Municipal District Local Area Plan 2018.

The proposed development referred to as 'Fassaroe Phase 1', will be the first phase of development within these lands and will comprise:

- Road link (2.4km) connecting N11 to Ballyman Road (with westerly connection to Ballyman Road already in place)
- Pedestrian / cycle route including bridge across the N11 to Dargle Road Upper
- 15.3ha of District Park / Active Open Space
- 650 no. residential units comprising 241 no. houses and 409 no. apartments
- 3 No. pocket park areas comprising a total of 0.43ha.
- 733sq.m approx. crèche with capacity for approx. 138 no. childcare spaces
- Retail unit / kiosk (108sq.m.) in district park
- Neighbourhood Centre Phase 1 comprising:
  - 1,035sq.m. retail
  - 360sq.m. café,
  - 480sq.m community concierge (serving entire Fassaroe community)
  - 414sq.m. residential ancillary uses for residents of the neighbourhood centre apartments (residents lounge 256sq.m., residents gym 90sq.m., and residents concierge 68sq.m.)
- Demolition of an existing dwelling at Berryfield Lane
- Rerouting and undergrounding of overhead ESB lines (110kV and 38kV lines) across site and into existing ESB Substation
- Site development / ground works on future development areas to ensure sustainable cut and fill balances across the lands
- Water supply, foul and surface water drainage proposals
- Provisions for public bus services in line with demand towards Bray (DART and Bray bus interchange) and towards the Luas at Cherrywood / Brides Glen
- Remediation of 5 no. historic landfill sites in line with Certificates of Authorisation issued to Wicklow County Council by the EPA in 2019

The location of the proposed development is shown in **Figure 1.1**.

Figure 1-1: Site Location Map of Fassaroe Development Lands

1.2 Need for the Environmental Impact Assessment Report (EIAR)

The requirement for Environmental Impact Assessment (EIA) in Ireland was initially introduced by European Directive 85/337/EEC and amended in 1997, 2003, and 2009. Therese were codified by Directive 2011/92/EU which has in turn been further amended by Directive 2014/52/EU. The Directive requires the assessment of effects of certain public and private projects on the environment.

These Directives have been transposed into law in Ireland through a variety of legislation, including the Planning and Development Act 2000 as amended and the Regulations made thereunder as well as a variety of European Communities (environmental Impact Assessment) Regulations / European Union (Environmental Impact Assessment) Regulations from 1989 to 2019. The Planning and Development Regulations and the EIA Regulations specify the developments for which EIA will be required and the information which must be provided in an Environmental Impact Assessment Report (EIAR) prepared in connection with the proposed development.

Article 93 of the Planning and Development Regulations, 2001-2021 states that the prescribed classes of development for the purposes of section 176 of the Act are set out in Schedule 5.

The proposed development falls within categories 10(b)(i) and 10(b)(iv) of Part 2 of Schedule 5 of the Regulations. Category 10(b)(i) refers to *'Construction of more than 500 dwellings'*. The development includes 650 no. residential units. Category 10(b)(iv) refers *to 'Urban development which would involve an area greater than 2 hectares in the case of business district, 10 hectares in the case of other parts of a built up area and 20 hectares elsewhere.* The proposed application site area is approximately 78.52 hectares. Having regard to both the overall size of the site and the number of proposed dwellings, it is a mandatory requirement to prepare an Environmental Impact Assessment Report.

1.3 Purpose of the EIAR

Environmental Impact Assessment (EIA) can be described as the following:

> 'An EIA is a systematic process for anticipating the effects on the environment that a development may cause, in advance' (Glasson *et al*., 2001).

An Environmental Impact Assessment Report (EIAR) is the document produced as a result of that process. Its purpose is to identify the environmental effects of the upgrade and examine how these impacts can be avoided or reduced during the design process, construction and operational stages of the development.

1.4 Methodology, Content and Structure of the EIAR

This EIAR has been carried out in accordance with the requirements of Schedule 6 *"Information to be Contained in EIAR"* of the Planning and Development Regulations, 2001 to 2021. The methodology for undertaking the environmental assessments and preparing this EIAR also has regard to the following general guidance. European Commission (2017) '*Environmental Impact Assessment of Projects Guidance on the Preparation of the Environmental Impact Assessment Report'*.

- EPA (2015) '*Draft Advice Notes for Preparing Environmental Impact Statements'*.
- EPA (2017) '*Draft Guidelines on Information to be contained in Environmental Impact Assessment Reports'*.
- NRA (2008) '*Environmental Impact Assessment of National Road Schemes - A Practical Guide'*.
- Department of Housing, Planning and Local Government (2018) '*Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment'*.
- Department of Housing, Planning and Local Government (2017), Circular Letter PL 8/2017 – *'Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive) - Advice on electronic notification requirements'*.

Furthermore, the content and scope of the individual specialist chapters of this EIAR have regard to a variety of specialist topic guidelines. These are referred to as relevant in the 'methodology' description of each of the specialist environmental chapters.

A Non-Technical Summary (NTS) has also been produced to summarise the main content and findings of the EIAR in nontechnical language. It comprises **Volume 1** of the EIAR.

The main body of the EIAR is contained in **Volume 2**. This initially sets out the policy context, need for the scheme, its description, and alternatives considered in Chapters 1 to 3. Thereafter, the EIAR comprises individual chapters addressing distinct aspects of the environment and the likely and significant impacts of the proposed development thereon, i.e., Noise and Vibration, Landscape and Visual Assessment, Biodiversity, etc. The assessment of impacts and environmental effects on distinct environmental topics (along with the mitigation measures proposed) are based on the description of the proposal as set out in **Chapter 2: Description of the Development** of this EIAR, along with the detailed planning application drawings and the various specialist documents provided as part of the SHD planning application. Where any such documents are of particular relevance to a specific environmental topic they are referenced within that chapter. The individual specialist topic chapter also outline topic specific methodologies and baseline desk studies, surveys or site assessments. Finally, they identify any potential for cumulative impacts of the proposed development with other plans or projects.

The assessments are undertaken on the basis of an assumed development commencement in 2022. While the Phase 1 development is expected to be completed within approximately 4 years planning permission is sought for 8 years to allow for some flexibility in the event of any unforeseen delays. For the purposes of the traffic impact assessment a design year of 2024 is adopted for assessing impacts of the entire Phase 1 development. A +9 years scenario is also assessed for the purposes of traffic and transportation impact.

There is potential for interaction impacts between any two or more environmental topics. The potential for likely significant effects from these interactions is reported on specifically in **Chapter 13: Interactions of Impacts.**

Technical Documents and Appendices to the EIAR are contained in **Volumes 3** and **4.** The technical documentation at **Volume 3** comprises of various environmental documentation in respect of the historic landfill remediation proposals. They present a detailed environmental risk assessment specifically of the historic landfills on site and their proposed remediation as well as the implications for the proposed new development. This includes an Environmental Risk Assessment previously prepared as part of an application to the EPA by Wicklow County Council for Certificates of Authorisation for the landfill remediation. It also includes an Addendum to the ERA prepared to support this planning application which now addresses both landfill remediation proposals and also residential and other development proposals. Separately, the planning application documentation (a Landfill Remediation Strategy report and a Landfill Gas Management Strategy report) describes the landfill remediation proposals presented in the application and they are referred to as appropriately within the EIAR.

The assessment undertaken in this EIAR is also undertaken with reference to the planning application drawings presented with the planning application, as relevant to particular environmental topics.

Volume 4 includes technical Appendices for the various environmental topics assessed in Chapters 4 – 12 of this EIAR.

Table 1.1 presents the structure and content of the EIAR.

Table 1-1: Structure and Content of EIAR

Volume	Chapters / Parts
Volume 1 Non-Technical Summary	Non-Technical Summary
Volume 2 EIAR Main Report	Chapter 1: Introduction and Need for the EIAR
	Chapter 2: Description of the Development
	Chapter 3: Planning and Policy Context
	Chapter 4: Population and Human Health
	Chapter 5: Biodiversity
	Chapter 6: Soils, Geology and Hydrogeology
	Chapter 7: Water Services, Hydrology and Flood Risk
	Chapter 8: Air Quality and Climate
	Chapter 9: Noise and Vibration
	Chapter 10: Landscape and Visual Impact
	Chapter 11: Archaeology, Architectural and Cultural Heritage
	Chapter 12: Traffic and Transportation Impact Assessment
	Chapter 13: Interaction of Impacts
	Chapter 14: References
Volume 3 Landfill Remediation Documentation	Part 1: Map of Historic Landfill Sites
	Part 2: Copies of Certificates of Authorisation from EPA for Historic Landfill Sites 2, 3a, 3b and 3c
	Part 3: Fassaroe Historic Landfills Environmental Risk Assessment, RPS, 2018
	Part 4: Addendum to Environmental Risk Assessment, RPS, 2022
Volume 4 Appendices	Appendix 1A: EIA Scoping Report, RPS, March 2020
	Appendix 1B: Copies of EIA Scoping Letters to Prescribed Bodies
	Appendix 1C: Copies of EIA Scoping Responses from Prescribed Bodies
	Appendix 2A: Confirmation of Agreement from NTA to Public Transport Access Strategy
	Appendix 2B: Construction Environmental Management Plan
	Appendix 3A: N11 Junction 6 Traffic Mgmt Framework Agreement
	Appendix 3B: TII Response to Junction 6 Traffic Mgmt Proposals
	Appendix 3C: NTA Response to Junction 6 Traffic Mgmt Proposals
	Appendix 3D: TII Traffic Mgmt Framework Agreement, 16.04.21
	Appendix 3E: Letter from WCC re Proposed Action Area Plan
	Appendix 4A: List of Community and Education Services in the Vicinity of the Site
	Appendix 5A: An Assessment of Water Quality in the Stream flowing through Ballyman Glen, Co. Wicklow, Aquens Ltd. 2021
	Appendix 5B: Wetlands Surveys
	Appendix 5C: NBDC Species Records

Volume	Chapters / Parts
	Appendix 6A: Criteria For Rating The Magnitude And Significance Of Impacts At EIA Stage National Roads Authority (NRA, TII, 2009)
	Appendix 6B: Consolidated GI Locations
	Appendix 6C: Bray Western Environs 5138958 TP Logs 2015
	Appendix 6D: Geotechnical Interpretative Report-Warehouse and Ancillary Offices SI 2001
	Appendix 6E: GL04184 (GI la vallee sept 2001)
	Appendix 6F: M11 Interchange SIGI N11 interch May 2000
	Appendix 7A: Criteria For Rating The Magnitude And Significance Of Impacts At EIA Stage National Roads Authority (NRA, TII, 2009)
	Appendix 9A: Noise Receptor Details
	Appendix 9B: Noise Monitoring Equipment Calibration Certificates
	Appendix 9C: Baseline Noise Graphs
	Appendix 10A: Photomontages of Proposed Development for LVIA
	Appendix 11A: Archaeological Heritage Legislative / Guideline Considerations
	Appendix 11B: Classification of Archaeological Monuments
	Appendix 11C: Archaeological Inventory
	Appendix 11D: Geophysical Survey Report, Monastery, Co. Wicklow, J.M.Leigh 2016
	Appendix 11E: Site CH-4 – Results of Archaeological Testing
	Appendix 11F: Architectural Heritage Inventory
	Appendix 12A: N11 Junction 6 Traffic management Microsimulation Modelling Results Report, Wicklow County Council

Table 1.2 below sets out the requirements of Schedule 6 of the Planning and Development Regulations, 2001 to 2021 and notes the main locations within the EIAR where each of the informational items are found. It should be noted however that these main locations in turn will refer to other sources of information including EIAR appendices and other reference material provided elsewhere as part of the planning application.

Table 1-2: Main Locations of Schedule 6 Information in EIAR

Requirement of Schedule 6 of P&D Regulations, 2021		Main Location of Relevant Information in EIAR
Item No.	Requirement of Schedule 6	
1 (a)	A description of the proposed development comprising information on the site, design, size and other relevant features of the proposed development	Chapter 2
1(b)	A description of the likely significant effects on the environment of the proposed development.	Potential and Residual Impacts sections within each of the specialist environmental topic chapters (Chapters 4 – 12)
1(c)	A description of the features, if any, of the proposed development and the measures, if any, envisaged to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment of the development.	Mitigation Measures sections within each of the specialist environmental topic chapters (Chapters 4 – 12). Description of the Development in Chapter 2 also identifies matters incorporated into the development proposals which seek to minimise or eliminate potential for environmental impact by design in the first instance.
1(d)	A description of the reasonable alternatives studied by the person or persons who prepared the EIAR, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the proposed development on the environment.	Chapter 2

Requirement of Schedule 6 of P&D Regulations, 2021		Main Location of Relevant Information in EIAR
Item No.	Requirement of Schedule 6	
2	Additional information, relevant to the specific characteristics of the development or type of development concerned and to the environmental features likely to be affected, on the following matters, by way of explanation or amplification of the information referred to in paragraph 1	
2(a)(i)	a description of the proposed development, including, in particular— a description of the location of the proposed development	General description of location and of site in sections 2.1 and 2.2 of Chapter 2. Detailed environmental descriptions of the site and surroundings in the receiving environment sections of the specialist chapters 3 – 12.
2(a)(ii)	a description of the physical characteristics of the whole proposed development, including, where relevant, requisite demolition works, and the land-use requirements during the construction and operational phases	Physical description of development components in section 2.5 of Chapter 2. Operational description in sections 2.5 and 2.6 of Chapter 2. Construction description in section 2.7 of Chapter 2 and CEMP Appendix 2B
2(a)(iii)	a description of the main characteristics of the operational phase of the proposed development (in particular any production process), for instance, energy demand and energy used, nature and quantity of the materials and natural resources (including water, land, soil and biodiversity) used, and	Section 2.5 and 2.6 of Chapter 2.
2(a)(iv)	an estimate, by type and quantity, of expected residues and emissions (such as water, air, soil and subsoil pollution, noise, vibration, light, heat, radiation) and quantities and types of waste produced during the construction and operation phases;	Within the potential and residual impact sections of the specialist environmental topic chapters 3 – 12. Also some relevant information in Chapter 2 for estimates of excavation and filling exercises.
2(b)	a description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the person or persons who prepared the EIAR, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects;	Section 2.10 of Chapter 2.
2(c)	a description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge;	Receiving Environment and Do-Nothing Scenario sections of specialist environmental topic chapters 3 -12.
2(d)	a description of the factors specified in paragraph (b)(i)(I) to (V) of the definition of 'environmental impact assessment' in section 171A of the Act likely to be significantly affected by the proposed development: population, human health, biodiversity (for example fauna and flora), land (for example land take), soil (for example organic matter, erosion, compaction, sealing), water (for example hydromorphological changes, quantity and quality), air, climate (for example greenhouse gas emissions, impacts relevant to adaptation), material assets, cultural heritage, including architectural and archaeological aspects, and landscape;	Specialist environmental topic chapters (Chapters 4 – 12) • population, human health – Chapter 4 • biodiversity (for example fauna and flora) – chapter 5, • land (for example land take), Chapter 4 and Chapter 6 • soil (for example organic matter, erosion, compaction, sealing) – Chapter 6

Requirement of Schedule 6 of P&D Regulations, 2021		Main Location of Relevant Information in EIAR
Item No.	Requirement of Schedule 6	
		• water (for example hydromorphological changes, quantity and quality) – Chapter 7 • air, climate (for example greenhouse gas emissions, impacts relevant to adaptation) – Chapters 8 and 9 • material assets – Chapter 12 (Traffic & Transporation) • cultural heritage, including architectural and archaeological aspects – Chapter 11, and landscape – Chapter 10
2(e)(i)(I)	a description of the likely significant effects on the environment of the proposed development resulting from, among other things— the construction and existence of the proposed development, including, where relevant, demolition works,	Construction Phase sections of potential and residual impact sections of specialist environmental topic chapters
2(e)(i)(II)	the use of natural resources, in particular land, soil, water and biodiversity, considering as far as possible the sustainable availability of these resources,	Impact assessment sections of Chapters 5, 6 and 7
2(e)(i)(III)	the emission of pollutants, noise, vibration, light, heat and radiation, the creation of nuisances, and the disposal and recovery of waste	Impact assessment sections of Chapters 8 and 9. Sections 2.6.5, 2.7.7 and 2.7.11 of Chapter 2
2(e)(i)(IV)	the risks to human health, cultural heritage or the environment (for example due to accidents or disasters),	Chapters 4, 8, 9, and 11
2(e)(i)(V)	the cumulation of effects with other existing or approved developments, or both, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources	Cumulative impact sections of each of the specialist environmental topic chapters 4 – 12.
2(e)(i)(VI)	the impact of the proposed development on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the proposed development to climate change, and	Chapter 8
2(e)(i)(VII)	the technologies and the substances used, and	Chapter 2
2(e)(ii)	the description of the likely significant effects on the factors specified in paragraph (b)(i)(I) to (V) of the definition of 'environmental impact assessment' in section 171A of the Act should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, mediumterm and long-term, permanent and temporary, positive and negative effects of the proposed development, taking into account the environmental protection objectives established at European Union level or by a Member State of the European Union which are relevant to the proposed development;	Specialist environmental topic chapters (Chapters 4 – 12)
2(f)	a description of the forecasting methods or evidence used to identify and assess the significant effects on the environment, including details of difficulties (for example technical deficiencies or lack of knowledge) encountered compiling the required information, and the main uncertainties involved;	Specialist environmental topic chapters (Chapters 4 – 12)
2(g)	a description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements (for example the preparation of an analysis after completion of the development), explaining the extent to which	Specialist environmental topic chapters (Chapters 4 – 12) – see mitigation measures section and if appropriate monitoring measures section.

Requirement of Schedule 6 of P&D Regulations, 2021		Main Location of Relevant Information in EIAR
Item No.	Requirement of Schedule 6	
	significant adverse effects on the environment are avoided, prevented, reduced or offset during both the construction and operational phases of the development;	
2(h)	a description of the expected significant adverse effects on the environment of the proposed development deriving from its vulnerability to risks of major accidents and/or disasters which are relevant to it. Relevant information available and obtained through risk assessments pursuant to European Union legislation such as the Seveso III Directive or the Nuclear Safety Directive or relevant assessments carried out pursuant to national legislation may be used for this purpose, provided that the requirements of the Environmental Impact Assessment Directive are met. Where appropriate, this description should include measures envisaged to prevent or mitigate the significant adverse effects of such events on the environment and details of the preparedness for, and proposed response to, emergencies arising from such events.	Chapter 2 section 2.9 and Section 8 of Appendix 2B Construction Environmental Management Plan

1.5 Contributors and Specialist Input

This EIAR is prepared and managed by Consultants, RPS, with inputs from a number of Design Team consultants (for Description of Development) and specialist consultants for a number of the environmental topic assessments. As required under Article 5(3)(a) of the EIA Directive, in order to ensure the completeness and quality of the environmental impact assessment report, the developer must ensure that the environmental impact assessment report is prepared by competent experts. To illustrate the competence of the experts who have prepared this EIAR, the names, qualifications and a sample list of some previous relevant experience of the relevant specialists are set out in **Table 1.3**.

Table 1-3: Specialist Inputs

Specialist Input	Author / Sub Consultant	Qualification	Years' Experience of EIA / Environmental Assessment	Description of relevant previous experience
Chapter 1: Introduction and Need for the EIAR **Chapter 2: Description of the Development** **Chapter 3: Planning and Policy Context** **Chapter 4: Population and Human Health**	Maria Lombard Director, Planning and Environment, RPS	BA MRUP Dip EIA Mgmt	25 years	Maria in experienced in overall EIA management, review and co-ordination for 25 years. In this period, she has also undertaken the writing of general introductory, impact interaction and the preparation of Population and latterly Population and human health chapters of EIARs / EISs for a wide variety of project types including urban development, residential, mixed use, transport, waste, renewable energy and recreation projects.
Chapter 5: Biodiversity	Karen Banks - Ecologist, Green Leaf Ecology	BSc MCIEEM	15 years	Karen has extensive experience in the production of Ecological Impact Assessments (EcIA) including those for small to large scale housing and mixed-use developments, flood alleviation schemes, wind farms and transport infrastructure.
Chapter 6: Soils, Geology and Hydrogeology	Kieran Lynch	BSc, MSc, LLB, BL, MCIWEM, CWEM CSci	15 years	Kieran has prepared has co-ordinated, prepared and peer reviewed full EIARs and prepared Soils and Geology, Waste, Material Assets Chapters for a large number of infrastructure development projects including housing developments, road schemes waste infrastructure and transportation infrastructure projects.
	Colm Driver Senior Environmental Scientists / Teri Hayes Director	BSc MSc / BSc MSc P.Geo	5+ years / 25+ years	Colm has experience in EIA management as well as the preparation of Soil, Geology and Hydrogeology EIAR Chapters for a range of project types including urban development, industrial, mixed use and data centre projects amongst others. Teri is a Director with AWN with over 25 years of experience in water resource management and environmental assessment and remediation. Key expertise include hydrogeological assessment, contaminated land assessment including risk assessment and cost effective remediation. Her project experience has resulted in an in-depth knowledge of the natural environment and current EU and Irish legislative framework.
Chapter 7: Water Services, Hydrology and Flood Risk	Colm Driver Senior Environmental Scientists	BSc MSc / BSc MSc P.Geo	5+ years / 25+ years	Colm has experience in EIA management as well as the preparation of Hydrology EIAR Chapters for a range of project types including urban development, industrial, mixed use and data centre projects amongst others.

Specialist Input	Author / Sub Consultant	Qualification	Years' Experience of EIA / Environmental Assessment	Description of relevant previous experience
	/ Teri Hayes Director			Teri is a Director with AWN with over 25 years of experience in water resource management and environmental assessment and remediation.
Chapter 8: Air Quality and Climate	Paul Chadwick Technical Director - Environment, RPS	BA (Hons), M. Phil, AIEMA	20 years	Paul has substantial experience in EIA management as well as the preparation of Air and Climatic Factors EIAR/ EIS Chapters for a range of project types including urban development, industrial, mixed use and waste projects amongst others.
Chapter 9: Noise and Vibration	Eugene McKeown Senior Associate - Acoustics, RPS	BE LLB MSc CEng MIEI MIoA	18 years	Preparation including baseline measurement, noise modelling and writing of Noise and vibration impact assessments and noise and vibration chapters of EIARs and EISs for various project types including urban development, road projects, renewable energy amongst others.
Chapter 10: Landscape and Visual Impact	Richard Butler, Model Works Ltd.	B LArch , MSc Sp Planning, MILI, MIPI	20 + years	Richard has degrees in landscape architecture and planning and is a member of the Irish Landscape Institute and the Irish Planning Institute. He has over 20 years' experience in development and environmental planning, specialising in Landscape/Townscape and Visual Impact Assessment (LVIA). He has significant experience of LVIA and LVIA as part of an EIA.
Chapter 11: Archaeology, Architectural and Cultural Heritage	Martin Byrne, Byrne Mullins & Associates	MA,Dip EIA Mgmt, IAI	28 years	Martin has considerable experience of archaeological and architectural heritage impact assessment for various project types across the country including the preparation of archaeological impact assessments as well as archaeological and architectural impact assessment for EIA.
Chapter 12: Traffic and Transportation	Peter Foley, Senior Transport Consultant, Atkins	MURP, 2007	13 years	Peter's area of expertise includes transport planning. His experience includes assessing the transport impacts of development projects and developing transport strategies. His experience includes all project stages from planning through to implementation, including Traffic and Transportation Assessment.

1.6 Appropriate Assessment

An Appropriate Assessment Screening exercise was undertaken by Ms. Karen Banks which found that the proposed development has potential for significant impact on a Natura 2000 site in the vicinity of the proposed development. In particular the report found that the works have potential to impact on the Ballyman SAC. A Stage 2 Natura Impact Statement was prepared and this forms part of the overall application package. It is referred to within this EIAR as necessary.

1.7 Technical Difficulties Encountered

No particular technical difficulties were encountered in undertaking the environmental assessments to inform this Environmental Impact Assessment Report. Suitable data and information to undertake the assessments was acquired by way of published public information and supplemented by significant additional survey and site investigation works as required. No outstanding data limitations or gaps have been encountered for the purposes of preparing and assessing the proposals, though some additional survey and monitoring requirements are identified to be undertaken prior to the commencement of development.

1.8 EIAR Scoping and Consultation

A number of prescribed bodies which were considered to have potential interest in the proposed development were identified for the purposes of EIA consultation. In this regard an EIA scoping report was prepared by RPS in March 2020 (see Appendix 1A) and issued to the identified prescribed bodies for review and comment in March / April 2020 (see Appendix 1B for cover letters). The prescribed bodies consulted are listed in **Table 1.4** along with a record of any responses received and where such were received a summary thereof. Copies of the responses received are provided in Appendix 1C.

It is noted that EIA scoping was also previously undertaken in September / October 2015 for a previously proposed similar development at the subject lands (Wicklow County Council Reg. Ref. 16/999 / An Bord Pleanála Ref. PL27.248705. While that application was subsequently refused planning permission the responses of the prescribed bodies in that instance to EIA scoping were reviewed again for the current EIAR preparation as the site context remains the same and the development proposed is similar. A summary of the responses received for that previous proposal is presented in **Table 1.5**.

Table 1-4: EIA Scoping Consultation Responses for Current EIAR

Consultees	Response Received	General Content of Response
Córas Iompair Éireann	No	
Department of Agriculture, Food and the Marine	No	
Department of Communications, Climate Action and Environment (Geological Survey Ireland (GSI))	Yes – Letter dated 30.03.20	**Geoheritage** – The application site lies entirely within the Enniskerry County Geological Site (CGS Site 24 in the Wicklow County Development Plan) – Regard should be had for Section 10.3 – Natural Heritage and Landscape, Subsection 10.3.5, and the following County Development Plan Objectives; ***NH26**: Protect and enhance 'County Geological Sites' (Schedule 10.10 and Map 10.10 of this plan) from inappropriate development at or in the vicinity of a site, such that would adversely affect their existence, or value.* ***NH27**: To consult with the Geological Survey of Ireland as is deemed necessary, when dealing with any proposals for major developments, which will entail 'significant' ground excavation, such as quarrying, road cuttings, tunnels, major drainage works, and foundations for industrial or large buildings and complexes.* ***NH28**: To facilitate public access to County Geological Heritage Sites, on the principle of "agreed access" subject to appropriate measures being put in place to ensure public health and safety and subject to the requirements of Article 6 of the Habitats Directive.* **Natural Resources (Minerals / Aggregates)** – The sustainable development of our natural resources should be an integral part of all development plans. GSI highlights the consideration of mineral resources and potential resources as a material asset which should be explicitly recognised within the environmental assessment process. GSI Aggregates Potential Map records granular aggregate potential as 'very high potential' in the vicinity of the proposed development and consideration to aggregate potential sterilisation should be included as part of the EIAR and planning process. **Groundwater** – There is a need to ensure groundwater is understood managed and protected. The GSI Groundwater Programme provides advice and maps in this regard. – GSI recommends using the National Aquifer and Recharge maps with regard to Flood Risk Management and interaction with local aquifers and wetlands. **Geohazards** – Geohazards such as landslides can cause damage to landscapes, wildlife, property and human life. The GSI Map Viewer includes information on past landslides. Along with this, information is available from national projects such as Landslide Susceptibility Mapping and GWFlood Groundwater Flooding. GSI recommend that geohazards be taken into consideration, especially when developing

Consultees	Response Received	General Content of Response
		areas where these risks and susceptibility are prevalent, and encourage the use of their data when doing so. **Geotechnical Database Resources** – It is recommended that the national geotechnical database be consulted as part of any baseline geological assessment of the proposed development. – GSI would also appreciate a copy of reports detailing any site investigations carried out in order to add data to their national database of site investigation boreholes.
Department of Culture, Heritage and the Gaeltacht	No	
Department of Housing, Planning and Local Government	Yes – email dated 18.03.20	The Minister is precluded from exercising power or control in relation to any particular case with which a planning authority or An Bord Pleanála may be concerned.
Eastern and Midland Regional Assembly	No	
Environmental Protection Agency	No	
The Heritage Council	No	
Inland Fisheries Ireland	No	
Irish Water	No	
The National Transport Authority	Yes – Letter dated 17.04.20	**Context** – Fassaroe is a challenging location for large-scale residential development due to its severance from Bray to the east by the N11 / M11, and its lack of continuity to urban development to the north. The site is isolated and does not lend itself readily to servicing by non-car modes of transport. The topography of the area also leads to challenges in making walking and cycling attractive. Regard should be had to the Bray and Environs Transport Study 2019. **NTA Comments on Previous Application Reg. Ref. 16/999** – In response to the previous application, the NTA advised the Fassaroe Masterplan be reviewed, with the review accompanied by a comprehensive transport plan. – The residential aspect of the previous proposed development was supported on the condition that appropriate provision be made for mitigation measures to address the impact on the national road network in accordance with the requirements of the *Spatial Planning and National Roads Guidelines*. – The NTA recommended permission should not be granted for the previously proposed office component pending the completion of a comprehensive transport plan for the overall Fassaroe area.

Consultees	Response Received	General Content of Response
		Bray and Environs Transport Study – The Bray and Environs Transport Study was undertaken in response to the decision from An Bord Pleanála to refuse planning permission for the previous proposal (Ref. Ref. 16/999 / PL27.248705). This study sought to devise a suite of transport infrastructure and service proposals which would enable development in the area. In relation to Fassaroe, the study set out the following approach to facilitate development commensurate to the previous proposal; • Internal roads within Fassaroe • N11 cycle and pedestrian bridge • Traffic management measures at Fassaroe interchange • New bus services in line with demand • Bus priority on Upper Dargle Road including the approach to Sunnybank Junction • Bus priority on Dublin Road – Castle Street – In addition to the above, it was recommended that any application for the development of the Fassaroe lands demonstrates the following; a) That the proposed development provides fully for walking and cycling trips to all local services within Fassaroe; b) That the applicant will provide a bus service to Bray DART station in advance of demand justifying public investment as part of the expansion of the bus network under BusConnects; c) That the applicant has fully assessed a requirement for a bus service to Bride's Glen or Cherrywood Luas and provides same if demand is deemed sufficient in advance of demand justifying public investment as part of the expansion of the bus network under BusConnects; and d) That the applicant demonstrates how demand for travel to schools from Fassaroe can be accommodated without undue recourse to the private car. – Further phases of development in the area were recommended to be governed by a separate implementation and monitoring plan to be developed by Wicklow County Council with input from the NTA and TII. Whereby such a plan has been agreed with all agencies, the full build-out of Fassaroe could then proceed on that basis. As the proposed SHD application provides for a quantum of development significantly in excess of that in the previous application, the NTA would expect that this implementation and monitoring plan is agreed with all parties in advance of an application being lodged and that it would be submitted as part of the application to An Bord Pleanála. **Key Transport Issues for the EIAR** – The NTA assumes the applicant will undertake a full Transport Assessment for the proposed development which addresses all forecast travel demand by all modes within Fassaroe; between Fassaroe and Bray; and between Fassaroe and all other destinations. The NTA is of the view that this should incorporate the following; a) A demonstration that the mode share for all trip purposes from the proposed development is in line with national policy. The mode shares that emerged as part of the Bray Study should be regarded by the applicant as a baseline and efforts should be made to achieve lower rates of car use; b) A demonstration that the proposed development will not have adverse impacts on the carrying capacity of the N11 / M11 in its current configuration and as configurated after the J4-J14

Consultees	Response Received	General Content of Response
		Upgrade scheme. This should be agreed with Wicklow County Council in consultation with TII in advance of an application being lodged, taking account of the transport requirements of the Bray Transport Study; c) The full extent of physical works required to facilitate the sustainable operation of the proposed development and the mechanism for their delivery, including the financial implications for all relevant parties, in particular – • The manner in which public transport priority will be provided between Fassaroe and Bray DART Station, by agreement with the NTA and Wicklow County Council d) The full extent of public transport services required to facilitate the sustainable operation of the proposed development and the mechanism for their delivery, including their direct provision by the applicant by agreement with the NTA; e) The manner in which public transport services proposed to serve Fassaroe would link with and complement, those set out in the BusConnects Metropolitan Bus Network Review; f) The manner in which pedestrians and cyclists travelling to Bray town centre, Bray DART Station and the proposed Dublin Road Core Bus Corridor will be catered for safely; g) A comprehensive assessment of the cumulative impact of the proposed development with any further phases within Fassaroe; the full build-out of Old Conna; Woodbrook; Bray Golf Club; Cherrywood and a reasonable estimate of the potential development of the lands at Rathmichael in the longer term, as provided for by the Bray and Environs Transport Study; h) All roads and junctions must be designed in accordance with the NTA's National Cycle manual and Permeability: A Best Practice Guide; i) A Mobility Management Plan shoul be included covering all aspects of travel deman generated by the proposed development, demonstrating how car use will be minimised; and j) All aspects of the assessment, as set out above, will be required to be undertaken for each phase of the proposed development, as appropriate. **Additional Considerations** – The NTA also recommends that the submissions of the NTA and TII on the previous application (Reg. Ref. 16/999) are reviewed alongside the detailed assessment of traffic and transport issues undertaken in the assessment of that application by An Bord Pleanála (Ref. PL27.248705). – It is emphasised that the requirements of official Governemt policy in relation to the protection of the strategic function of the N11 / M11 must be met in order for the NTA to be satisfied that the proposed development is consistent with the Transport Strategy.
Office of Public Works	No	
An Taisce	No	
Transport Infrastructure Ireland	Yes – 17.04.20	**Recent Planning History** – A revised application on the site would need to consider and address the reasons for refusal cited by An Bord Pleanála in their decision to refuse the previous application (Ref. PL27.248705).

Consultees	Response Received	General Content of Response
		Official Policy Context – The N11 / M11 corridor is a strategic road of national significance providing access to the south-east as well as Rosslare Euro-port. The corridor is also identified as part of the TEN-T Comprehensive Network. This designation brings repercussions and action requirements for policies and objectives which should be considered in the preparation of an EIAR. – The Eastern and Midland Regional Spatial and Economic Strategy (EMRA RSES) makes provisions for this designation. Regional Policy Objective RPO 8.11 generally supports the improvement, and protection, of the EU TEN-T network, while RPO 8.16 makes specific reference to the N11 / M11; ***RPO 8.16:*** *Support the improvement and protection of the TEN-T network to strengthen access routes to Ireland's ports, including investment in the ongoing development of the N11 / M11 to improve connectivity to Rosslare and improvements to the Dublin-Wexford Rail line.* – Project Ireland 2040 | National Development Plan 2018 – 2027 outlines the investment priority to ensure that the existing extensive transport networks are maintained to a high level to ensure quality levels of service, accessibility and connectivity to transport users. – Under National Strategic Outcome 2, the National Planning Framework also includes the objective to maintain the strategic capacity and safety of the national roads network, including planning for future capacity enhancements. **The Bray and Environs Transport Study** – This study was undertaken to identify a strategy to facilitate the land use objective of Wicklow County Council and Dun Laoghaire-Rathdown County Council in relation to Bray, including Fassaroe, as provided for in statutory regional, county and local plans. Development proposals in relation to Fassaroe should take full cognisance of and demonstrate adherence with the Transport Study. – The Transport Study identifies a number of transport interventions required to facilitate the development of 650 Phase 1 residential units and appropriate residential support facilities. – These interventions include the agreement of a Wicklow County Council Traffic Management System Framework. The Council has not yet finalised this Framework for agreement with the Authority. – Development proposals in advance of such a framework have the potential to significantly impact on the safety and operation of the N11 / M11 strategic national road network and associated junctions in the vicinity. TII would therefore welcome Wicklow County Council finalising agreeing the Framework , prior to the submission of any SHD application, in accordance with the requirements of the Transport Study. **Development Proposals above that provided for in Fassaroe Phase 1** – The Bray and Environs Transport Study provides for a Phase 1 development of 650 residential units and appropriate residential support facilities. The Study sets out that further development in excess of this level is recommended to be subject to the development of an implementation plan by Wicklow County Council in collaboration with NTA and TII. – TII is not aware that the Council has undertaken such an implementation plan.

Consultees	Response Received	General Content of Response
		General EIAR Scoping Recommendations – The developer should have regard, *inter alia*, to the following: ○ Consultations should be had with the relevant Local Authority/National Roads Design Office with regard to locations of existing and future national roads schemes; • In particular, regard should be had to N11 – M11 TEN-T Corridor Study. The M11 from Junction 4 M50 to Kilmacanogue Scheme is included as a Scheme in Pre-Appraisal/Early Planning in Project Ireland 2040 | National Development Plan 2018-2027. ○ Consultations should be had with the relevant Local Authority/National Transport Authority with regard to locations of existing and future light rail schemes. ○ The Authority would be specifically concerned as to potential significant impacts the development would have on the national road network (and junctions with national roads) in the proximity of the proposed development, i.e. existing N11 / M11. There are significant capacity issues which pertain to the N11 / M11 at this location. ○ It would be required that a Traffic and Transport Assessment be carried out in accordance with relevant guidelines, noting traffic volumes attending the site and traffic routes to/from the site with reference to impacts on the national road network and junctions of lower category roads with national roads. The Authority's Traffic and Transport Assessment Guidelines (2014) should be referred to in relation to the proposed development with potential impacts on the national road network. Having regard to the nature of the proposed development and location, the TTA should be undertaken in accordance with the TII Traffic and Transport Guidelines; • A mobility management plan should accompany the transport assessment, • Modal share targets (pre- and post-light rail) should be outlined and how any PT modal share is accommodated in advance of light rail, • What measures that are proposed to reduce car dependency should be outlined, • Detailed phasing proposals of development with associated transport infrastructure provision is required, • Consider and address cumulative impacts of other development and impacts on limited national road capacity • The traffic and transport assessment should consider all road users, • Mitigation measures should be aligned with phasing of road infrastructure improvements and required public transport interventions; all clearly outlined, • Demonstrate compliance with the requirements of the Bray and Environs Transport Study (2019). ○ The developer should assess the visual impacts from existing national roads. ○ The developer should have regard to any EIS/EIAR and all conditions and/or modifications imposed by An Bord Pleanála regarding road schemes in the area. The developer should in particular have regard to any potential cumulative impacts. ○ The developer, in conducting EIAR, should have regard to the TII Publications (formerly NRA DMRB and NRA Manual of Contract Documents for Road Works). ○ The developer, in conducting EIAR, should have regard to the TII's Environmental Assessment and Construction Guidelines, including the *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (National Roads Authority, 2006).

Consultees	Response Received	General Content of Response
		○ The EIAR should consider the Environmental Noise Regulations 2006 (SI 140 of 2006) and, in particular, how the development will affect future action plans by the relevant competent authority. The developer may need to consider the incorporation of noise barriers to reduce noise impacts (see *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* (1st Rev., National Roads Authority, 2004)). ○ The designers are asked to consult TII Publications to determine whether a Road Safety Audit is required. ○ In the interests of maintaining the safety standard of the national road network, the EIAR should identify the methods/techniques proposed for any works traversing/in proximity to the national road network. Any works to the national road network are required to be undertaken in accordance with standards outlined in TII Publications. Structures crossing national roads, such as a pedestrian footbridge, are subject to separate approvals/agreements and TII Technical Acceptance in advance of development. Additionally, such works should not compromise future road improvement proposals at this location. ○ TII recommends review of the Authority's observations submitted in relation to Wicklow County Council planning application ref. 16/999. ○ The Board decision and associated Inspectors Report in relation to file ref. 16/999, An Bord Pleanála case ref. PL27.248705, should be reviewed.

Table 1-5: EIS Scoping Consultation Responses to Previous Proposal at the Subject Lands (Reg. Ref. 16/999 / ABP PL27.248705

Consultees	Response Received
Department of Arts, Heritage & the Gaeltacht	• Assess impact on Ballyman cSAC. This should include impacts on hedgerows, impacts on water quality and ground water. • General scoping comments for EIA / AA reports which cover; ○ Ecological surveys ○ Baseline data ○ Impact assessment ○ Alien invasive species ○ Hedgerows and protected species ○ Bats ○ Rivers and wetlands ○ Water quality ○ Green infrastructure ○ CMPs • And specifically in relation to appropriate assessment; ○ Guidance ○ Conservation objectives ○ Cumulative and ex-situ impacts ○ Water and wastewater ○ Licences
Wicklow County Council	• Human Beings ○ The population profile of future residents of the lands. ○ The availability of existing/proposed schools and local services to serve the future residents of the lands and the transport links between the lands and these facilities ○ The anticipated location of employment for future residents – journey to work times, etc. ○ Availability of Water and Wastewater Infrastructure to serve the lands • Flora and Fauna ○ Potential impacts of the development on Ballyman Glen SAC (It is noted you have indicated screening for Appropriate Assessment, ○ A Screening Document should be included in any application to assist the Planning Authority to carry out their Stage 1 AA Screening, • Water ○ Impacts of the development on groundwater, ○ Management of surface water, • Material Assets (Traffic and Transportation) ○ The traffic associated with the lands both during construction and once developed and the impacts of same on the surrounding local and national road network, • It is also noted that the EIS is to take account of the cumulative impact of the development of the future lands in the Masterplan. The inclusion of these cumulative impacts is important in providing an analysis of the potential environmental impacts on the entire Masterplan area.
The National Roads Authority; / Transport Infrastructure Ireland	The developer should have regard, inter alia, to the following: • Consultation should be had with the relevant Local Authority / National Roads Design Office with regard to locations of existing and future national road schemes; ○ In particular, regard should be had to N11 – M11 TEN-T Corridor Study, • It would be required that a Traffic and Transport Assessment be carried out in accordance with relevant guidelines, noting traffic volumes attending the site and traffic routes to/from the site with reference to impacts on the national road network and junctions of lower category roads with national roads. The Authority's Traffic and Transport Assessment Guidelines (2014) should be referred to in relation to proposed development with potential impacts on the national road network. Having regard to the nature of the proposes development and location, the TTA should be undertaken in accordance with the NRA Traffic and Transport Guidelines (2014); ○ A mobility management plan should accompany the transport assessment, ○ Modal share targets (pre. and post light rail) should be outlined and how any PT modal share is accommodated in advance of light rail. ○ What measures that are proposed to reduce car dependency should be outlined, ○ Detailed phasing proposals of development with associated transport infrastructure provision in required, ○ Consider and address cumulative impacts of other development and impacts on limited national road capacity, ○ The TA should consider all road users,

Consultees	Response Received
	○ Mitigation measures should be aligned with phasing of road infrastructure improvements and required public transport interventions; all clearly outlined, • The developer should assess visual impacts from existing national roads, • The developer should have regard to any Environmental Impact Statement and all conditions and / or modifications imposed by An Bord Pleanála regarding road schemes in the area. the developer should in particular have regard to any potential cumulative impacts, • The developer, in conducting Environmental Impact Assessment, should have regard to the NRA DMRB and the NRA Manual of Contract Documents for Road Works, • The developer in conducting Environmental Impact Assessment, should have regard to the NRA's Environmental Assessment and Construction Guidelines, including the Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes, • The EIS should consider the Environmental Noise Regulations 2006 (SI 140 of 2006) and, in particular, how the development will affect future action plans by the relevant competent authority. The developer may need to consider the incorporation of noise barriers to reduce noise impacts (see Guidelines for the Treatment of Noise and Vibration in National Road Schemes (1st Rev., National Roads Authority, 2004)), • The designers are asked to consult the National Roads Authority DMRB Road Safety Audit (NRA HD 19/12) to determine whether a Road Safety Audit is required, • In the interests of maintaining the safety and standard of the national road network, the EIS should identify the methods / techniques proposed for any works traversing / in proximity to the national road network.
National Parks and Wildlife Service	Advised to contact Department of Arts, Heritage and the Gaeltacht who sent a response, see above.
Office for Public Works;	Acknowledgement only.
The Eastern Regional Fisheries Board (Inland Fisheries Ireland);	• The proposed development is located in the catchment of the Glencullen / Cookstown River. The Dargle (an EU-Designated Salmonid System) and its tributaries support a nationally significant population of Sea trout (*Salmo trutta*) in addition to a significant and biologically valuable population of Atlantic salmon (*Salmo salar,* listed under Annex II and V of the EU Habitats Directive). All proposed works must be designed and implemented in an environmentally sound and sustainable manner and should not impact negatively on the salmonid status of this system. • Best practice should be implemented at all times in relation to any activities that may impact on surface water (stream and river) or riparian habitats. Only clean, uncontaminated water should leave the site and drain to the river network. Ground preparation and associated construction works, including large-scale topographic alteration and the creation of roads and buildings (as proposed), have significant potential to cause the release of sediments and pollutants into surrounding watercourses. Pollution of the adjacent freshwaters from poor on-site construction practices could have a significantly negative impact on the fauna and flora of this sensitive and important freshwater system. Any discharges to surface streams present on the site must not impact negatively on the salmonid status of the system. Comprehensive surface water management measures (GDSDS study recommendations) must be implemented at the construction and operational stage to prevent any pollution of local surface waters. On-site attenuation ponds may be required to allow for the settlement of fine/particulate materials out of potentially discharging surface waters during construction. Petrol/oil interception (and possibly hydrobrake controls) should be in place on primary surface water discharges to protect receiving freshwaters in terms of water quality (and possibly quantity if flooding is an issue, although beyond the remit of this authority). Only clean, uncontaminated water should discharge to local surface waters. The environmentally-sensitive design and implementation of surface water discharge structures would be required to ensure protection of ecological integrity at point of discharge. • Watercourses should be maintained in their open natural state in order to prevent habitat loss, preserve and enhance biological diversity and aid in pollution detection. All proposed works must be designed and implemented in an environmentally sound and sustainable manner and should not impact negatively on the salmonid status of this system. Natural fish migration should be maintained by minimizing changes to the natural stream morphology and hydraulic conditions. In facilitating road developments where permanent and temporary structures are constructed over watercourses the structures should not impact negatively on predevelopment conditions. Clear span bridging is the preferable option. All culverts should be as short as possible to minimise habitat loss and should be adequately sized to accommodate the required flood discharge and remain backwatered to ensure the unhindered passage of fish. Design details should be discussed and agreed with IFI.

Consultees	Response Received
	• It is essential that local infrastructural capacity is available to cope with increased surface and foul water generated by the proposed development in order to protect the ecological integrity of any receiving aquatic environment. All discharges must be in compliance with the European Communities (Surface Water) Regulations 2009 and the European Communities (Groundwater) Regulations 2010. • It is recommended that the "Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites" (http://www.fishingireland.net/environment/constructionanddevelopment.htm) be consulted when planning to undertake works on this site. The maintenance of habitat integrity (both in-stream and riparian) is essential in safeguarding the ecological value of this important urban natural resource. The specific details of any works directly affecting watercourses or riparian habitats in the area, must first be submitted to IFI for assessment.

2 PROJECT DESCRIPTION AND CONSTRUCTION

2.1 Site Location and Context

The proposed application site forms part of a larger designated new development area under the Bray Municipal District Local Area Plan 2018 -2024 (LAP). These wider development lands are identified as an 'Action Area' in the LAP. The lands lie on the western side of Bray. See **Figure 2.1** Site Location Map and **Figure 2.2** which illustrates the zoned lands at Fassaroe with the Action Area boundary outlined in blue.

Figure 2-1: Site Location Map

The majority of the zoned development lands within the Fassaroe Action Area are currently in agricultural use, although there are a number of other notable uses within the overall lands. They are framed by the Ballyman Glen in the north and the Cookstown River valley in the south. The most significant of these are a Roadstone quarry (no longer operational) and retail operation within the south eastern quadrant of the lands. This facility and former quarry lies outside of the current proposed application site, beyond the south eastern boundary. There are also a number of residential clusters in the Fassaroe area; at Thornhill Road, adjacent to a Greenstar facility in the north east, along Kilbride Lane in the south east, and along Berryfield Lane which runs east-west through the development lands and connects to the Ballyman Road in the west. There are a number of small businesses located within the residential clusters at Thornhill Road and Berryfield Lane.

Figure 2.3 below presents an aerial photograph of the lands at Fassaroe in the overall context of Bray. Lands to the north of Fassaroe at Old Conna are also zoned for future development under the Dún Laoghaire Rathdown County Development Plan 2016. Given the physical restrictions on the future growth of Bray to the east by the sea and to the south by Bray Head and Sugar Loaf Mountains, the most significant direction for future growth of Bray is westwards to Fassaroe with new development also identified at Woodbrook to the north of Bray.

Figure 2-2: Extent of Masterplan Zoned Lands under Bray Environs Municipal District Local Area Plan 2018

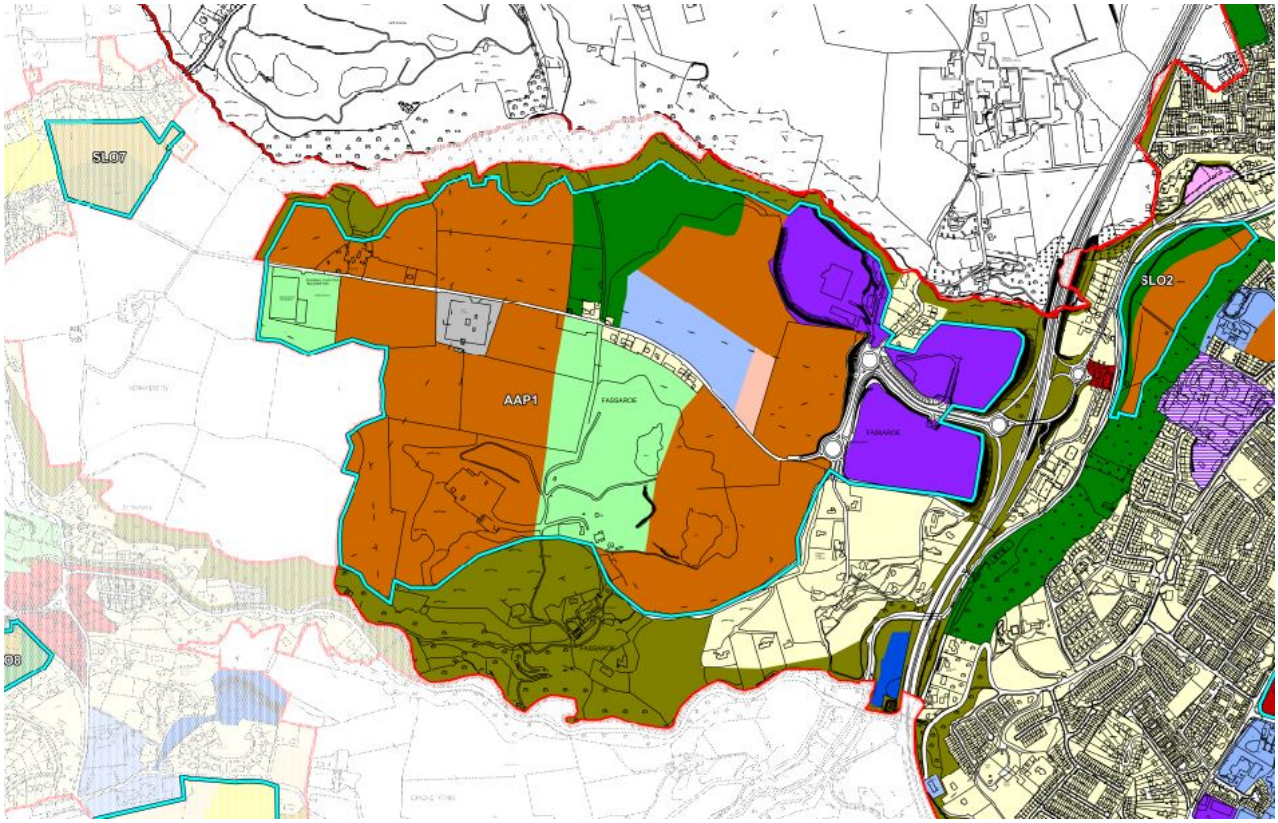
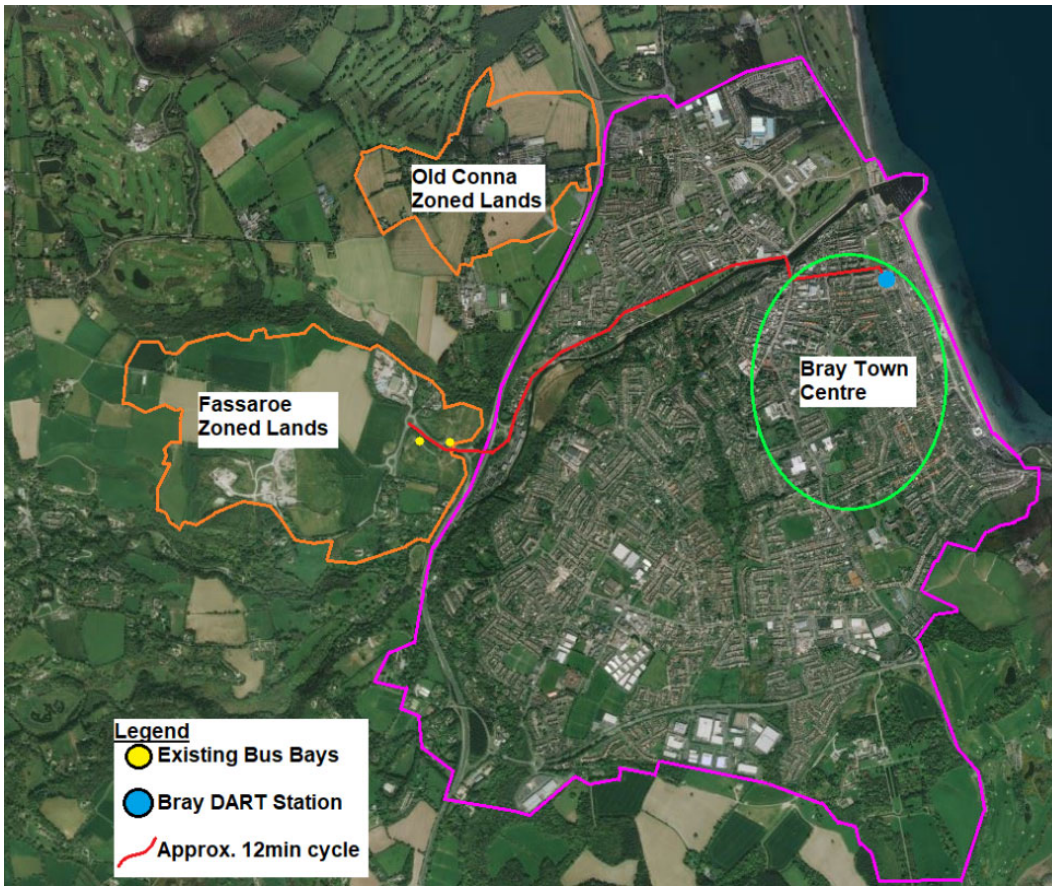


Figure 2-3: Aerial Photo of Fassaroe Zoned Action Area Lands in Wider Context of Bray

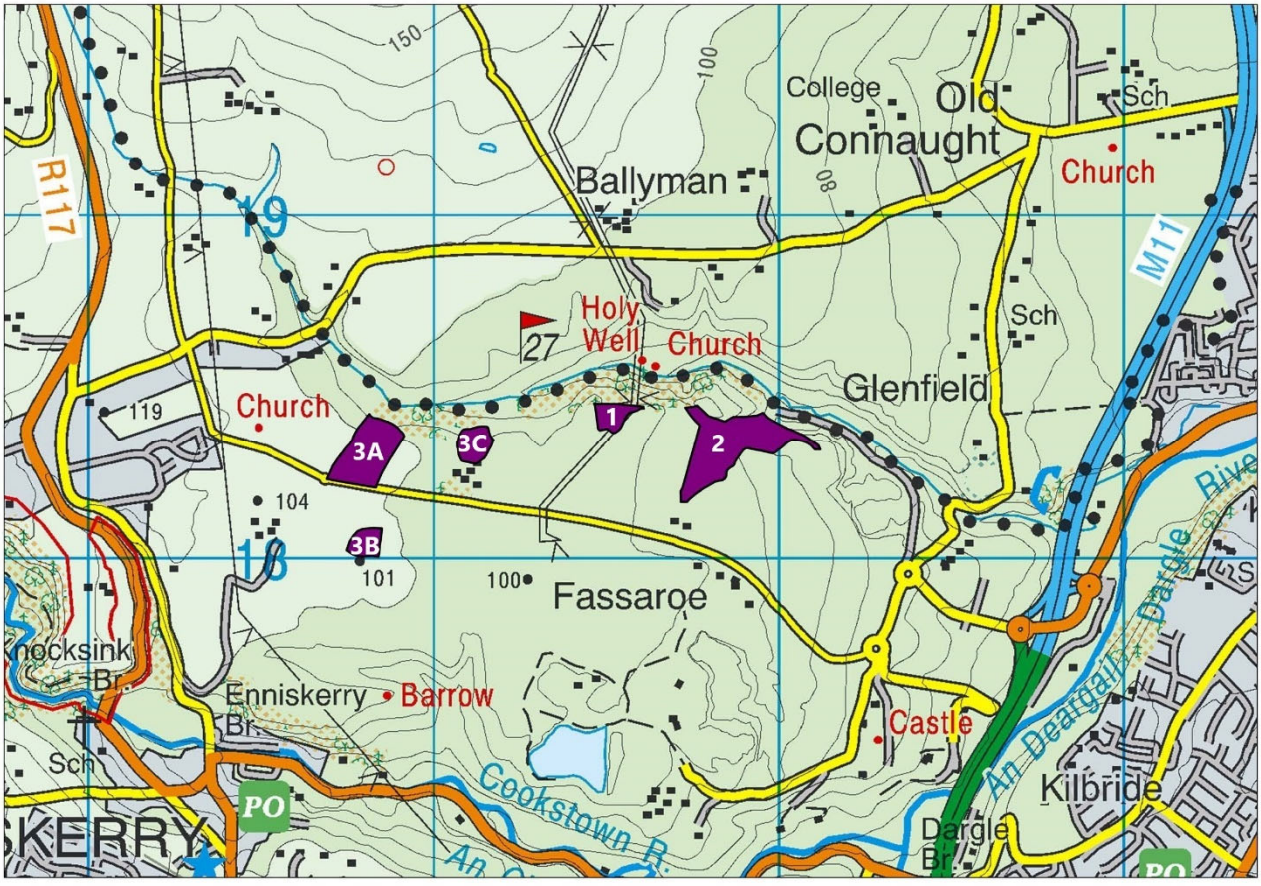


The lands at Fassaroe benefit from significant roads access infrastructure from the N11 which was previously constructed by Cosgrave Property Group (CPG) as part of a permitted commercial development that was subsequently not constructed. This comprises of part of a distributor road with existing laybys and a series of 3 no. roundabouts. This existing boulevard type road is referred to as Fassaroe Avenue in this EIAR. Drainage infrastructure was also installed within these roads by CPG at the time. In addition, 280m approx. of an access road into the Fassaroe lands from Ballyman Road to the west has also recently been provided by the Applicants (which was granted as part of a housing development permission at Monastery, Enniskerry (Wicklow County Council Ref. 17/15 / ABP Ref. PL 27.248914)).

There are 5 no. historic landfill locations within the northern part of the overall Action Area Plan lands which were previously operated by Wicklow County Council. These landfill sites had previously been used for quarrying activities. The landfill operations ceased in the early 1990s at which time these areas were covered in topsoil and returned to agricultural use. The locations of these sites and their designated numbers are shown on **Figure 2.4** below. Localised landslips have occurred in four areas to the north of Landfill Site 2.

In accordance with the requirements of the Waste Management Act 1996, 4 no. of these former landfill sites are classified as Historic Unlicensed Waste Disposal sites which require Certificates of Authorisation from the EPA for their remediation. One of the sites, though operated by Wicklow County Council, does not fall under the certification requirements of the Waste Management Act due to its age. In any event, applications were made by Wicklow County Council to the EPA for the remediation of the 4 sites. The Environmental Risk Assessment for the applications had regard to the presence and need for remediation of all 5 sites. In November 2019, the EPA issued final Certificates of Authorisation for the remediation of the 4 no. sites.

Figure 2-4: Locations of Historic Unregulated Landfill Sites



To the north of the Fassaroe Action Area lands is the Ballyman Glen SAC. The extent of the SAC is shown in **Figure 2.5**. The qualifying interests of the SAC are groundwater dependant habitats of Petrifying springs with tufa formation and alkaline fens.

Figure 2-5: Location and Extent of Ballyman Glen SAC

The Action Area lands rise steeply to the west from the N11. They also rise from Ballyman Glen in the north and from Cookstown River valley in the south. The highest point of the overall lands is just to the south of Berryfield Lane at the western extent of the Action Area boundary from where the land falls north-eastwards and south-eastwards and rises to the west.

The current planning application and EIAR relate to the first phase of proposed development within the Action Area. This lands which are the subject of this Phase 1 proposed development comprise a substantial part of the northern portion of the overall Action Area lands.

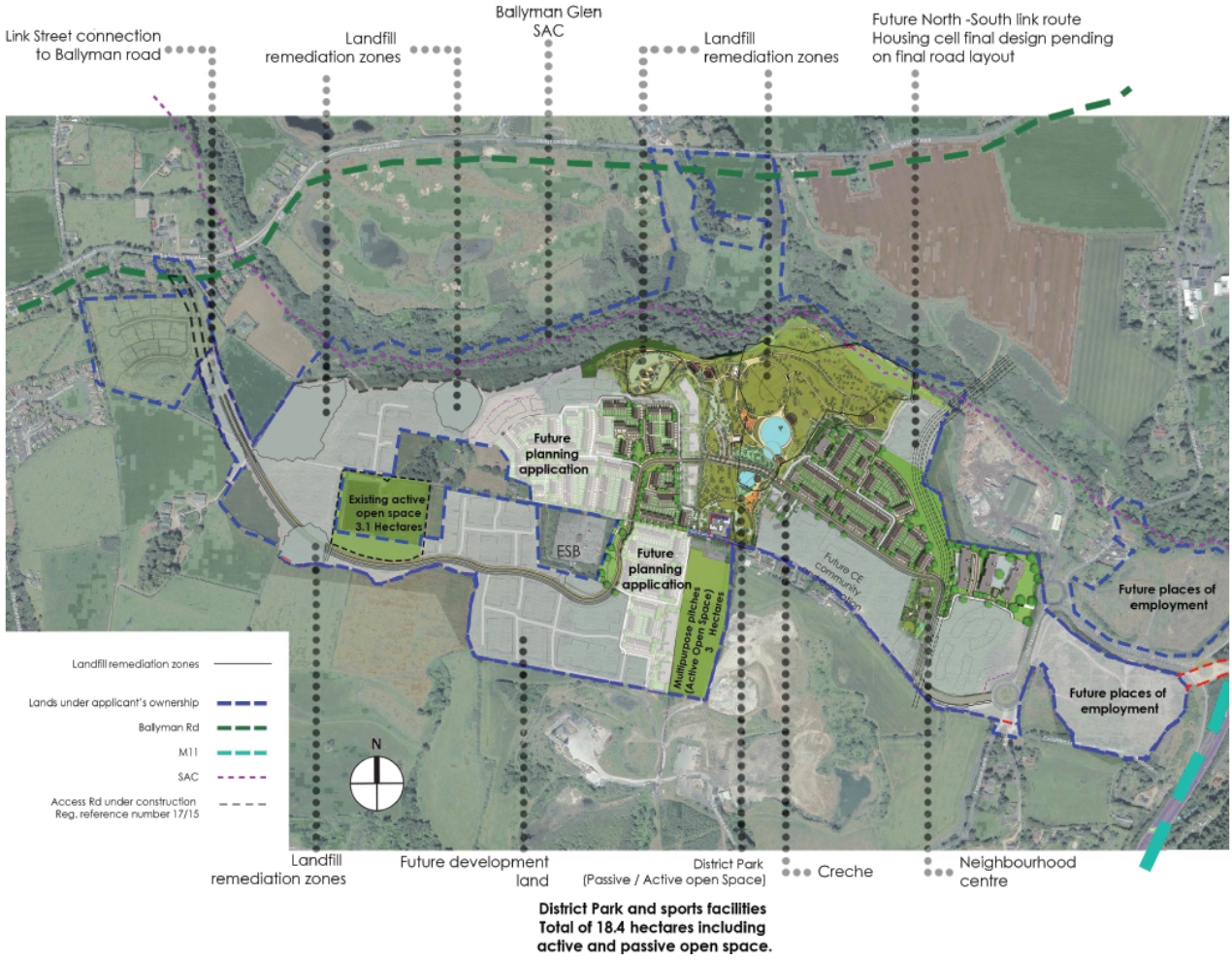
2.2 Site Description

2.2.1 Phase 1 Site Extent and Current Uses

The Phase 1 planning application site extends to a large proportion of the northern half of the Action Area lands on the northern side of Berryfield Lane. The application site however also extends to the south of Berryfield Lane to provide active public open space, the main east-west link road and a small number of houses. The extent of the application site extends beyond the Action Area lands to the west to provide for the east west road connection to Ballyman Road and to the east to provide for a proposed pedestrian and cycle route (including bridge) connection across the N11 to Dargle Road. The extent of the Phase 1 application boundary and general layout are show in **Figure 2.6** below. More detailed drawings are presented in the MCROM Site Layout Plans submitted with the application.

The overall application site area comprises a total of 80.16 hectares approx.

Figure 2-6: Phase 1 Site Area and General Layout



The Phase 1 lands are currently largely in agricultural use. The easternmost part of the application site adjoining the previously constructed road access has been the subject of some site development work in the past in preparation for an intended commercial development which was not subsequently constructed. This is the lowest part of the application site. The Phase 1 lands are sloped with the highest point in the west and falling northwards and north-eastwards to Ballyman Glen and eastwards towards the N11.

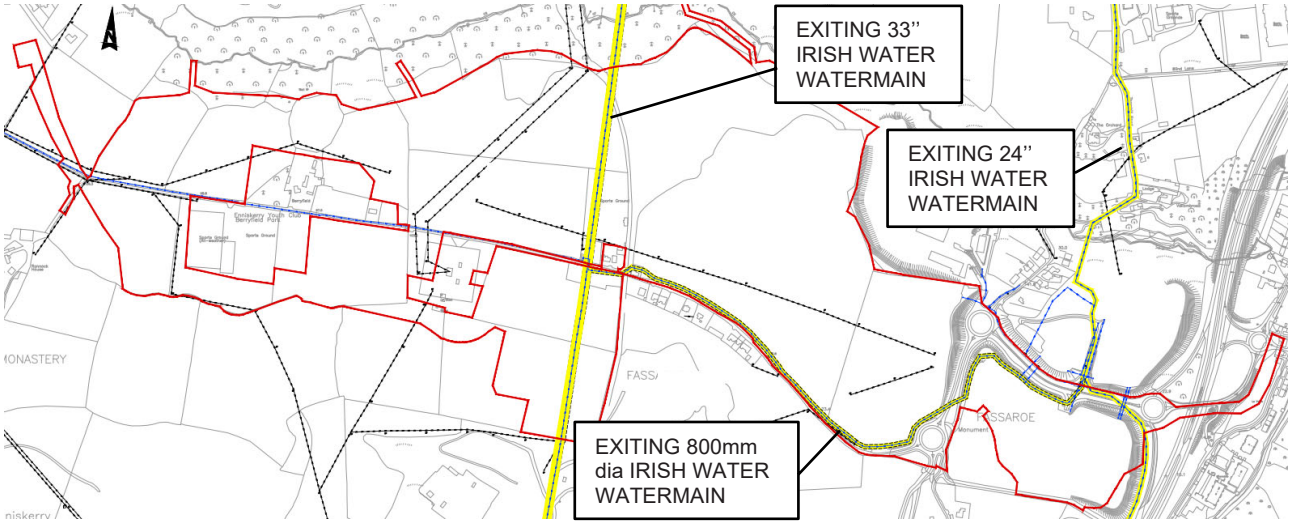
All 5 No. of the historic landfill sites are included within the application for the purposes of remediation works in accordance with the Certificates of Authorisation issued by the EPA to Wicklow County Council. Two of the sites are also subject of landscaping proposals for the District Park provision, one will partly accommodate the route of the east-west link road, and two will be simply grassed following remediation.

The 110kV ESB sub-station on Berryfield Lane also forms part of this Phase 1 application site in order to accommodate the proposed undergrounding and rerouting of ESB lines across the site.

2.2.2 Existing Services and Utilities Crossing the Lands

There are 3 no. existing Irish Water watermains which cross the Phase 1 lands; a 33" watermain running north south through the centre of the Phase 1 site, a 24" watermain also running generally north south through the eastern side of the Phase 1 site, and an 800mm dia interconnector watermain between the existing 33" and 24" crossing from west to east along Berryfield Lane. **Figure 2.7** below shows the route of these mains as they cross the overall proposed red line boundary. The layout of the proposed development and positioning of proposed structures has had regard to these wayleaves to ensure appropriate access for maintenance is provided and that no structures are proposed within the existing wayleaves in accordance with Irish Water Code of Practice.

Figure 2-7: Route of Existing Watermains Within Red Line Boundary



There are a number of electricity lines which cross the lands and which will need to be diverted and undergrounded in order to accommodate the proposed development. These relate to an existing twin 110kV overhead line and 2 No. existing 38kV overhead lines, all of which run to the existing Fassaroe ESB sub-station. The twin 110kV line runs from the north of the site (within Dun Laoghaire Golf Club lands at Ballyman) across Ballyman Glen in a north south direction. Just to the south of the glen it currently swings south-westwards to a point on the northern side of Berryfield Lane just to the northwest of the sub-station. From here is swings back to a north south alignment and enters the existing ESB substation on its western side.

One of the existing overhead 38kV lines runs from a point to the northeast of the subject site across Ballyman Glen and the development lands to the ESB substation. The second runs south-eastwards from the ESB substation, to the south of Berryfield Lane to a point adjacent to the roundabout at Kibride Lane.

2.3 Land Ownership

Cosgrave Property Group and / or Borg Developments Unlimited are the owners of approximately 113ha of lands at Fassaroe. Cosgrave Property Group is a partnership of individuals who are also Directors of Borg Developments Unlimited. This includes the majority of the Fassaroe Action Area lands to the north of Berryfield Lane and the existing access road and roundabouts from the N11 at the eastern side of the land (with the exception generally of the Greenstar lands and the existing private residences at Thornhill Road). Their combined ownership also includes lands to the south of Berryfield Lane at the western side of the Action Area lands (excluding the ESB substation), and extends westwards beyond the zoned lands to both north and south of Berryfield Lane, and providing a connection to Ballyman Road. At the eastern side of the Fassaroe lands, the ownership also includes the lands to the south of the access road and roundabout. Also included in the combined ownership are lands next to the LaVallee apartment development at Dargle Road on the eastern side of the N11.

As the applicant in this case is Cosgrave Property Group a letter of consent for making the application from Borg Developments Unlimited is provided.

There are a number of localised areas in which the proposed application boundary incorporates lands in the ownership of others.

The proposed link road through the site to Ballyman Road will necessitate a revised access into third party lands. The application boundary includes this access point to provide for the revised arrangement. A letter of consent from Mr. Dermot Fisher is accordingly provided.

The application incorporates proposals for ESB line diversions and for associated modifications within the sub-station. The sub-station is therefore included within the application site and consent for the making of the application has accordingly been provided by ESB Networks.

As part of the application, it is proposed to provide a pedestrian / cycle route across the N11 connecting to Dargle Road. Part of these roads / connection are public roads. A letter confirming same is enclosed herewith from Wicklow County Council, which is aware that these are incorporated in the planning application boundary.

2.4 Basis for Development Proposal

2.4.1 Policy Background and Concept Plan

The overall development lands at Fassaroe are zoned under the Bray Municipal Area Local Area Plan 2018 - 2024, and are designated as an Action Area to accommodate a range of uses, with the greatest emphasis on residential development and supporting services and facilities. **Figure 2.2** above indicates residential zoned land in orange and employment uses in purple. Also zoned for the full development of these lands are a neighbourhood centre (pink area in **Figure 2.2**), large scale open space (light and mid green in **Figure 2.2**) and community and education use (blue area in **Figure 2.2**).

The Bray Municipal District Local Area Plan sets out the overall development of the zoned lands at Fassaroe in the following phases:

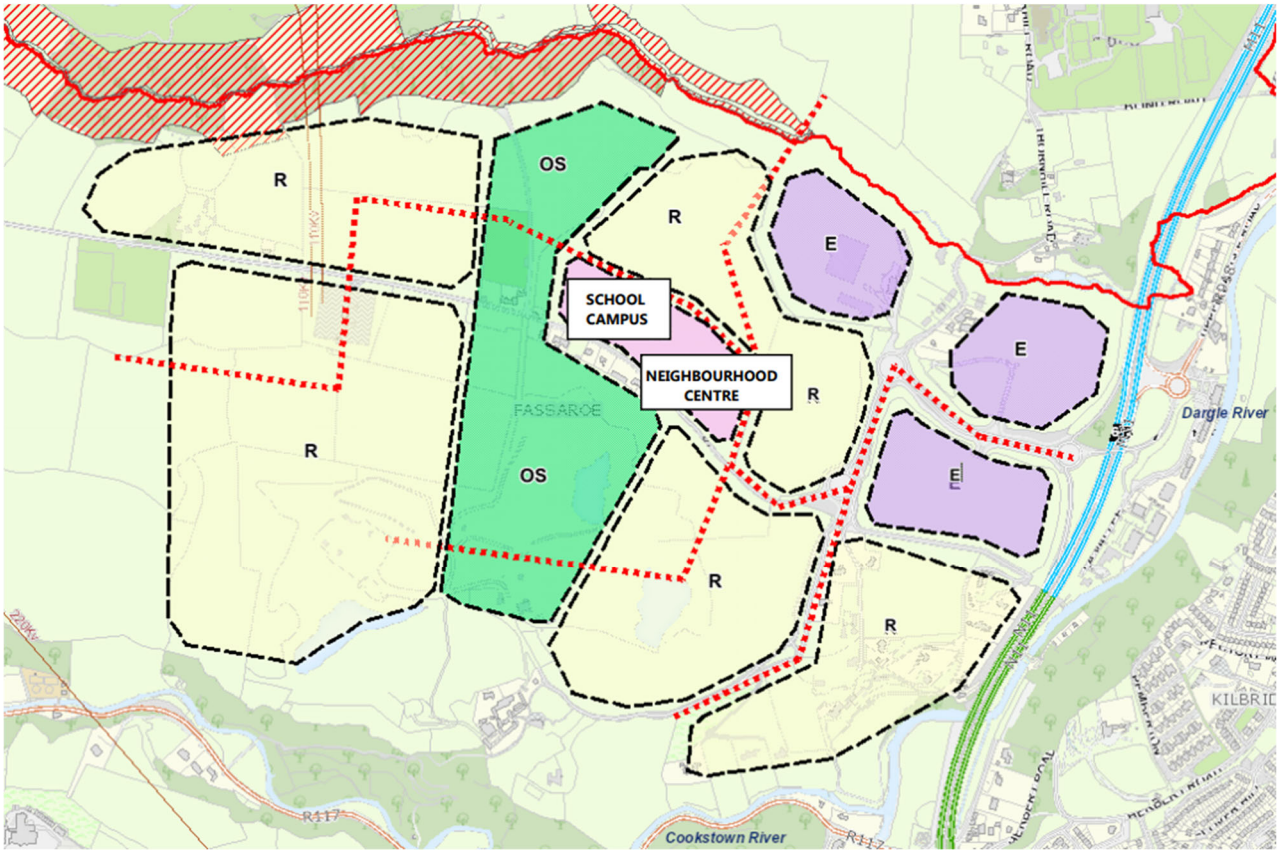
Phase 1	Road link from N11 to Ballyman Road Passive Park (minimum of 8ha) Active Open Space / Sports Zone (minimum of 14ha) Site identified and reserved for school campus Neighbourhood Centre Up to 2,000 residential units
Phase 2	Identification and reservation of the site for additional primary school Remainder of residential units

The Bray MD LAP also sets out a Concept Plan for the lands at Fassaroe (see **Figure 2.8** below) with reference to a number of key parameters.

- Existence of a Natura 2000 site along the northern boundary (Ballyman Glen SAC); development will be suitably set back from this site and lands reserved for passive open uses;
- The necessity of a link road through the area from Bray directly to Enniskerry; the provision of such a road could provide an alternative link to Enniskerry, allow for adjustment to the existing main access road to Enniskerry from the N11, the R117;
- While plans for Luas extension to Bray have undergone a number of revisions, the plan should retain the possibility of Luas extension to and stabling in Fassaroe;
- The area will require a new, central ‘village centre’ which will provide for both the retail and services needs of the resident population but will also include a school campus;
- The need for a significant new open space facility to serve both the future residents of the area and the wider area; significant parts of the area were formerly used for aggregate extraction and for land filling and such areas are considered optimal for such use.

The zoning provisions of the Bray MD LAP shown in **Figure 2.2** above also reflect this Concept Plan.

Figure 2-8: Concept Plan for Fassaroe Action Area



2.4.2 Design Concept and Principles

2.4.2.1 Proposed Action Area Plan and Initial Site Strategy

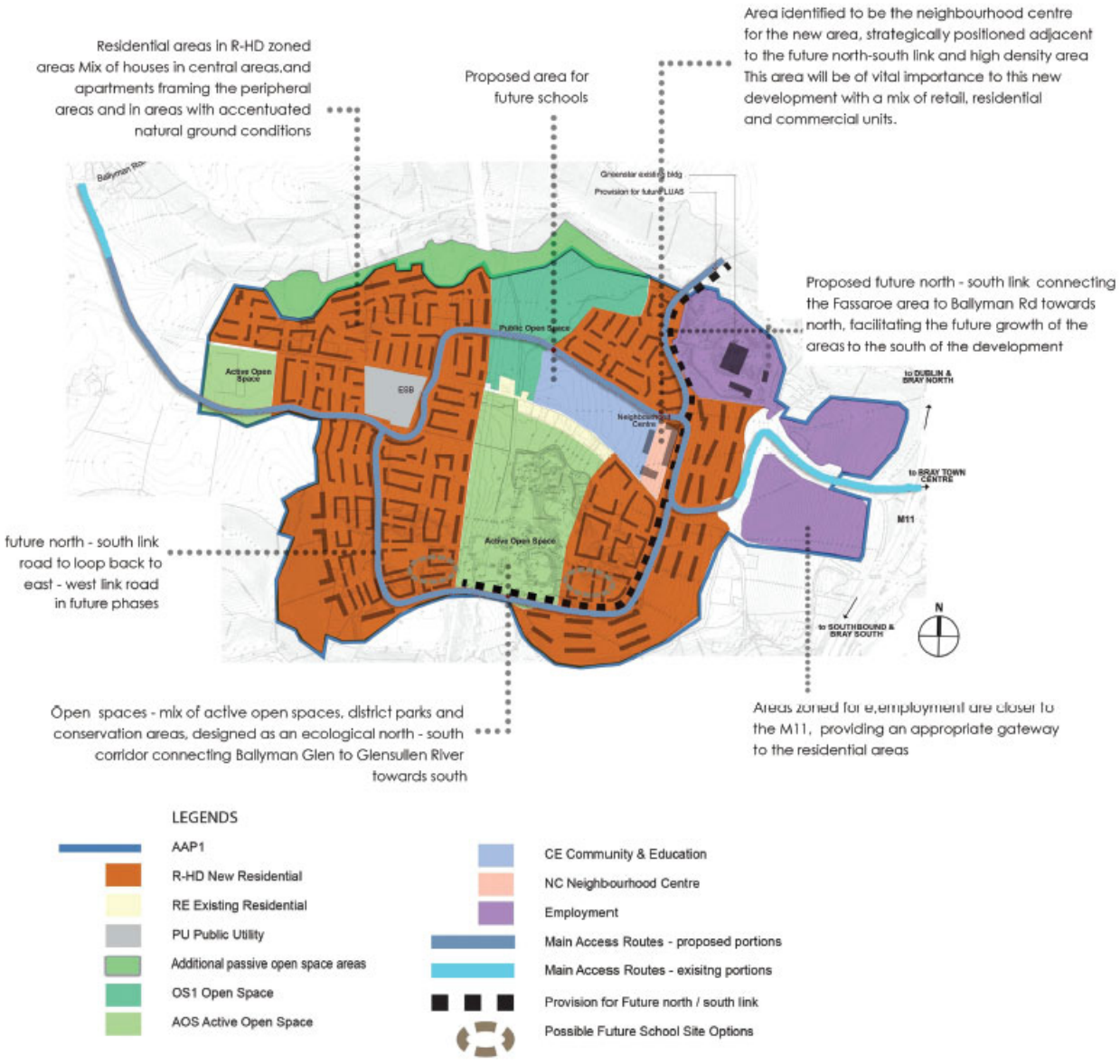
The Bray Municipal Local Area Plan identifies the overall development lands at Fassaroe as an Action Area. The LAP provides that separate applications for sections of each Action Area Plan will not be considered until an overall Action Area Plan has been agreed in writing with the Planning Authority or in the alternative if it can be shown that any application will not undermine the achievement of the overall objectives for that Action Area and would contribute its 'pro rata' share of the public infrastructure and facilities set out in the LAP for a specific area.

A proposed Action Area Plan (AAP) was drawn up for the lands. The Site Strategy presented in the proposed AAP (see **Figure 2.9**) has regard to the existing urban fabric of Bray town as well as the Action Area objectives and Concept Plan set out in the LAP.

The urban fabric of the existing Bray area is well defined, with the established built-up area centred around a distinct commercial and civic area — mostly focused upon Main Street. Outside the traditional Town Centre area, the various existing communities and neighbourhoods of Bray are served by lower hierarchy district and neighbourhood-scale retail and civic cores. These include the shopping centres at Little Bray, the Vevay Road and Boghall Road. In terms of function and urban structure, these are subservient to the Town Centre, providing convenience retail and community services for the residents and employees of these areas. Other local facilities, such as primary and secondary schools, and places of worship are generally spread throughout the existing built-up areas which they serve. The Bray MD LAP aims at creating in the Fassaroe area a new community, comprising of places of employment, schools, a new neighbourhood centre within an urban residential fabric, all serviced by a substantial amount of high quality public open spaces. This well thought out combination of uses will deliver a neighbourhood well served by necessary ancillary facilities. In line with this, the Applicants have developed a framework as part of a proposed Action Area Plan for the overall Fassaroe Lands to broaden the existing urban and landscape fabric of Bray. The proposal is intended to provide a distinctive sense of place to be the framework to a self-sustaining diverse multi-

generational community that grows in harmony with its environment. Favouring living, working and recreation, the intention is that the development will respond to different use requirements through a legible hierarchy of streets which have been designed to facilitate connections through the area and wider community, mainly prioritizing pedestrians and cyclists. The uses provided allow for home working and promotion of work / live balance. It will also be well connected to Bray Town Centre with excellent bus and cycle links which allow for travel to Bray, Dublin City Centre and other localities using public transport.

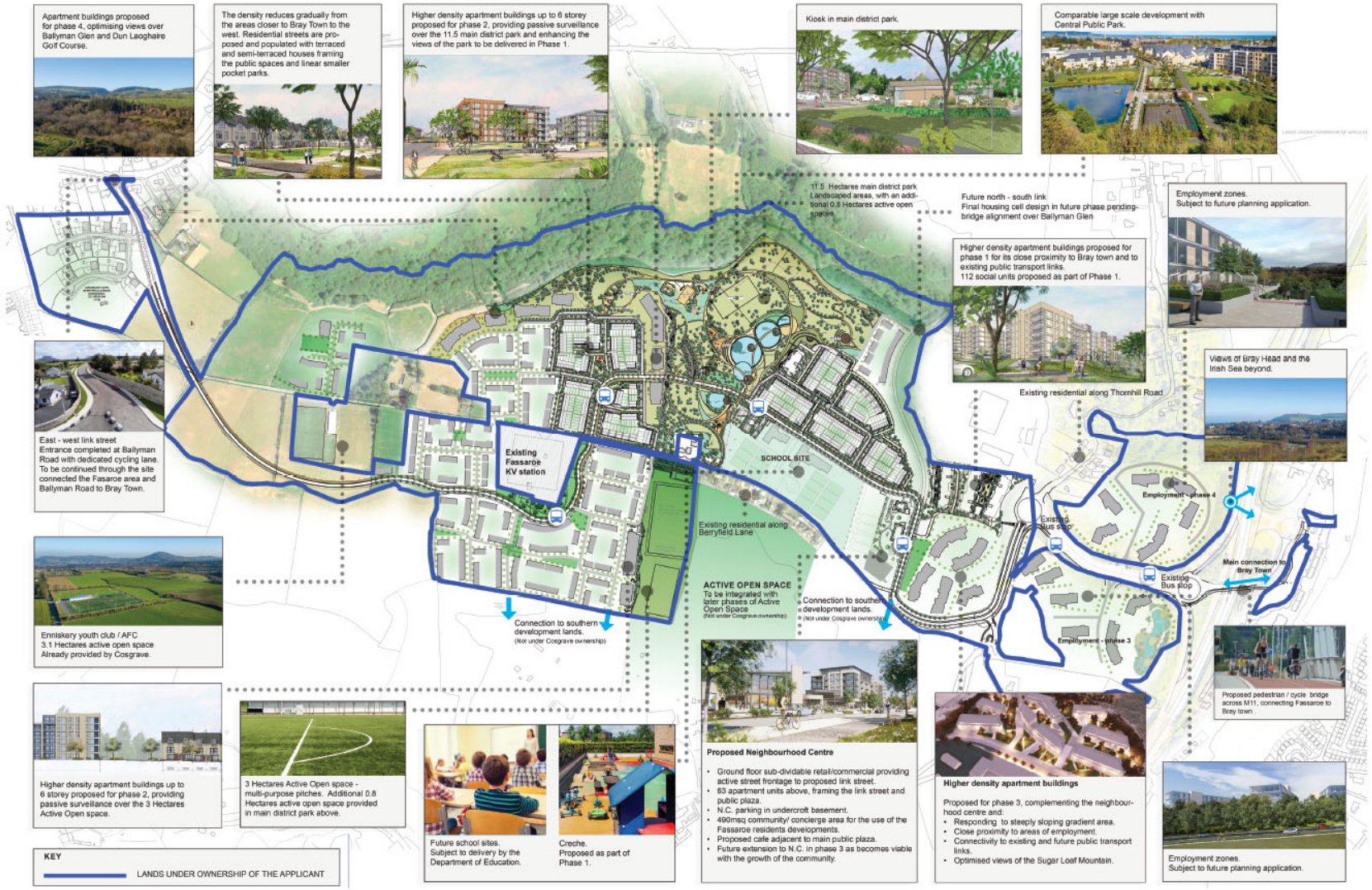
Figure 2-9: Initial Proposed Action Area Plan Site Strategy



2.4.2.2 Masterplan for Cosgrave Property Group Lands at Fassaroe

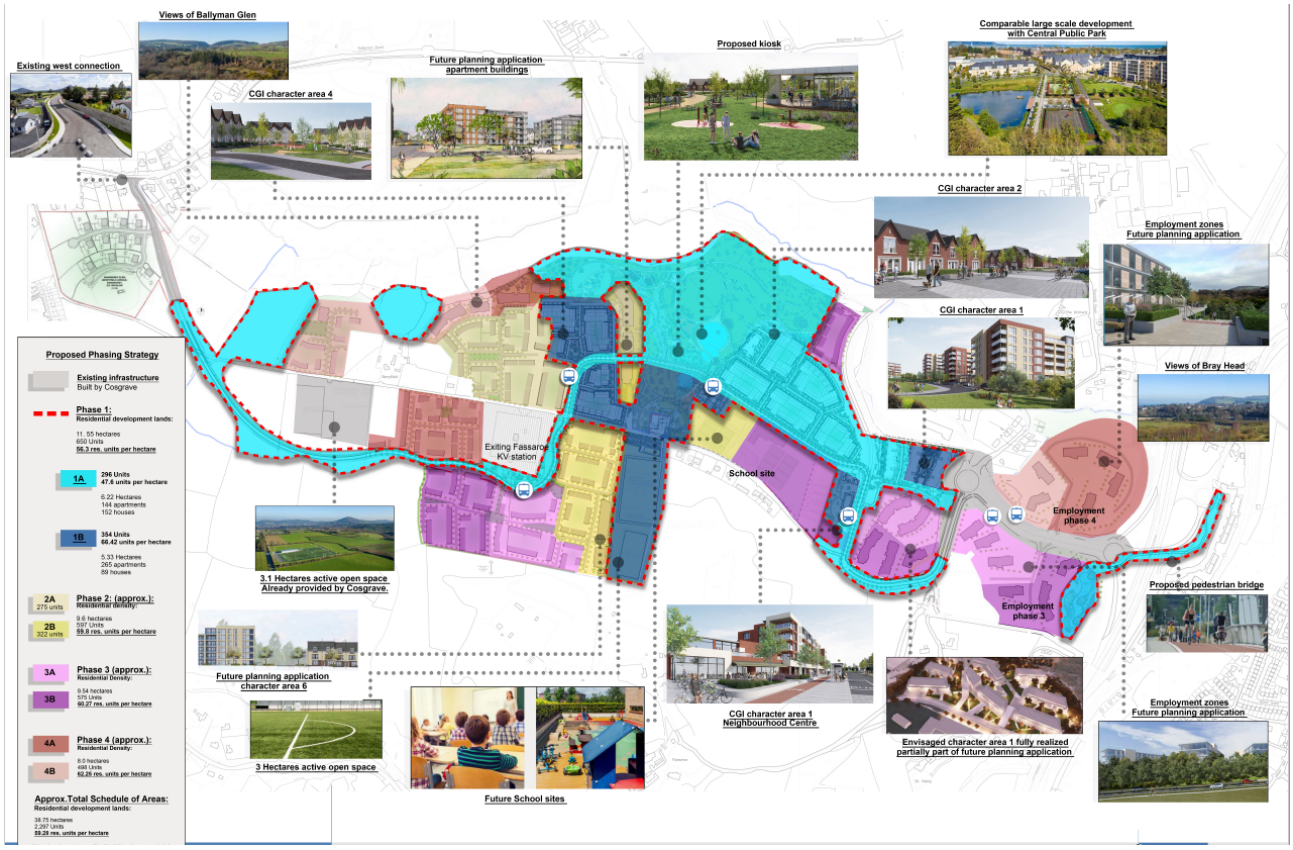
Based on this Action Area Site Strategy a Masterplan has been drawn up for the lands at Fassaroe in the ownership of Cosgrave Property Group. This masterplan is presented in Figure **2.10.**

Figure 2-10: Masterplan for CPG Owned Lands at Fassaroe



The delivery of the development under this Masterplan is envisaged to be undertaken across four phases. The location of these phases are identified on **Figure 2.11** (and on Application Drg No. PL02 by MCORM Architects). The extent of the Phase 1 development subject of this EIAR is identified in turquoise and blue. The turquoise (Phase 1A) will the first areas constructed followed by the blue (Phase 1B).

Figure 2-11: Phased Approach to Full Build out of CPG Owned Lands at Fassaroe



2.4.2.3 Layout and Design Principles

2.4.2.3.1 Site Layout and Street Hierarchy Approach

The context of the site has been fully recognised and informed the final layout design. A clear circulation hierarchy is essential to the design. The layout seeks to provide a high degree of pedestrian and bike permeability and connectivity, with a clear street hierarchy for access by car. The fabric addresses future growth enabling the future expansion of Fassaroe as envisioned in the Bray MD LAP and Bray and environs transport strategy with provisions made for a future north-south link. Special attention was taken in the development of the proposed east - west link street (N11 to Ballyman Road) from which the proposed residential quarters will be accessed. The location of key elements at node points along the proposed new N11 to Ballyman Road Link including a Neighbourhood Centre and Main Street, well-appointed District Park, new Active open space for use by sports clubs and indeed the Enniskerry football Club facility already delivered by Cosgrave Property Group creates a strong easily navigated route through the site. A significant portion of this link road has already been constructed from the Ballyman junction eastward into the Fassaroe lands as part of a previous planning permission for 12 houses - Monastery, Ballyman.

The use of a grid system to organise the built form and urban structure, which is more organic than rigidly orthogonal, creates a well-connected framework that is legible and enjoyable for people to use. The permeable nature of the resulting layout will avoid larger than necessary pedestrian and cycle routes thereby discouraging the use of the car for relatively short local journeys. The use of short cul de sacs has been employed in a limited number of locations to introduce variety into the scheme. These areas generally have

a shared surface treatment allowing priority for the pedestrian. Full pedestrian and cycle permeability is always provided between the cul de sac areas and neighbouring streets.

2.4.2.3.2 Residential Areas Approach

The design concept is to create an ordered series of residential cells, linked by a clear hierarchy of streets and open spaces. A concentration of apartment buildings is planned at the entrance of the residential precinct and opposite the Neighbourhood Centre. This portion of the site is the closest residentially zoned lands to Bray Town Centre and is also adjacent to the important ancillary facilities provided in the Neighbourhood Centre. It is appropriate, therefore, to maximise density here and provide density of population at this location. This higher density strategy here and mix of uses creates a new Town Centre sense of place. This allows for a shift to lower scale housing immediately to the west with an entirely different character. A switch back to apartment typology occurs overlooking the proposed new Main District Park as one moves further west through the site. This use of significant variation in typology establishes the various distinct character areas proposed introducing visual interest and making the scheme very legible and easy to navigate.

2.4.2.3.3 Green Spaces

High quality design and placement of a range of types and sizes of open space is a key factor in the quality of the resulting urban living environment. A new centrally located public park space area will stretch across the site, connecting the most southern portion of the site to Ballyman Glen in the north, providing a series of active and passive open spaces to be used by the local community and visitors alike. In addition the park provides a valuable ecological corridor connecting back to the rural landscape adjacent.

Open space areas within the scheme are well defined whether public open space or private open space. A hierarchy of well distributed public open space has been provided including the District Park reducing in scale to pocket parks within each character area and also the creation of well-designed hard landscaped areas. All buildings enjoy a defensible space buffer between the building edge and public footpath. This private set-back allows for a degree of privacy for the dwellings but also ensures good overlooking and passive surveillance of the public area whether streets, squares or parkland.

2.4.2.3.4 Scale and Density

The urban design and landscape framework proposes a medium density mixed typology scheme, providing a good balance of different unit types that will address the many unique aspects of the site as well as delivering a well populated sustainable new neighbourhood. A wide range of end uses is anticipated and the residential mix will provide for this.

Key drivers for overall Action Area Site Strategy:

- The proposed massing/scale of development generally decreases as one moves from the entrance to the scheme in the east moving westward towards Ballyman Road. The entrance of the site is proposed to provide higher density apartment blocks, varying from five to six storeys high. This is in response to the steep gradient of the site at this location as well as the proximity to public transport, places of employment, the M11 and Bray Town Centre.
- The main urban centre will be focussed around the future neighbourhood centre. This building must achieve optimum density, providing active frontage to the street, passive surveillance and suitable legible urban edges to the new central plaza.
- Development located centrally in the site reduces in scale changing to two and three storey houses arranged into legible urban cells. These cells are designed to have active frontage on all sides and a fully permeable pattern.
- The main district park for the Action Area will be framed to the east and west by taller apartment blocks, varying from four to seven storey in height, These blocks will provide an appropriate scale adjacent to this expansive public park and provide excellent passive surveillance over this area. This landscaped corridor will allow for visual and ecological connections to Ballyman Glen to the north and to the Sugar Loaf Mountain to the south.
- The local topography led to the proposal to place taller apartment buildings in the sloping areas at the northern side of the site overlooking Ballyman Glen and at the eastern entrance to the site. Higher density buildings will address the existing topography in their final design.

- The proposed urban structure is respectful of the current context along Berryfield Lane, while also enabling existing residents to be integrated into the overall development. It is the design intention to maintain its "boreen" like character to minimse impact on the existing residents.

2.4.2.3.5 Character Areas

The Site Strategy draws on natural and designed features to give the future Fassaroe neighbourhood both a distinctive feel while also introducing a variety of character across the development. A number of Character Areas have been defined for the first two Phases of development identified in the Masterplan. **Figure 2.12** identifies these areas with the development areas contained within the current Phase 1 application outlined in red.

Figure 2-12: Character Areas for Phase 1 and 2 of CPG Masterplan Layout

2.5 Description of Development Components of Phase 1 Application

2.5.1 General Application Content

As noted at section 2.4.1 above, the Bray MD LAP 2018 – 2024 identifies two overall phases of development for the Fassaroe Action Area. The Bray and Environs Transport Study (BETS) published the following year in 2019 identifies an initial Phase 1(a) development at Fassaroe as comprising c.650 residential units and appropriate residential support facilities.

In line with the provisions of the BETS, the development now proposed under the Phase 1 application and subject of this current Environmental Impact Assessment Report comprises of the construction of 650 no.

residential units comprising a mix of apartments and houses along with a neighbourhood centre, a crèche, a district park, local parks, the diversion and rerouting of ESB electricity lines, a distributor road connecting to Ballyman Road, a new pedestrian / cycle route across the N11 connecting to Dargle Road, historic landfill remediation works, landscaping works, parking facilities, ancillary services and facilities and associated site development works.

The various elements of the application then include:

- Road link (2.4km) connecting N11 to Ballyman Road (with westerly connection to Ballyman Road already in place).
- Pedestrian / cycle route including bridge across the N11 to Dargle Road Upper.
- 15.3ha of District Park / Active Open Space.
- 650 no. residential units comprising 241 no. houses and 409 no. apartments.
- 3 No. pocket park areas comprising a total of 0.43ha.
- 733sq.m approx. crèche with capacity for approx. 138 no. childcare spaces.
- Retail unit / kiosk (108sq.m.) in district park.
- Neighbourhood Centre Phase 1 comprising:
  - 1,035sq.m. retail;
  - 360sq.m. café;
  - 480sq.m community concierge (serving entire Fassaroe community);
  - 414sq.m. residential ancillary uses for residents of the neighbourhood centre apartments (residents lounge 256sq.m., residents gym 90sq.m., and residents concierge 68sq.m.).
- Demolition of an existing dwelling at Berryfield Lane.
- Rerouting and undergrounding of overhead ESB lines (110kV and 38kV lines) across site and into existing ESB Substation.
- Site development / ground works on future development areas to ensure sustainable cut and fill balances across the lands.
- Water supply, foul and surface water drainage proposals.
- Provisions for public bus services in line with demand towards Bray (DART and Bray bus interchange) and towards the Luas at Cherrywood / Brides Glen.
- Remediation of 5 no. historic landfill sites in line with Certificates of Authorisation issued to Wicklow County Council by the EPA in 2019.

The Site Layout Plan for these proposed Phase 1 works is shown in Figure 2.6 above. Drawing Nos. PL102 – PL104 by MCORM Architects enclosed with the application drawing shows the overall extent of the proposed development at 1:2,000. Site Layout Plans at 1:500 are also provided with the application drawing package.

The various elements of the development are described hereunder in more detail.

2.5.2 Road Link Connecting N11 to Ballyman Road

Under the Bray Municipal District Local Area Plan 2018, the development of lands at Fassaroe are subject to the provisions of a new link road from the N11 to the Ballyman Road. As noted above both the eastern (Fassaroe Avenue) and western extents of this overall link road have already been provided by the Applicant under two previous permissions. The current application will complete the connecting 2.4km section of this road, thereby providing for the full extent of the link road from the N11 through to Ballyman Road. This new Link Road will be call Berryfield Avenue and will take a route to the north of Berryfield Lane as it runs through the main development area. At the western side of the development lands the new access road will cross to the south of Berryfield Lane immediately to the east of the existing ESB substation. From the sub-station it will run east west to the south of the existing Enniskerry Youth Club /AFC pitches before crossing Berryfield Lane again as it heads north to join with Ballyman Road at a new access point. This section is referred to as Ballyman Link Road.

This proposed link road runs through existing large open agricultural fields. It also passes through part of one of the historic landfill sites. The roadworks here, combined with the landfill remediation as authorised by the EPA, require a modest amount of waste removal along with a cap and gas management strategy.

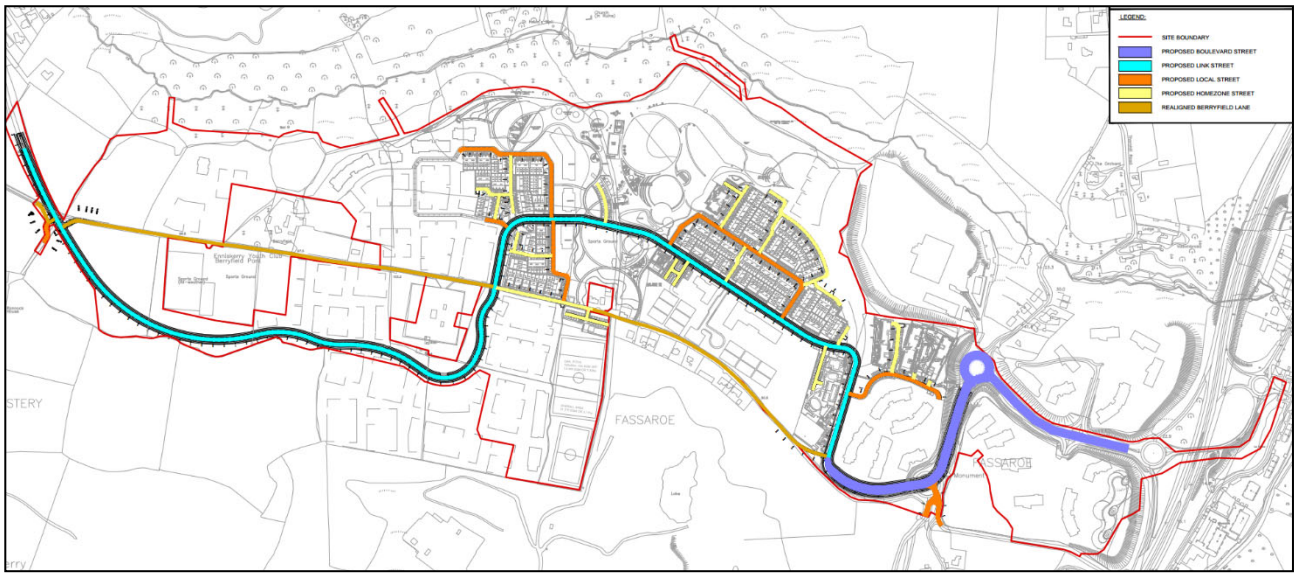
2.5.3 Internal Street Network

The masterplanning of the CPG owned lands has been developed in a collaborative and iterative process amongst the design team to ensure that the layout was designed to follow the road hierarchy with pedestrian at the top and vehicles at the bottom of the priority, in line with the principles of design set out in DMURS. The internal layout looks to maximise permeability and opportunities for walking and cycling. External access points including some pedestrian cycle only access points which are located along predicted desire lines to facilitate easy access to public transport, local services and amenities.

There will be five types of street typology provided within Fassaroe. These comprise the existing roads infrastructure at the eastern side of the site which is a Boulevard typology. Berryfield Avenue east west link to Ballyman Road is a Link Street. The typologies within the residential areas will comprise of local streets and homezone street types. The fifth typology is the existing Berryfiled Lane which has a boreen quality.

Figure 2.13 shows the five street typologies within the CPG Masterplan lands.

Figure 2-13: Street Typology and Layout



Typical details of each of these typologies are illustrated in **Figures 2.14 – 2.18** below.

Figure 2-14: Typical Cross Section of Boulevard Street (Existing – now referred to as Fassaroe Avenue)

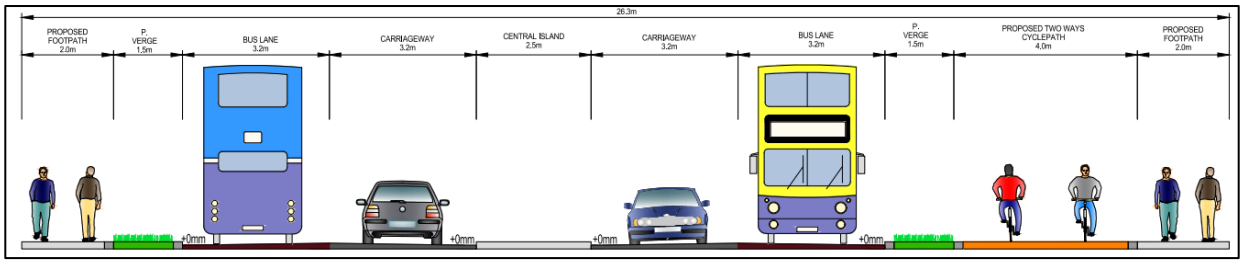


Figure 2-15: Typical Cross Section of Proposed Link Street

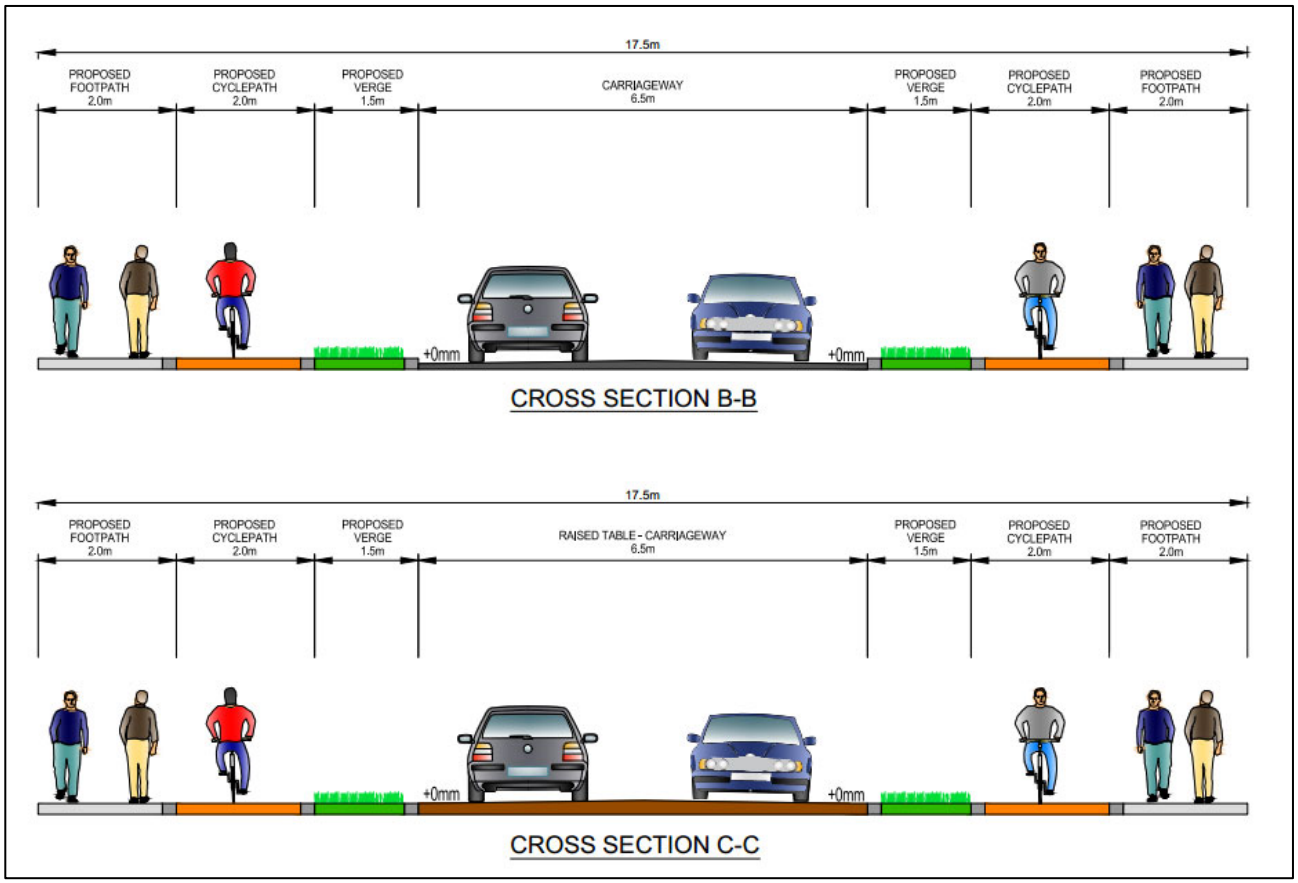


Figure 2-16: Typical Cross Section of a Local Street

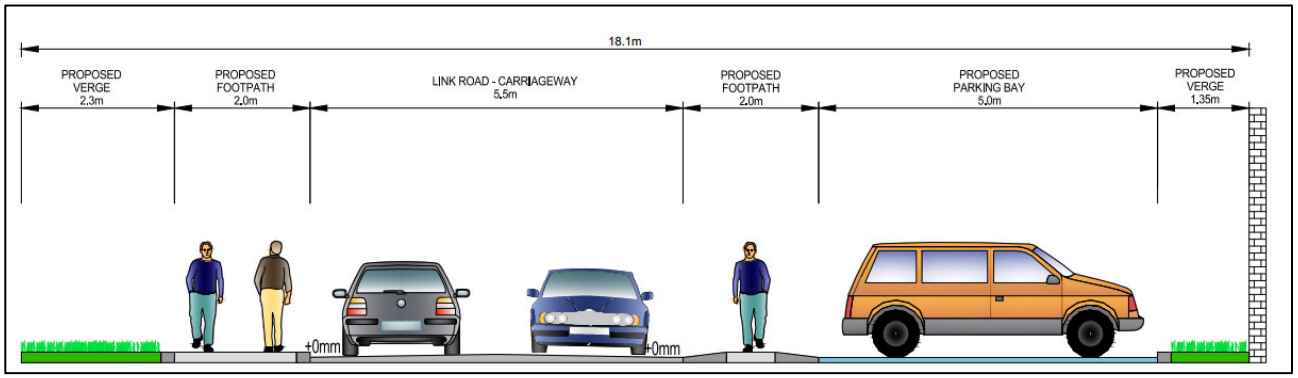


Figure 2-17: Typical Cross Section of a Homezone Street

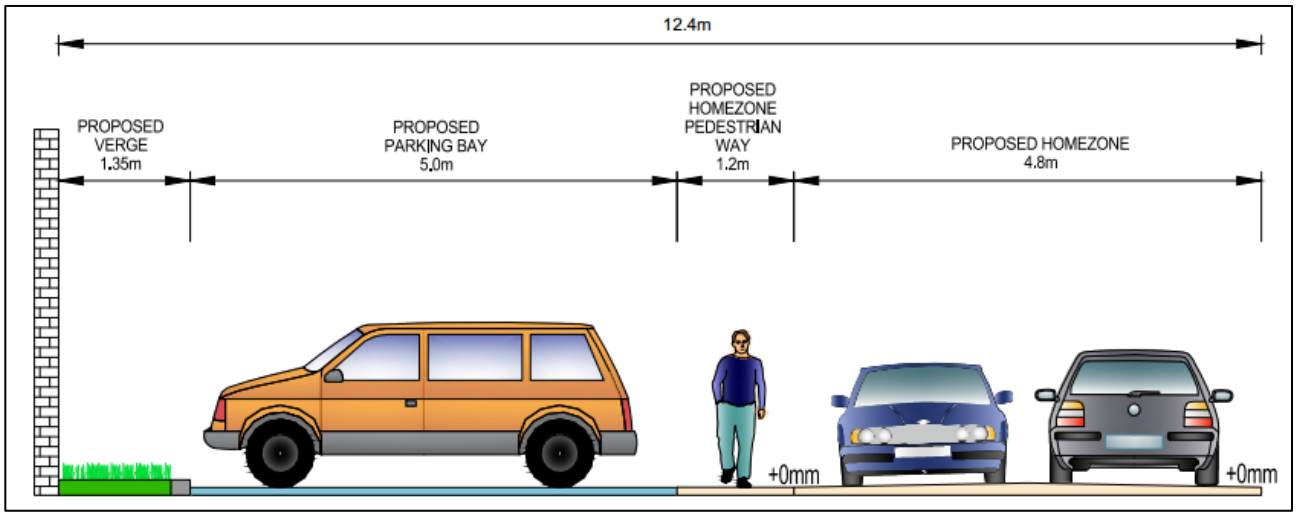
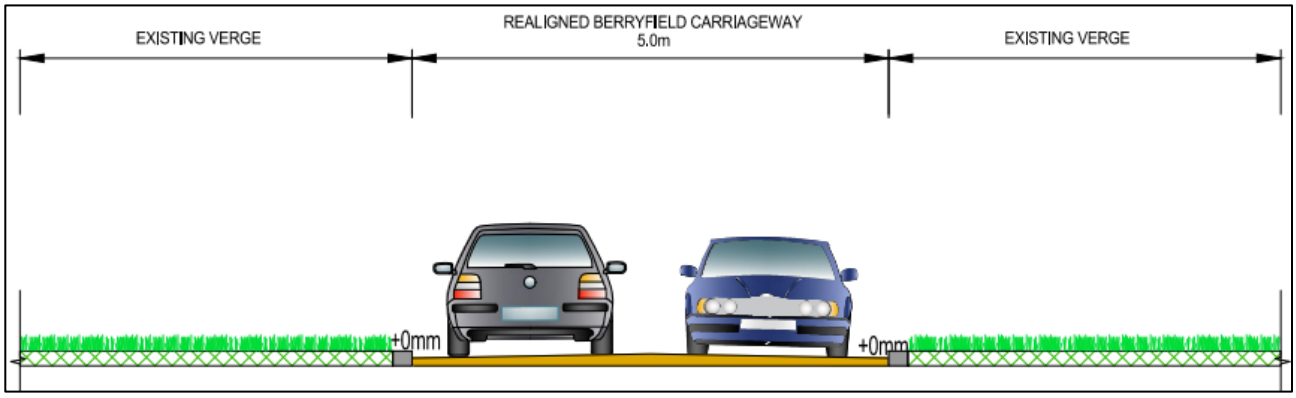


Figure 2-18: Typical Cross Section of Berryfield Lane (Existing)



2.5.4 Pedestrian and Cycle Provision

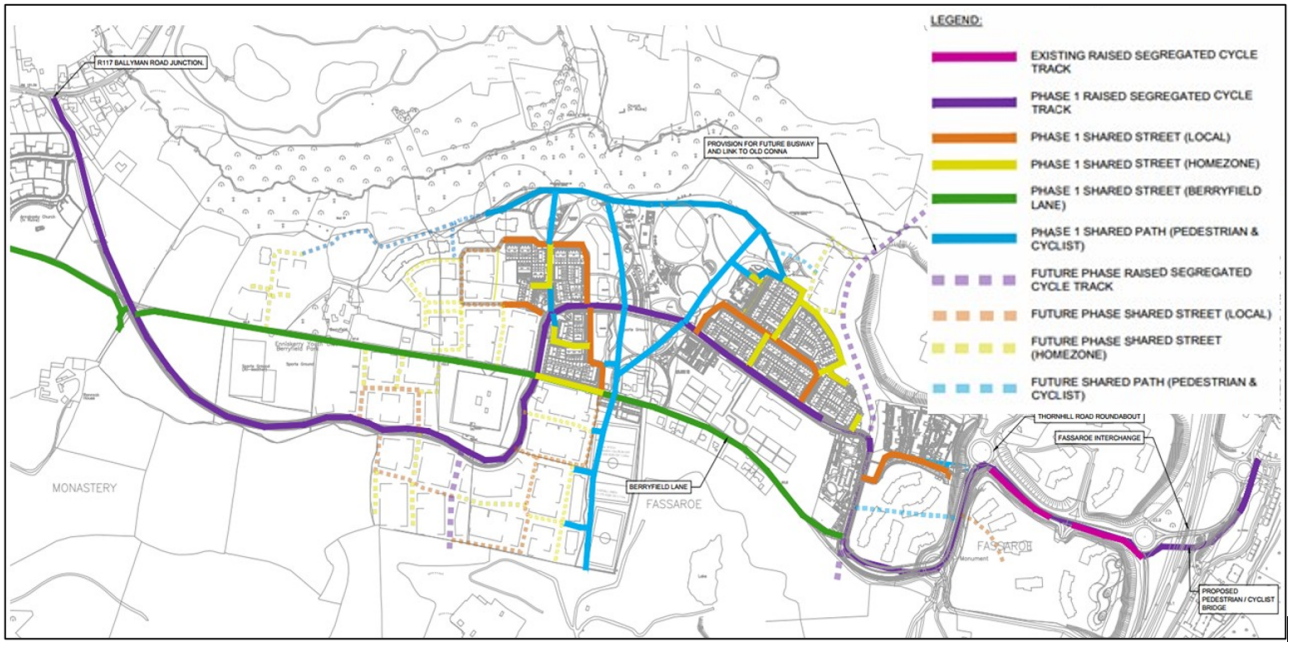
The provision of high-quality pedestrian and cyclist facilities within the development is central to the filtered permeability design principles. The development of the lands at Fassaroe accords with the '15-minute neighbourhood' principle in that the range of primary and secondary schools, commercial uses, leisure, amenity and employment later phases uses will provide residents and users with a significant range of facilities on their door stop that will encourage walking and cycling and minimise the need to travel short distances by private car.

The masterplan for the CPG owned lands has been developed to maximise connectivity and permeability through the site through a network of walking and cycling paths and tracks that provide directly overlooked linkages to and from all major destinations including public transport bus stops. The range of pedestrian and cyclists' facilities includes:

- Footpaths adjoining the external and internal road network;
- Internal pedestrian and cycle only routes;
- Segregated cycle tracks along Berryfield Avenue; and
- Segregated pedestrian and cycle links from the site across the N11 to Lavallee Roundabout.

The full range of proposed pedestrian and cyclist facilities is shown indicatively in **Figure 12.19**.

Figure 2-19: Pedestrian and Cycle Network



Cycle facilities will be a mix of segregated provision on Boulevard and Link Streets and integrated shared street provision on Local and Homezone streets in line with the principles set out in the National Cycle Manual and reinforced within DMURS.

Based on DMURS criteria, the proposed pedestrian and cyclist provision on the street network are summarised in **Table 2-1** and described in detail below.

Table 2.1: Pedestrian and Cyclist Provision

Street Typology	Pedestrian Provision	Cyclist Provision
Boulevard Street	Footpaths both sides	Segregated cycle track both sides
Link Street	Footpaths both sides	Segregated cycle track both sides
Local Street	Footpaths both sides	Integrated Shared Street Provision, cyclist shares carriageway with vehicles in low traffic speed and low traffic volume environment
Homezone Street	Shared Surface with 1.2m wide pedestrian comfort strip	Integrated Shared Street Provision, cyclist shares carriageway with vehicles in low traffic speed and low traffic volume environment
Berryfield Lane	Shared Surface	Integrated Shared Street Provision, cyclist shares carriageway with vehicles in low traffic speed and low traffic volume environment
Shared Path	Shared pedestrian & cycle track through open space	

2.5.5 Pedestrian / Cycle Route (including bridge across the N11) Connecting to Dargle Road Upper

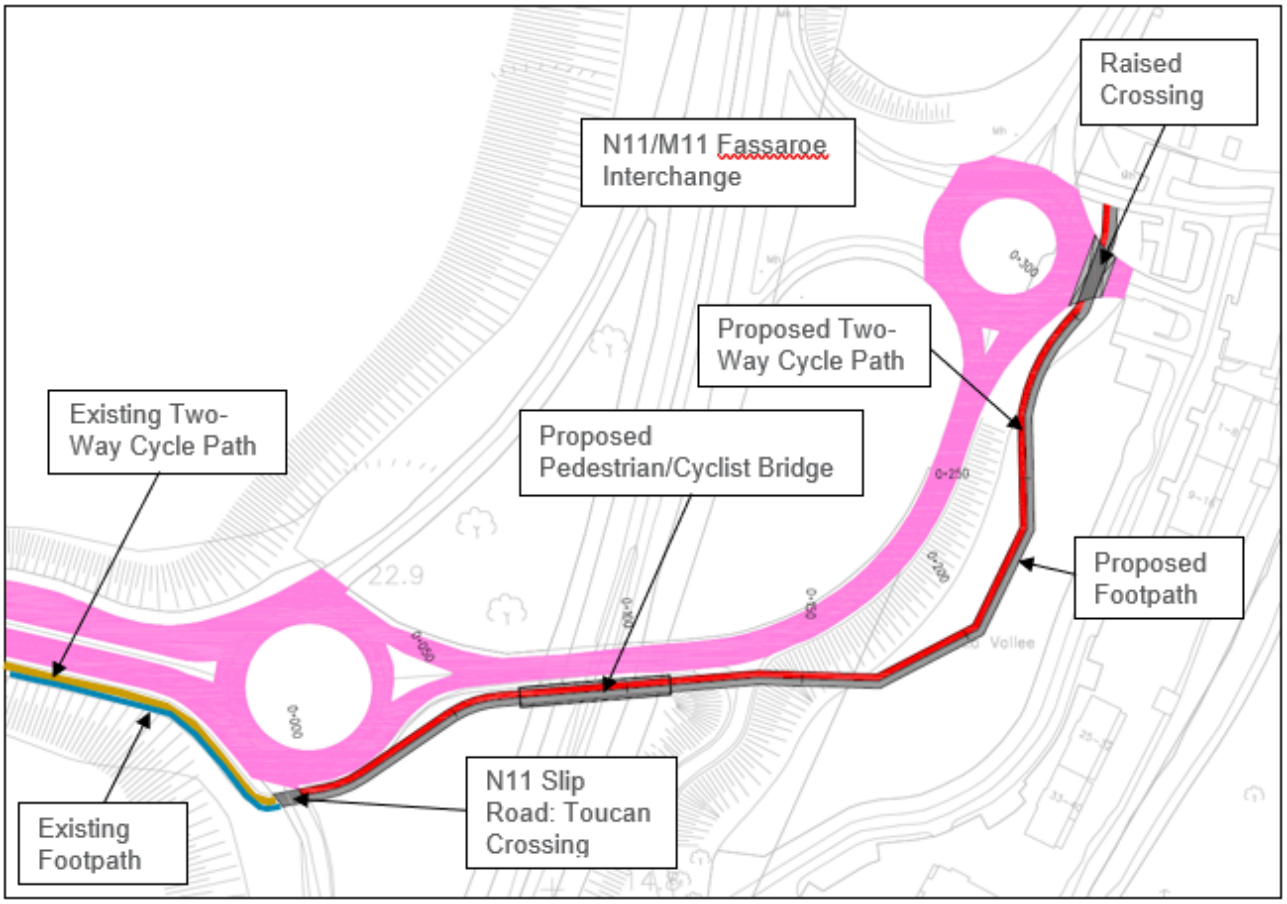
The segregated cycle track provided along the main east west link road will connect with the existing segregated cycle track already in place at the eastern extent of the Fassaroe lands between the Junction 6 roundabout and the Thornhill Road roundabout. From The Junction 6 roundabout a new segregated cycle track and footpath will be provided to link to the La Vallee roundabout at Upper Dargle Road. This will include a new pedestrian / cycle bridge immediately south of the existing road bridge. The bridge will comprise a main span of approximately 45m across the N11 which would accommodate future widening of

the N11 by an extra lane in each direction, if required as part of the N11 / M11 Junction 4 to Junction 14 Improvement Scheme.

The bridge construction will be undertaken by the applicant in consultation with Wicklow County Council and Transport Infrastructure Ireland. This bridge will serve the full build out of Fassaroe and will form a key link on cycle route W2a between Bray, Fassaroe and Enniskerry as set out in the Greater Dublin Area Cycle Network Plan. This cycle route will be fully completed through Fassaroe in the first phase of development. The bridge will be completed and open for use in advance of the occupation of dwellings in Phase 1.

The route of this new pedestrian / cycle connection across the N11 to Upper Dargle Road is shown in **Figure 2.20**.

Figure 2-20: Pedestrian / Cycle Route from Fassaroe to Upper Dargle Road



2.5.6 District Park / Active Open Space

The District Park will provide the principle green open space for the Fassaroe development. It will in time, along with future phases of development, also connect the Ballyman Glen with the Cookstown Dargle Glen creating a North - South green corridor enhancing biodiversity through the development.

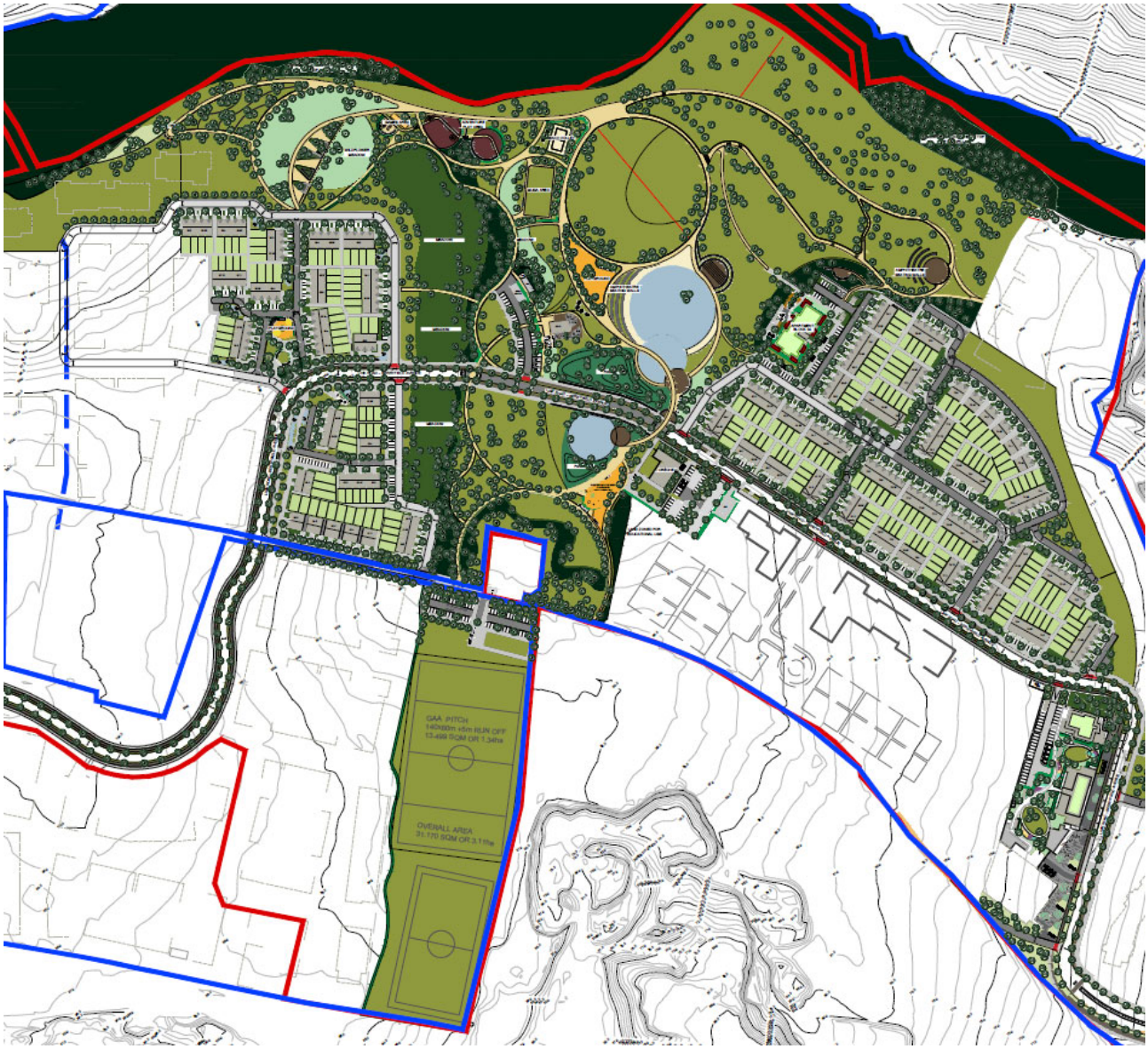
The Ballyman Glen SAC, straddles the County boundary between Dublin and Wicklow and extends beyond this proposed planning application boundary. It is orientated in an east-west direction with a stream running through the centre. Currently the glen is bounded by steeply sloping ground with Gorse and areas of woodland and scrub. The masterplan design retains the open space adjacent to this glen by locating the district park along its length acting as a buffer for the glen to ensure nature conservation and to discourage and prevent access into the glen through the use of landscape. The design of this open space has been sensitively developed to protect the SAC and its surrounding woodland with levels to the perimeter of the park seamlessly integrating with the existing levels so as to avoid any disturbance of the tree rooting zones of Ballyman Glen. The layout of the District Park including the Active Open Space is shown on **Figure 2.21**.

The District Park will consist of the components described hereunder.

2.5.6.1 Parkland Areas

The district park provides a sinuous arrangement of pathways through a variety of spaces. There are large open grassed spaces for both active organised sport and informal kick about spaces to occur. These spaces are punctuated with large parkland and native trees which reveal and frame views as one moves through the spaces. Open character and close character planting create a sequence and variety of parkland areas within the district park. Picnic tables and seating areas are provided throughout the park for passive recreation and areas for families to sit while others play close by.

Figure 2-21: Proposed District Park and Active Open Space



The park area to the north of Berryfield Lane provides generally for passive open space and recreation purposes but with active elements interwoven. Throughout the park active play is provided for by jogging and trim trails which also can be used for mountain biking. An undulating mounded area has been provided to the lower level of the park which can be utilised as a natural play area. This area is populated with dense tree planting to provide screening and extend the Ballyman Glen into the park. A wooded adventure play area and multi-use games area is proposed along the back of the apartment blocks, to provide for older children opportunities to play. The woodland will buffer noise and the elevated apartment blocks will provide for passive surveillance. The woodland will visually connect the park to the Ballyman Glen and create a naturalistic setting for families to enjoy but will discourage and prevent access into the glen through a dense landscaped buffer area.

The main open space provides open space for informal kick about spaces, or open ground to run and enjoy the outside space.

A large playground is proposed between the car park and main open space. This play area will be fenced to the perimeter with dog gates provided to create a safe area for young children to play. Seating benches are proposed so adults can sit and socialise while children play. Open spaces within the playground will be provided for buggies to be stored and a variety of equipment will be provided within a wet pour rubber safety surfacing.

The district park continues westwards between the Ballyman Glen and the future proposed apartment blocks. The park provides a range of informal kick about spaces and seating spaces with the jogging and trim trails extended to connect users from their homes into the wider district park. Strong connections are formed with a considered network of circulation routes maximising universal access to open space and amenity activities.

The district park extends south of the Link Road (Berryfield Avenue). The park will utilise a common design language, materials and planting layout connecting the spaces. 2 number raised uncontrolled crossing points will be provided either side of the park from the main arrival plaza at the east of the park and from the west, this will help to create a very permeable open, safe park to enjoy. The southern section of the park connects directly with Berryfield Lane and the proposed active open space connecting the park with the wider environment making an easily accessible high quality open space for all and providing for a future link between the north - Ballyman Glen SAC - and south – the Cookstown River valley.

To the southern section of the district park an additional toddler playground is proposed. This is located close to the proposed crèche and will provide additional opportunities to the crèche open play space. The crèche will have its own secure open play space immediately associated with the building. Smaller open spaces are provided for lying out or small ball play so creating a quieter park close to homes.

The park area to the south of Berryfield Lane provides for active recreation and will be laid out as playing pitches etc.

2.5.6.2 Attenuation Ponds with Viewing Platforms

One of the main elements of the district park are the Ponds. These are designed to provide an aesthetic focus in the park, maximise the restorative benefits of the open space, increase biodiversity and amenity and operate as part of the overall SuDS strategy for the development. The ponds are designed as 3 lily pads gradually stepping down in height and flowing from one into the next. Each pond provides a 600mm free board for water attenuation. The perimeter of the ponds will be formed with shelves to facilitate marginal planting. This coupled with riparian corridors flanking the ponds the biodiversity and amenity of the park is maximised.

Viewing platforms are dotted along a sinuous walkway across the ponds and strategically located information boards provide information re the Fauna and flora and the working of the attenuation ponds. A beach is proposed to the west of the largest lily pad where there is a gradual transition into the water, this will enable water fowl to enter and exit the pond freely and provide an opportunity for users to engage safely with the water. This beach will be formed in sand for safety, to reduce the risk of individuals throwing stones. The ground levels naturally rise in this area and a naturalistic amphitheatre is proposed with seating terraces radiating form the pond. This will allow users to sit and look over the water out to the spectacular views across the Ballyman Glen and beyond.

2.5.6.3 Path Infrastructure and Steps

To create a multifunctional park a wide variety of open spaces have been created, these spaces offer a range of experiences, providing for different ages groups and abilities. Some areas have been created as universally accessible with gentle gradients and in other areas the sloping topography has been retained and the challenge of the gradients has become part of the enjoyment of the space.

To the forefront of the design is creating a park that can be utilised by all. Universal access routes from the “Arrivals Plaza” through the parkland open space, around the attenuation ponds, to and from the car park and main playground have been provided. This provides for a variety of experiences encompassing a wide range of ages and abilities.

A hierarchy of paths has been created with the main circulation route 3m wide accommodating both cyclists and pedestrians. 114 no. bicycle parking spaces have been provided within the passive open space and

have been grouped in key locations. In addition, 26 No. bicycle parking spaces have been provided for the active open space.

The meandering circulation route means that spaces are concealed and revealed creating an exciting series of spaces. The intention is that this pathway will be an amenity for users to spend time, socialise and relax and enjoy the views and its unique setting. The sinuous pathway passes through a sequence of spaces of both naturalistic and ornamental planting, grass lawns, seating spaces which will all act as orientation points and focal landmarks along the way to create an exciting lively experience as one moves through the park. The variety of spaces will create a natural wayfinding strategy enabling users to easily navigate through the park and its amenities creating unique sense of place and inviting people to further explore the spaces. Other circulation routes are stepped with seating points to rest and enjoy views from the site providing immediate access to the lower and higher levels. The topography and stepped access routes is considered as an attraction in itself where the challenge is part of the experience.

Seating edges formed around pocket spaces along the central meandering pathway maximises the extent of informal seating opportunities. The seating edges are all inward facing to encourage social interaction. The space provides the opportunity for social gathering, lounging and resting points to users of the park.

There are a number of additional access points from the residential buildings and through the residential park to ensure permeability. A gently sloped access route is provided from the car park up into the main parkland area that can be utilised by older people, families with buggies, cyclists and wheelchair users etc. A sinuously shaped pathway provides breath-taking views over the Ballyman Glen and beyond.

2.5.6.4 Entrance Area

The main entrance area is located off the proposed main Link Road (Berryfield Avenue). At this point there is an area of hardstanding for events or park activities to take place and on a daily basis it provides a space for users of the park to enjoy views over the attenuation ponds with seating areas. A small designated area is proposed to provide a mobile ice cream van or local farmers produce stall. The entrance area also connects the park north and south by a generous raised crossing point, this will also act as a traffic calming measure along the main link road.

2.5.6.5 Crossing Points

Where Berryfield Lane intersects the District park to the north and the active open space to the south, a continuous raised platform will be created across the frontage to create a physical and visual link and gateway between the two spaces that prioritises pedestrian activity. The road surface will be treated with a different material to further reinforce the message that this is a pedestrian priority area. The gateway will be further enhanced by dense tree planting along the park edge creating a different feel to the road edge and also contributing to the traffic calming of this road section. The continuous crossing will be a continuation of the main pathway network and therefore its design creates a seamless link between either side of the park. A wetland and strategically dense tree planting to the north and the strategically located pond to the south coral the park users to these designated crossing points, hence creating a well-designed, safe and clear uninterrupted connection. Low verge planting along this section of Link Road will further contribute to the guidance of people. At the car park entrance and kiosk an additional traffic ramp is created to further slow vehicular speed along this section of the Link Road. Further south in the Park a similar approach has been taken for the crossing point with the existing Berryfield Lane connecting the park to the more active open space.

2.5.6.6 Kiosk and Car Park Area

A small car park providing for 40 no. spaces including 4 no. disabled car park spaces is proposed to the west of the arrival plaza accessed immediately from the Link Road Berryfield Avenue. This car park is densely planted with trees to the perimeter and arranged on a sinuous curving line to help integrate the car park into the surroundings and reduce the visual impact of the cars. While residents of the Fassaroe development will be able to access the district park though a network of pathways this district park will welcome visitors from a wider catchment area to come and enjoy the space and park facilities and it is for these users that this car park has been provided. Strong connections are also provided for visitors to access the park through a designated cycle track along the length of Berryfield Avenue or along the shared surface route of Berryfield Lane. In addition to these facilities a bus stop is proposed close to the district park to encourage further sustainable modes of transport. The park will not be gated and will remain open to the public throughout.

The car park area also allows room for a kiosk type structure which can operate as a coffee shop facility with long views over the glen, the new ponds and to the sugarloaf. The kiosk will also provide for public toilet facilities and function as a security and maintenance storage kiosk. In the short term it can also deliver a local retail function for residents of Fassaroe pending the delivery of a Neighbourhood Centre within the development.

2.5.7 Soft Landscaping and Biodiversity Enhancement

The overarching aim for the establishment of vegetation communities in Fassaroe District Park is to produce a mosaic of native habitats. This is seen to be a way of maximizing the biodiversity potential of the site, providing new opportunities for expansion of (and cross-interaction between) habitats whilst also providing attractive areas of green open space with high amenity value.

Whilst some areas will have a naturalistic character, others are more formal. Some areas will be exposed whilst others will in time be more intimate and sheltered, providing opportunities for interest and a varied experience whilst moving around the site.

The habitats that are proposed across the park include:

- Areas of native deciduous and mixed woodland;
- Areas of mixed scrub,
- Areas of tall herb grassland;
- Wildflower meadows
- Areas of close-cropped amenity grassland;
- Marshland and riparian planting;
- Areas of loose rock and scree for lichens, mosses and chasmophytic plants.

2.5.8 Residential Development

2.5.8.1 Total Units Proposed

The proposed development incorporates a total of 650 No. residential units. These comprise of 241 no. houses and 409 no. apartments.

Of the 409 no. apartments proposed, the unit breakdown is as shown in **Table 2.2**.

Table 2.2: Total Apartments, Types and Numbers

Apt Type	No. Units	% of Apartments
1 Bed (incl. 1 Bed plus study)	99	24%
2 Bed	279	68%
3 Bed	31	8%
Total Apts	409	

Of the 241 no. houses proposed, the breakdown of units is as shown in **Table 2.3**.

Table 2.3: Total Houses, Types and Numbers

House Type	No. Units	% of Houses
3 Bed (+ study)	50	21%
4 Bed	88	36%
5 Bed	103	43%
Total Houses	241	

These result in an overall unit size breakdown as shown in **Table 2.4**.

Table 2.4: Total Houses and Apartments, Types and Numbers

Unit Type	No. Units	% of Units
1 Bed	99	15%
2 Bed	279	43%
3 Bed / 3 bed + study)	81	12%
4 Bed	88	14%
5 Bed	103	16%
Total Units	650	

2.5.8.2 Apartment Blocks Proposed

The proposed apartments are provided in 4 No. apartment blocks and within the Neighbourhood Centre, above the proposed ground floor retail.

Three of the blocks (Blocks 1, 2 and 3) are located at the eastern side of the development. These three blocks are five storey over basement car parks. Blocks 1 and 2 have a combined basement with a separate basement to Block 3. These basements also contain secure bicycle parking and segregated waste collection points. Blocks 1 – 3 are located within Character Area 1 along with the proposed Neighbourhood Centre.

Block 4 is a four storey building with no basement. Car parking for residents of Block 4 will be provided at grade at the streets surrounding the block. 2 no. single storey bicycle stores are proposed on the northern side of the apartment block, one of which includes a bin store. These provide for secure residents bicycle parking and segregated waste collection. Block 4 is located within Character Area 2.

The breakdown of apartment types per Block is shown on **Table 2.5**.

Table 2.5: Apartment Type Per Apartment Block

Block	Apartment Type				Total
	1 Bed	1 Bed & Study	2 Bed	3 Bed	
Block 1	13	0	77	6	**96**
Block 2	18	0	82	6	**106**
Block 3	47	0	53	12	**112**
Block 4	5	0	23	4	**32**
Neighbourhood Centre	13	3	44	3	**63**
TOTAL	**96**	**3**	**279**	**31**	**409**

2.5.8.3 Proposed Housing Areas and Types

The housing element proposed within the development comprises of 3, 4 and 5 bed dwellings. These are provided across three character areas; character areas 2, 4 and 5. The different house types and numbers in each area are presented in **Tables 2.6 – 2.8** below.

Table 2.6: House Types and Number in Character Area 2

Character Area 2 House Types	Description	No. Proposed
2A	5 Bed – Terrace and semi-detached house – 3 storey	52
2B	5 Bed - End of terrace - side entrance– 3 storey	8
2B1	5 Bed - End of terrace - side entrance special end – 3 storey	2
2C	4 Bed - Terraced house – 2 storey	48
2D	4 Bed - End of terrace - side entrance – 2 storey	4
2D1	4 Bed - End of terrace – side entrance special end – 2 storey	6
2E	3 Bed - Terraced house – 2 storey	28
2F	5 Bed – Terraced house – 3 storey	4
Total		**152**

Table 2.7: House Types and Number in Character Area 4

Character Area 4 House Types	Description	No. Proposed
4A	5 Bed - Terraced house – 3 storey	30
4B	5 Bed - End of terrace - side entrance – 3 storey	7
4C	4 Bed - Terraced house – 2 storey	6
4D	4 Bed - End of terrace - side entrance – 2 storey	1
4E	3 Bed - Terraced house – 2 storey	10
Total		**54**

Table 2.8: House Types and Number in Character Area 5

Character Area 5 House Types	Description	No. Proposed
5C	4 Bed - Terraced house – 2 storey	17
5D	4 Bed - End of terrace - side entrance – 2 storey	6
5E	3 Bed - Terraced house – 2 storey	7
5E1	3 Bed – End of terraced house – 2 storey	5
Total		35

2.5.8.4 Layout of Housing

Housing is provided in semi-detached and terraced blocks with a maximum of 6 No. units in a terrace. The majority of the houses have in curtilage car parking to the front and all have private gardens to the rear. End of terrace or semi-detached houses which side on to a public street have their front entrance on the gable side of the house and appear as dual frontage units. In addition, public open space strips or private garden areas are generally provided at these locations. These design features eliminate the potential for long runs of rear garden walls bounding onto public streets, and also deliver secure and defensible private space for all dwellings.

All houses have external access to rear gardens via side and rear laneways incorporated into the housing layout. **Figure 2.22** shows a photograph of this design approach adopted by the same developer in their housing developments at Honeypark and Cualanor in Dún Laoghaire.

Differences in ground levels across the site will be accommodated by stepping levels of houses within a terrace and also by sloping of rear gardens. This will ensure private open space is useable and easy access can be achieved for all. **Figure 2.22** also shows this stepping within a terrace and also along the length of a back garden (see stepped fence panels).

2.5.8.5 Design and Materials

The houses proposed will be primarily finished with a high-quality brick finish on all primary elevations facing the street or other public realm areas. As a low maintenance material, a variety of different bricks chosen for different character areas will ensure that the streetscapes created will endure and retain a high-quality feel for longer. The roofs of the houses will be completed with a dark coloured concrete roof tile to complement the brickwork & U-PVC windows add to the high thermal efficiency of each unit and will also be very low maintenance components.

The apartment units will also be finished in brickwork matching the houses in their respective character areas. Durable materials on management-controlled buildings is critical to avoid the deterioration of external finishes over time.

Figure 2-22: Photo of Rear Lane Access at Other Development by the Applicant

2.5.9 Pocket Parks

Additional public and communal open space provision is proposed within the residential areas. The distribution and layout of these spaces provide for visual and physical connections to the district park insofar as is reasonably possible. They are also located so as to benefit houses which have less direct visual connection with the main district park.

These residential pocket parks have been designed for the local residents and provides for informal meeting and gathering places. They are fully overlooked due to their locations within residential cells with adjacent dwellings providing for passive surveillance. A low-key toddler playground is proposed in some instances for local residents. This compliments the larger play area located within the district park. This low-key playgrounds favour the immediate local residents, without attracting increased vehicular traffic to utilise the facilities.

Traffic calming measures like raised table crossings and shared surfaces are proposed to access the pocket parks. These aim to reduce traffic speeds and highlight to motorists that pedestrians have priority. Gently sloped pathways will provide for universal access.

2.5.10 Creche

A crèche of 733sq.m with capacity for 138 no. childcare spaces approx. is proposed to be delivered as part of the Phase 1 development. This is proposed to be located at the western end of the Community and Education zoned lands adjacent to the proposed district park. This is a central location which allows the crèche to benefit from the amenities of the public open space both visually and also allowing easy and safe physical access. It will also be immediately adjacent to the school complex (on the lands zoned for Community and Education use under the Local Area Plan) in the long-term.

2.5.11 Retail Unit / Café Kiosk

The first phase of the Neighbourhood Centre proposed under the current application will be provided at the latter stages of construction, when an on-site customer base has been established. In advance of this, in order to provide some element of local retail provision within Fassaroe in the short term, it is proposed to provide a retail unit / café kiosk within the public park close to the main access road through the site. At 108sq.m. this will be of a scale akin to a traditional local shop. In the short term it will serve local everyday convenience requirements for the Phase 1 residents. In the long term this local café / retail unit which would be compatible with and enhance the amenities of the District Park. An Artists Impression of the kiosk is provided at **Figure 2.23**.

Figure 2-23: Artists Impression of Proposed Retail Unit / Café Kiosk

2.5.12 Neighbourhood Centre Phase 1

The proposed development comprises the first phase of a Neighbourhood Centre at Fassaroe. This first phase comprises of ground floor parking, retail, café and community concierge / gym uses. At podium level above this are two apartment blocks of five storeys above ground.

The total retail provision proposed within the neighbourhood centre is 1,050sq.m. This comprises of two units which are in turn sub-dividable so as to be able to accommodate a variety of different potential future end users. Permission is also sought for these units for retail, retail services or commercial uses – again to provide for flexibility of end users.

A café of 335 sq.m is also proposed, as well as a community residents concierge area (490sq.m.) which will serve residents of the entire future Fassaroe development. This service will provide a number of functions for residents such as:

- Contact point for maintenance or operational queries in respect of public areas within the development.
- Meeting facilities for residents.
- Post / parcel collection service.
- Information in respect of public transport services and car club operations within Fassaroe.

A second phase of the Neighbourhood Centre will be provided as part of a future phase of development at Fassaroe. This will comprise an anchor convenience store (envisaged to be of the order of 1,650sq.m. approx.).

This phased delivery of the Neighbourhood Centre will establish a mix of services and amenities for residents at an earlier stage and will provide for the immediate everyday convenience needs of the Phase 1 population. It will also control the provision of a larger format retail store until there is a larger onsite population at Fassaroe to sustainably support such a service.

Figure 2.24 presents an Artists Impression of the final Neighbourhood Centre including both the currently proposed Phase 1 element (on the right hand side of the image), and the future anchor unit phase (on the left hand side of the image).

Figure 2-24: Artists Impression of Final Neighbourhood Centre (Current Phase 1 and Future Phase)

2.5.13 Demolition of Existing Dwelling at Berryfield Lane

There is an existing single storey dwelling on the northern side of Berryfield Lane which will be demolished to accommodate the district park and to enhance the connectivity between the passive and active parts of the park. This dwelling is not protected.

2.5.14 Car Parking Proposals

A range of parking solutions is proposed across the development including in curtilage private parking within house, parking bays perpendicular to streets, parking plots and basement car parking. Car parking provisions have been designed so that they do not dominate the visual character of the surrounding environment.

Car parking is provided in accordance with the provisions in WCC Development Plan- Volume 3 Appendix 1 Development Standards Section 7 Table 7.1. The level of car parking proposed is appropriate to the location and level of access to public transport and active travel infrastructure to ensure sustainable travel is not undermined.

2.5.14.1 Residential Car Parking

All houses are provided with 2 No. spaces – either in curtilage or within parking bays adjacent to houses.

For Apartment Blocks 1 and 2, 253 no. car parking spaces are provided in a combined basement, along with 5 no. surface level spaces. A total of 258 No. parking spaces are provided, of which 13 No. are disabled access spaces.

At Block 3 there are 67 No. car parking spaces provided at surface level, and 68 no. spaces at the Undercroft / Basement Floor level. Of these 135 no. spaces, 7 No. are disabled access spaces.

Serving Block 4 there are 42 No. surface level parking spaces provided of which 2 No. are disabled access spaces.

2.5.14.2 Neighbourhood Centre Car Parking

Parking at the Neighbourhood Centre is provided within the undercroft / basement area as well as at surface/ podium level. This comprises of:

- Commercial parking total 120 No. spaces consisting of 10 No. surface / podium level spaces and 110 no. undercroft / basement spaces, of which 7 No. are disabled access spaces
- Residential parking total 77 No. spaces consisting of 38 No. surface / podium level spaces and 39 No. undercroft / basement spaces, of which 4 No. are disabled access spaces.

2.5.14.3 Creche Car Parking

The proposed creche has a designated adjacent car park comprising of 28 no. spaces.

2.5.14.4 District Park / Active Open Space Car Parking

Parking to serve the Park is provided in two locations given its size, configuration and differing use profile. There is a parking area with 33 No. spaces proposed within the passive District Park accessed from the northern side of Berryfield Avenue (the east-west link road). 4 No. of the parking spaces proposed here will be disabled access spaces. In addition, 46 No. spaces are proposed in a parking area on the southern side of Berryfield Lane, with 4 no. of these being disabled access spaces. These will serve the Active Open Space lands, but also the passive district park area which is directly accessible on the northern side of Berryfield Lane.

2.5.14.5 Electrical Vehicle Charging Provisions

The strategy for Electrical Vehicle Charging (EVC) provisions at Fassaroe is set out below in respect of the different elements of the development.

Housing Areas: The developer will provide cabling to in curtilage parking and parking bays serving the proposed houses. This will allow easy installation of car charging points for residents in the future as required.

Apartment Buildings: When being constructed basement parking areas (and surface parking spaces in the cases of Blocks 3 and 4) will be cabled to allow for installation of car charging points at each parking space as required in the future. The electricity supply to these charging points will be from the landlord supply and managed by an interface system such as 'Randridge' to manage usage and payment for use at any given charging point.

Neighbourhood Centre: It is proposed to provided 2 No. EVC spaces within the car parking areas serving the retail / commercial use.

2.5.15 Bicycle Parking

2.5.15.1 Residential Bicycle Parking Provisions

Residential bicycle parking is proposed as follows:

Apartment Blocks 1 and 2: There are a total of 606 no. spaces provided. 268 No. bicycle parking spaces proposed within the basement of Blocks 1 and 2. At the Ground Floor, there are an additional 324 No. bicycle spaces provided, with 14 No. surface level spaces.

Block 3: There is a total of 280 No. bicycle spaces proposed. This comprises of 250 No. spaces within the basement and 30 No. at surface level.

Block 4: At Block 4 secure bicycle parking is provided in a single storey bicycle and waste storage unit on the northern side of the apartment building. This shelter provides 64 No. spaces, with an additional 16 No. spaces at surface level. A total of 80 No. bicycle spaces is provided.

Neighbourhood Centre Bicycle Parking: A total of 168 No. spaces are provided at podium level, including 120 No. resident spaces and 48 No. visitor spaces.

2.5.15.2 Neighbourhood Centre Bicycle Parking

Public bicycle parking provision is proposed at a number of points within the public plaza area around the Neighbourhood Centre. This will provide parking primarily for people accessing the services of the Neighbourhood Centre. It will also serve those transferring to bus services, but given the presence of bus stops along the length of the east-west Link Road (Berryfield Avenue) is it likely that most residents of Fassaroe accessing bus services out of the area will do so by foot. A total of 36 No. cycle spaces are provided.

2.5.15.3 Creche Bicycle Parking

30 no. secure bicycle parking will be provided at the proposed creche to serve employees and parent drop-off/pick-up at the creche and to encourage sustainable modes of travel. Staff parking will be covered.

2.5.15.4 District Park / Active Open Space Bicycle Parking

77 no. bicycle parking stands are provided at a number of convenient and safe locations around the park. These are:

- Adjacent to the car parking area at the Active Open Space lands,
- Inside pedestrian entrance to the southern section of the passive open space area to the south of Berryfield Avenue overlooking one of the proposed ponds,
- Adjacent to the toddler and children's playground within the southern section of the passive open space,
- Inside pedestrian entrance to the northern section of the passive open space area to the north of Berryfield Avenue,
- Adjacent to main car parking area on northern side of Berryfield Avenue,
- Adjacent to the children's playground within the northern section of the passive open space,
- At the Multi Use Games Area (MUGA) at the northern end of the passive open space.

In total, 154 no. cycle spaces are provided to serve the district park / active open space.

2.5.16 District Heating System

A centralised district heating system is proposed to serve all houses and apartments. The plant is proposed to be centralised in the basement of one of the apartment blocks and will be a combination of heat pumps, combined heat and power engines and boilers. The boilers are only envisaged to operate during peak periods and this will equate to 15% of the operation period of the system. Using a district heat plant allows

significant benefits of scale with the overall capacity required great reduced due to the diversified load profile.

All of the plant installed will be A rated, at the highest efficiency level and the repair maintenance and replacement of the system will all be captured in the single billing solution. In the future if a waste heat source becomes available it will be possible to network this around the site.

2.5.17 Services and Utilities Proposals

A number of new and upgraded utilities / services are proposed as part of the proposed Phase 1 development application. Utilities and services comprise, inter alia, water mains, storm water and foul sewers; electricity ducts and cabling; gas mains; as well as telecommunications ducting and cabling. In addition, and as part of the initial development the provision for suitably protected underground crossings of the roadbed will be made where required. New utilities will be laid at a location, depth and spacing in agreement with the utility owner. They will also be tested and commissioned by the utility owner prior to any of the existing utilities being decommissioned. The existing network on site includes the following infrastructure:

- Watermains – including existing 24", 33" and 800mm strategic mains;
- Foul Sewers;
- Storm Water Drainage;
- Gas Network;
- Electricity (110 kV, 38 kV and other lower voltage lines);
- Telecommunications (such as Eircom);
- Public Lighting; and
- Utilities owned by other stakeholders

The proposed services include for the provision of the services to facilitate the proposed Phase 1 development but also, in the majority of cases, to provide the service requirements associated with the ultimate development anticipated under the Action Area for the lands in question. A description of each of those services is as outlined below.

2.5.17.1 Water Supply

The proposed watermains has been designed in accordance with the following documents:

- Water Infrastructure Standard Details, Connection and Developer Services, Construction Requirements for Self-Lay Developments, July 2020 (Revision 04) IW-CDS-5020-01;
- Design Risk Assessment for Water Infrastructure Standard Details, Connection and Developer Services, Construction Requirements for Self-Lay Developments, July 2020 (Revision v4.02) IW-CDS-5020- 02.
- Code of Practice for Water Infrastructure, Connection and Developer Services, Design & Construction Requirements for Self-Lay Developments, July 2020 (Revision 2) IW-CDS-5020-03.
- Design Risk Assessment Associated with Code of Practice for Water Infrastructure, Connection and Developer Services, July 2020 (Revision 2) IW-CDS-5020-04.

The existing water supply infrastructure in the area comprises of a 24" trunk main which traverses the eastern Action Area lands of the Fassaroe development and a 33" main which traverses the western lands of the proposed Fassaroe Development. Both of these transfer treated water from the Irish Water Vartry Waterworks to the Stillorgan reservoir. An 800mm trunk main was constructed through the proposed Fassaroe development in 2009 to interconnect both pipes along a route parallel to Berryfield Lane. Wicklow County Council have a connection from this main and pump water from it to Killegar Reservoir to supply the Enniskerry area. There are connections from the trunk mains to supply water locally, with recent improvement works being carried out to improve the supply at Berryfield lane.

The current permanent plan for the region is to supply water via two storage reservoirs permitted at Ballyman – high and low level reservoirs (at 100m and 120m OD). This will serve the future water supply needs of Fassaroe lands and general south Dun Laoghaire /North Wicklow lands. These reservoirs will be served by the existing 33" main. These reservoirs are permitted.

As part of the multiple liaison / discussions with Irish Water in relation to this application, a pre-connection application for 2,000 units on the entire Cosgrave Property Group landholding was submitted to Irish Water on the 21st of March 2019 with a confirmation of feasibility received on the 24th of April 2019. To allow for a phased solution for the development a revised 650 unit pre-connection application was submitted to Irish Water on the 16th of July 2021 with a confirmation of feasibility received on the 8th of November 2021.

It is agreed with IW that a proposed temporary reservoir will be constructed as part of the phase 1 development that will be supplied from the existing 800mm along Berryfield Lane and will be located within apartment Block 3 at the eastern end of the site to allow for required management and maintenance. The temporary reservoir will have a maximum volume of 98m3 of capacity and has been sized based on providing sufficient storage to allow for water supply to the phase 1 during times of low pressure from the IW main supply.

Following completion of the proposed Ballyman Reservoir and associated infrastructure by IW which have been indicated by IW in the confirmation of feasibility letter to be due for completion in 2022, potable water supply for the proposed developed will be transferred and the temporary reservoir will be decommissioned. All necessary connections required to connect to the new mains from the Ballyman Reservoir have been included as part of this application and will be constructed as part of the proposed phase 1 construction works.

The proposed potable water supply for the site has been designed in accordance with Irish Water Code of Practice and standard construction details. The watermain throughout the site will be sized to meet Irish Water requirements and standards. In line Fire Hydrants will be located on the watermains in accordance with Irish Water standard construction details and “2006 Building Regulations” (Part B Fire Safety), so that no Fire Hydrant is > 46m and < 6m from any building. Fire Hydrants will be provided at a minimum rate of 1 for every 1000m2 of the area covered at ground level in accordance with “2006 Building Regulations” (Part B Fire Safety).

2.5.17.2 Foul Waste Disposal

The proposed Foul Drainage has been designed in accordance with the following documents:

- Wastewater Infrastructure Standard Details, Connection and Developer Services, Construction Requirements for Self-Lay Developments, July 2020 (Revision 04) IW-CDS-5030-01.
- Design Risk Assessment for Wastewater Infrastructure Standard Details, Connection and Developer Services, Construction Requirements for Self-Lay Developments, July 2020 (Revision v4.02) IWCDS-5030-02.
- Code of Practice for Wastewater Infrastructure, Connection and Developer Services, Design & Construction Requirements for Self-Lay Developments, December 2020 (Revision 2) IW-CDS-5030-03.
- Design Risk Assessment Associated with Code of Practice for Wastewater Infrastructure, Connection and Developer Services, July 2020 (Revision 1) IW-CDS-5030-04.

The nearest existing foul water connection to the proposed Fassaroe development is located close to the Berryfield Lane Roundabout at the western end of Fassaroe Lane. This sewer line was constructed by the Cosgrave Property Group in anticipation of a previously proposed (but not constructed) Fassaroe Business Park development and it caters for the entire development lands. This sewer system ultimately connects to an existing 450mm diameter sewer, which was laid under the N11 National Road by CPG as part of the above development and which in turn connects into the Upper Dargle Road sewer. The Upper Dargle Road sewer is a 525mm diameter sewer which drains the western Bray catchment into the existing system.

As part of the multiple liaison / discussions with Irish Water in relation to this application, a pre-connection application for the 2000 unit Masterplan lands was submit to Irish Water on the 21st of March 2019 with a confirmation of feasibility received on the 24th of April 2019. To allow for a phased solution for the development a revised 650 unit pre-connection application was submitted to Irish Water on the 16th of July 2021 with a confirmation of feasibility received on the 8th of November 2021.

A recent Drainage Area Plan (DAP) was undertaken by Irish Water to determine the capacity of the existing Foul drainage network within Bray. It is noted that some constraints within the existing network may need some upgrade works, however, none are envisaged as part of the phase 1 application. Bray PS and the Shanganagh WWTP have sufficient capacity to cater foul loadings from Fassaroe.

2.5.17.3 Surface Water Management

2.5.17.3.1 Surface Water Drainage Design

The majority of the Phase 1 lands (and indeed the wider Fassaroe Action Area lands) drain naturally at present to the Brook, Cookstown and Dargle River systems. There are minimal existing piped storm drainage facilities except in the lower eastern section of the Fassaroe lands, where water and drainage services were previously installed by the Cosgrave Property Group in anticipation of a previously proposed Business Park development which ultimately did not proceed. This existing storm drainage system extends from the Berryfield Lane roundabout eastwards to the N11 National Road. A connection is available at this roundabout at the head of the system to a 750mm diameter culvert laid under the N11 Road, into the River Dargle.

The new network to serve the Phase 1 development lands will be provided within the alignment of the proposed roads network with spurs into individual development areas. Soakaway areas will be provided throughout the development in order to retain infiltration rates as close to existing pre-development conditions as possible. The overall network will allow excess flow in storm events to discharge to the County Brook at a controlled rate via the proposed attenuation ponds within the District Park, and the River Dargle and the Cookstown Stream, via the connection previously installed as described above.

The proposed Surface Water Drainage including SuDS has been designed in accordance with the following documents:

- Wicklow County Development Plan 2016 – 2022.
- Greater Dublin Strategic Drainage Study (GDSDS).
- CIRIA report C753 The SuDS Manual-v6.

The principles behind the proposed design have been discussed and agreed in principle between Atkins and Wicklow County Council (WCC) drainage department.

The proposed SuDS measures included (where suitable) within the design proposal are as follows:

The proposed SuDS measures included (where suitable) within the design proposal are as follows:

- Swales in open space areas adjacent to roads.
- Permeable paving type systems in light traffic areas (parking bays).
- Porous asphalt in parking bays within car park areas
- Green Roofs to a minimum of 60% of the total roof area of suitable flat roofs (apartments).
- Underground Modular attenuation system within green corridors / park areas.
- Filter Drains in rear gardens where suitable.
- Attenuation Ponds incorporated into landscape features in public parks.
- Flow Control devices including vortex and orifice plates.

Surface water generated from the proposed development will be conveyed through a new surface water network including SuDS and attenuated at the agreed Qbar greenfield run-off rates prior to discharging to the existing watercourse / storm drainage network.

The site drainage will be designed in compliance with GDSDS Design Criteria and SuDS design criteria in accordance with CIRIA report C753.

Interception Volume – Criterion 1.1

Interception storage volume is based on 80% runoff from paved areas and 0% runoff from pervious surfaces for the first 5mm of rainfall.

Treatment Volume – Criterion 1.2

Interception storage volume is based on 80% runoff from paved areas and 0% runoff from pervious surfaces for the first 15mm of rainfall.

River Regime Protection – Criterion 2

Agreed Qbar runoff rates agreed with Wicklow County Council are indicated in the Atkins Stormwater Impact Assessment Report submitted as part of the current application.

Levels of Service – Criterion 3

There are four criteria for levels of service. These are:

- Criterion 3.1: No external flooding (30-year high intensity rainfall event)
- Criterion 3.2: No internal flooding. (100-year high intensity rainfall event).
- Criterion 3.3: No internal flooding. (100-year river event and critical duration for site storage)
- Criterion 3.4: No flood routing off site except where specifically planned. (100-year high intensity rainfall event)

River Flood Protection – Criterion 4

Of the three methods referred to in the GDSDS for establishing River Flood Protection, by comparison of the pre and post development runoff volumes, (Criteria 4.1, 4.2 and 4.3 respectively), Criteria 4.3 has been selected most suitable for use on this proposed site. Figure 2.25 below presents an extract from the GDSDS, section E2.4 which details the long-term formula for which Qbar Rural is applicable:

A 20% uplift will be applied for climate change.

A review of the SI information for the site indicates that the ground is predominantly sandy gravelly CLAY. Based on these findings CIRIA report C753 indicates a moderate runoff potential (soil type 3). Therefore, the soil type has is a poor infiltration media. The SuDS system will be designed based on these findings.

Further details associated with the surface water proposals are as outlined within the Atkins Stormwater Impact Assessment Report provided with the application.

Figure 2-25: Long Term Formula for which Qbar Rural is Applicable (Extract from section E2.4 of GDSDS)

$$Vol_{xs} = RD.A.10\left[\frac{PIMP}{100}(\alpha 0.8) + \left(1 - \frac{PIMP}{100}\right)(\beta.SOIL) - SOIL\right]$$

where:

Vol_{xs}	is the extra runoff volume (m^3) of development runoff over Greenfield runoff
RD	is the rainfall depth for the 100 year, 6-hour event (mm)
PIMP	is the impermeable area as a percentage of the total area (values from 0 to100)
A	is the area of the site (ha)
SOIL	is the "SPR" index from FSR
$\alpha 0.8$	is the proportion of paved area draining to the network or directly to the river (values from 0 to1) with 80 percent runoff
β	is the proportion of pervious area draining to the network or directly to the river (values from 0 to1)

2.5.17.3.2 Hydrological Features

The County Brook stream is located to the North of the proposed development. This stream forms part of the Ballyman Glen SAC. The SAC has numerous hydrological features including natural springs that will be fully assessed as part of the planning application.

The storm drainage design for proposed development will ensure compliance Criterion 1.1, 1.2 and 2 of the GDSDS through extensive use of SuDS. Compliance with these criterions will ensure that recharge to groundwater will be maintained at pre-development levels for all areas other than landfill areas that will be capped.

2.5.17.4 ESB Connections and Proposals

This planning application incorporates the undergrounding and alteration of two existing high voltage (HV) overhead lines (2 No 110kV (as a single circuit)) and 2 No 38kV. The proposed works are required to facilitate the development of the land immediately to the north of the existing ESB substation on Berryfield Lane.

Two existing Single Circuit overhead 110kV lines (the Fassaroe – Carrickmines East 110kV and Fassaroe – Carrickmines West 110kV) runs from the north of the site (within Dun Laoghaire Golf Club lands at Ballyman) across Ballyman Glen in a north-south direction. Just to the south of the glen (within the application site) it currently swings south-westwards (from 2 No. existing pylons) to a point on the northern side of Berryfield Lane just to the northwest of the sub-station. From here it swings back to a north-south alignment and enters the ESB substation on its western side.

It is proposed to underground part of the existing route. The existing 2 No. Pylons to the South of the Ballyman Glen will be decommissioned and replaced with 2No. proposed Line Cable Interface Masts (steel lattice masts to a maximum height of 17m), approximately at the location of the existing pylons. From here the 2 No. 110 kV lines will be undergrounded and the 2 No. 110 kV cables will travel in the pre-agreed route with the ESB within the proposed open space areas and through the alignment of proposed future Fassaroe phase 2 roads (as set out by the application in the CPG masterplan). The underground cables will then cross Berryfield Lane to enter the ESB substation underground at its western boundary. The 2 No. new underground route will measure approximately 605m in length.

An existing overhead 38kV line (Fassaroe-Little Bray 38kV single circuit) runs from a point to the northeast of the subject site across the proposed development lands to the ESB Fassaroe substation. It is proposed to underground this 38kV overhead line from a point on the southern side of Ballyman Glen to the ESB Fassaroe substation. The proposed underground 38kV cable will be routed through the proposed open space park and within the distributor road alignment. (1.No) new Type 63E - 12meter cable to line interface mast 12m above ground will be required to the South of the Ballyman Glen where the 38kV overhead line is proposed to go underground. Approximately 655m of 38kV overhead line (wires) and (4.No) four double wood. pole sets of the existing 38kV overhead line will be removed from this point back to the ESB Fassaroe substation. The replacement underground 38kV cable route will be a total of 750m.

There is also another existing (Fassaroe-Bray 38kV single circuit) overhead line running south-eastwards from the ESB Fassaroe substation to Fassaroe Lane. The current alignment runs to the south of Berryfield Lane to a point adjacent to the Kilbride Lane roundabout. It is proposed to remove 855m of 38kV overhead line (wires), 5 No. pole sets of double wood poles and 1 No. cable to line interface mast between these two points and to replace it with a new underground 38kV cable running from ESB Fassaroe substation along the distributor road to the roundabout and back to start of Berryfield Lane. The replacement underground cable route will be a total of 615m.

2.5.17.5 Utilities

There will be a comprehensive site infrastructure provided throughout the scheme. Services to be ducted around the site are:-

- Gas
- Water
- ESB
- Eir
- Virgin

There is an existing 110kV step down station on site and subject to agreement with the ESB it is proposed to power the site off this. There will be a number of substations needed around the site for distribution with single phase supplies to the houses and 3 phase power to the neighbourhood centre.

The telecoms ducting infrastructure for the proposed development will be designed to cater for full scale development within the Fassaroe Action Area lands. This seeks to minimise any future disruption along the proposed and existing road networks and minimise any abortive works during the initial phases of construction.

Ducting laid under this planning application will facilitate the provision of telecoms throughout the Fassaroe Action Area lands. The design proposes a bank of ducts within footpaths and cycle tracks along the road infrastructure, this is best practice where maintenance can be carried out without disruption to traffic.

2.5.17.6 Public Lighting

Public lighting is proposed through the scheme at three main levels of lighting. Lighting on the proposed main access route on Fassaroe Avenue and Berryfield Avenue will be provided at 60W LED and will tie in the lighting already provided at the part of Fassaroe Avenue already constructed. Lighting along the access routes within the residential areas and in the parking areas of the Neighbourhood Centre will be at a 20W LED. Lower lighting level provisions at 12W LED will be made along pedestrian routes within open spaces and accessing communal areas around apartment blocks.

2.5.18 Site Development and Ground Works

Construction of the proposed development will require considerable amounts of cut and fill across the site. This is to achieve suitable site development levels on a site with variations in height. The proposed east-west road through the site will require significant amounts of cut while the landfill remediation capping works will require significant amounts of fill / cover.

The site layout and site levels across the site have been designed so as to maximise the opportunity for achieving a sustainable materials balance which will minimise the need for import of material to the site. Due to the need for significant additional fill material on site for the landfill remediation capping however, it has not been possible to avoid a deficit of fill. **Table 2.9** sets out volumes of cut and fill estimates across different parts of the site. The site locations referenced in **Table 2.9** are conceptually identified on **Figure 2.26**.

Table 2.9: Materials Balance Estimate Across the Application Site

Location	Cut Volume m^3	Fill Volume m^3	Excess / Deficit m^3
Main Road (Berryfield Avenue) & Berryfield Lane tie in realignment works	26,851	13,302	+13,549
Block 1 - Residential Site	18,371	32,547	-14,176
Block 2 - Residential Site	24,660	6,642	+18,018
Block 3 - Residential Site	1,625	14,881	-13,256
Apartment Blocks - Residential Site	11,216	30,996	-19,780
Creche	3,009	1,030	+1,979
Neighbourhood Centre	30,156	0	+30,156
Landscape Area south of main Road	1,220	30,605	-29,385
Landscape Area north of main Road (including all landfill area capping (sites 1, 2, 3A, 3B & 3C)	18,944	135,797	-116,853
Totals	**136,052**	**265,800**	**-129,748**

Figure 2-26: Cut & Fill locations

Based on the development proposed under this current Phase 1 application alone it has been calculated that there will be a deficit of fill material of the order of 130,000m^3 required within the Phase 1 development areas.

As is clear from **Table 2.9**, the areas of significant fill requirements within the application site are the open space areas which incorporate the historic landfill sites and their substantial fill demand due to the capping remediation proposals. Despite the efforts to balance excavation and filling elsewhere on the site the additional volumes of material required for landfill remediation are unavoidable. The proposed landscaping on top of the remediated landfill sites has been designed to minimize any further fill requirements.

The capping volume requirements for alone comprise a total of approx. 82,865m^3 of which approx. 58,005m^3 is subsoil / topsoil and 24,860m^3 is for a sand regulation layer. This sand regulation layer will need to be imported to site regardless of what volume of other fill material may be sourced on site and reused. **Tables 2.10** and **2.11** identify the total volume of fill and the sand regulation layer volumes respectively for each of the landfill sites.

Table 2.10: Landfill Remediation Total Capping Volume Requirements

Landfill Location	Total Fill / Capping Volume (m^3)
Volume of Capping in Landfill Site 1 (1.0m depth)	5,309
Volume of Capping in Landfill Site 2 (1.0m depth)	45,013
Volume of Capping in Landfill Site 3A (1.0m depth)	19,046
Volume of Capping in Landfill Site 3B (1.0m depth)	4,437
Volume of Capping in Landfill Site 3C (1.0m depth)	9,060
Total Volume of Capping	82,865

Table 2.11: Landfill Remediation Regulation Sand Layer Volume Requirements

Landfill Location	Regulation Layer Fill Volume (m^3)
Volume of Capping in Landfill Site 1 (1.0m depth)	1,593
Volume of Capping in Landfill Site 2 (1.0m depth)	13,504
Volume of Capping in Landfill Site 3A (1.0m depth)	5,714
Volume of Capping in Landfill Site 3B (1.0m depth)	1,331
Volume of Capping in Landfill Site 3C (1.0m depth)	2,718
Total Volume of Capping	24,860

Apart from the landfill and open space areas other key areas of cut and fill at the site are the areas of Apartment Blocks 1 – 3 and the Neighbourhood Centre. Blocks 1 – 3 are five storeys over basement car parks. Blocks 1 and 2 have a combined basement with a separate basement to Block 3. Excavations of up to 3.8m below ground floor level are required to facilitate the basement dig.

The proposed first phase Neighbourhood Centre comprises of ground floor parking, retail, café and community concierge / gym uses. Given the levels at this site excavations of up to 5.5m below ground floor level are required to facilitate the dig in this area.

As a sustainable approach to development, it is proposed that the Developer if possible will identify a permitted development site(s) where excess clean inert soils by-product material is generated and which needs to be moved off that site, and which can be used as fill material at the application site. This is a more sustainable approach than sourcing materials as a virgin 'primary' resource from a commercial quarrying operation. Any by-product material imported to the site will be appropriately notified to the EPA under Article 27 of the European Communities (Waste Directive) Regulations 2011 as amended.

2.5.19 Provisions for Bus Services

There are currently two bus layby stops in place on the existing dual carriageway at the eastern extent of the overall Fassaroe lands between the Junction 6 roundabout and the Thornhill Road / Greenstar roundabout. The east bound bus stop will be relocated further west bringing it closer to the proposed Neighbourhood Centre and the Phase 1 lands making it easier and more convenient for users to utilise the bus services.

Three pairs of future stops are proposed along the east-west link road as part of this application including a pair at the Neighbourhood Centre and another in close proximity to the District Park. The final pair of stops will be located at the western housing area to the south east of the ESB substation.

The location of the stops will ensure that all residents are within a 400m to 800m walking distance of a bus stop to minimise walking distances and maximise catchment potential. All bus stops will be inline in accordance to NTA guidance to ensure bus services are not adversely impacted. Further detail of bus services and bus priority measures are set out in **Section 2.6** as well as in the Atkins report *Fassaroe Public Transport Access Strategy (REF 5186693DG86)* that forms part of the planning application.

2.5.20 Landfill Remediation Proposals

As described at section 2.1 above there are 5 No. historic landfill sites which were previously operated by Wicklow County Council within the Fassaroe area. These sites which are designated Sites 1, 2, 3A, 3B and 3C were operated by the Local Authority between the early 1970s and the mid-1990s. The locations are identified in **Figure 2.4** above, and in **Volume 3 Part 1** in the context of existing services crossing the site and the Ballyman Glen SAC.

At the time of operation of these landfill sites there were no licensing provisions in place. The Waste Management (Certification of Historic Unlicenced Waste Disposal and Recovery Activity) Regulations 2008 require Local Authorities to register unlicensed closed landfills which operated between 15th July 1977 and 27th March 1997 with the EPA and to obtain Certificates of Authorisation (CoA) to control and remediate (as appropriate) them. The objective of the legislation and the CoAs from the EPA is to ensure that waste disposed or recovered in unlicensed closed landfills is not causing, or is not likely to cause, environmental pollution. The operation of Fassaroe Site No. 1 was terminated prior to 15th July 1977 and accordingly was not subject of a CoA application to the EPA. Wicklow County Council has however applied to the EPA and received CoAs in respect of Fassaroe Site Nos 2, 3A, 3B and 3C. These are provided at **Volume 3, Part** The application documentation lodged with the EPA provided information in respect of Site 1 also to the same standard as that supplied for Sites 2, 3A, 3B and 3C. This allowed the EPA to assess remediation requirements at Fassaroe in a comprehensive manner, in the full knowledge of how all of the historic landfill sites are currently behaving (in terms of potential impact on groundwater and gas generation).

Significant site investigations were undertaken at the site in order to prepare an Environmental Risk Assessment (ERA) which in turn was used to inform and the remediation measures proposed to the EPA and for which Certificates of Authorisation have now issued. The ERA as submitted to the EPA is provided at **Volume 3 Part 3** of this EIAR and presents the detailed findings of the various site investigations undertaken. The ERA assesses and presents the potential risks to human or environmental receptors associated with the presence of the waste material in the historical landfills. It also provides an outline assessment of options for managing risks identified and sets out recommendations for remedial options. A subsequent accompanying remediation proposal report was prepared by RPS 'Fassaroe Historic Landfills

Remediation Strategy Report', July 2018 and was lodged with the EPA also by WCC. This is provided at **Volume 3 Part 4**. This presents the remediation proposals necessary to ensure that the closed landfills are not causing, or are not likely to cause, environmental pollution, and in turn to facilitate future development proposals such as the current proposed development.

Following receipt of the Certificates of Authorisation from the EPA further gas pumping trials were undertaken in 2020. An Addendum to the ERA has now been prepared which considers data from these trials as well as the full monitoring data from 2016 and 2017 and presents an updated appraisal in relation to ground gas. This Addendum is presented at **Volume 3 Part 5**.

An updated Remediation Strategy Report has also been prepared which is provided at **Volume 3 Part 6**.

Finally, a Gas Management Strategy has also now been prepared which sets out the gas management requirements for the proposed Phase 1 development in line with the principles set out in the Remediation Strategy and the CoA issued by the EPA. It presents an outline design for the management of gas and a monitoring and sampling plan to ensure the effectiveness of the remedial measures are verified. This is based on a previous Gas Management Strategy submitted to the ERA in 2018 and now updated to take account of the pumped gas trials undertaken on foot of the CoAs. This updated Gas Management Strategy is provided at **Volume 3 Part 7**.

2.5.20.1 Scope of Landfill Remediation Proposals

The proposed landfill capping remedial measures proposed are as permitted under the Certificates of Authorisation (CoAs) issued by the EPA and as required to accommodate the construction of the Phase 1 proposed development, specifically to:

- Minimise infiltration of water and maximise clean run off from the landfill areas;
- Promote surface drainage and maximise clean run off from the landfill areas;
- Control landfill gas migration; and
- Provide a physical separation between waste and human and environmental receptors.

The proposed landfill capping measures comprise mitigation and management proposals to eliminate any potential adverse impacts of the landfills on the development proposed, and in particular any potential to impact on human health or the uses proposed which include residential and amenity uses. The proposals will effectively close off any potential pathways from the landfills to the proposed new uses, including amenity uses on top of the landfills and residential uses adjacent to them, all in accordance with best practice.

It should be noted that while the lands on which Sites 2, 3A, 3B and 3C are located are owned by Cosgrave Property Group, Wicklow County Council as the CoA holder, is responsible for the operation, control and maintenance the sites and for ensuring the conditions of the Certificates of Authorisation are complied with. Accordingly, agreement has been obtained from Wicklow County Council to include the capping of the landfills (including Site 1) within the proposed Phase 1 development as it is acknowledged that the remediation of the sites in accordance with the Certificates of Authorisation is intrinsically linked to the future afteruse of the site post-development.

The permitted remediation measures on foot of the CoA include:-

- A Landfill Capping System
- Landfill Gas Management
- Leachate Interception
- Surface Water Drainage
- Excavation and Disposal (in localised areas)

In addition to these permitted remediation measures per the CoA the current planning application is accompanied by an updated Gas Management Strategy for the site which also specifically addresses the current SHD development. This strategy also includes building protection measures including floors slabs / membranes and passive venting (voids) for the development proposed within this application. The building protection measures will be incorporated at detailed construction design and will comply with the requirements of BS 8485:2019 – Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (BSI, 2019) and the UK's National House Building Classification Traffic Light System. Complying with these standards will ensure protection for human health.

2.5.20.2 Proposed Landfill Capping System

2.5.20.2.1 EPA Landfill Capping Guidelines

The proposed capping remediation works will be carried out in accordance with the Environmental Protection Agency (EPA) Landfill Capping Guidelines. The *EPA Landfill Manual: Landfill Site Design* (EPA 2000) provides guidance on landfill capping and construction of the various capping system components which includes the following:

- Topsoil;
- Subsoil;
- Drainage Layer;
- Barrier (infiltration) layer;
- Gas drainage layer.

Based on the investigations carried out to date at each of Sites 1, 2 and 3B, the sites can be classed as non-hazardous biodegradable landfills for the purposes of capping. The EPA guidelines recommend the following capping system for a non-hazardous biodegradable landfill:

- *‘’Topsoil (150-300m) and subsoil of at least 1m total thickness;*
- *Drainage layer of 0.5m thickness having a minimum hydraulic conductivity of 1x10-4m/s;*
- *Compacted mineral layer of a minimum 0.6m thickness having a hydraulic conductivity of less than or equal to 1x10-9m/s or a geosynthetic material (e.g. GCL) or similar that provides equivalent protection; and*
- *A gas collection layer of natural material (minimum 0.3m) or a geosynthetic layer. ‘’*

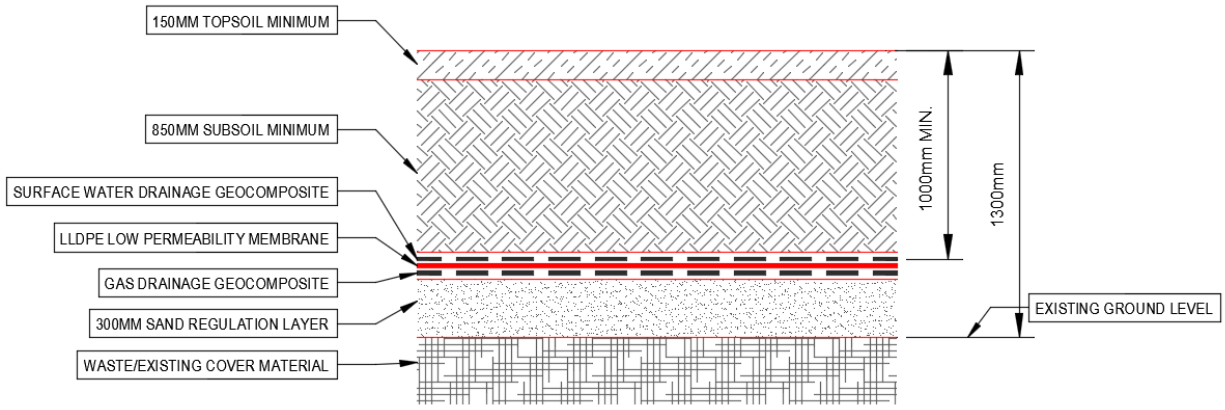
2.5.20.2.2 Proposed Capping System Details

The proposed land afteruse in each of the five sites to be capped varies both from site to site and within each site. Therefore the material make up of each area, depending on afteruse, will be different. However, in all landfill areas to be capped the following minimum capping system will be installed (in order of placement):

- 300mm sand regulation layer;
- Gas collection geocomposite (approximately 4-6mm thickness)
- 1 mm thick low permeability geomembrane (LLDPE-linear low density polyethylene) liner having a hydraulic conductivity of less than or equal to 1x10-9m/s,
- Surface water drainage geocomposite (approximately 4-6mm thickness)
- 850mm Subsoil layer;
- 150mm Topsoil layer.

The proposed minimum capping system is presented graphically in **Figure 2.27**. As shown, the minimum finished ground level shall be 1m above the capping surface water geocomposite and liner and 1.3m above existing ground.

Figure 2-27: Proposed Minimum Capping System



The purpose of the subsoil and topsoil layers in a normal landfill application is to provide a 1m physical barrier to the capping system geocomposite and geomembrane layers. Therefore in areas of the site which are to be raised by >1.3m above existing ground level , additional depths of general fill or subsoil materials will be used to make up the depth required. This will then be overlain by topsoil in landscaped areas to the required depth for planting. Areas to receive roads or pavements, such as through site 3B, will similarly need to maintain the 1m cover from the surface water geocomposite to finished road/pavement level or side slopes where relevant. Greater detail for the minimum capping system and the overlying materials proposed for the various proposed post-capping land uses throughout Sites 1, 2 3A – 3C are shown in the 'Fassaroe Historic Landfill Remediation Strategy Report' in **Volume 3 Part 5** of this EIAR.

2.5.20.2.2.1 Proposed Capping System Materials

The properties and function of the capping system materials are discussed below:-

- **300mm Sand Regulation Layer**: This is required to provide a smooth surface on which to lay the geocomposites and capping system and to ensure that when the overlying materials are being compacted and rolled, there is a physical barrier to any underlying sharp objects or protrusions. This will be particularly important in Sites 1 and 2 where vegetation is to be stripped in order to install the capping system. Where it can be demonstrated onsite during construction that the existing cover material over the waste is sufficiently 'regular', the thickness of the sand regulation layer may be reduced.
- **Gas collection geocomposite:** The primary purpose of the gas geocomposite is to provide flow capacity to maintain the landfill gas pressure within the geocomposite at an acceptable rate below the geomembrane. From a slope-stability point of view, gas pressure is an excess pore pressure that serves to reduce the effective normal stress. This pressure results in a decrease in the effective stress beneath the geomembrane that, ultimately, can lead to slope stability failure.

  The gas geocomposite layer will be a two or three layered, three dimensional geosynthetic material consisting of a HDPE drainage core mechanically bonded to geotextile filter layers on both sides. The geotextile will be non-woven needle-punched HDPE or Polypropylene. The thickness and compressive strength of the geocomposite will be specified at detailed design stage depending on the depth and loading of material to be placed above it.
- **Low Permeability LLDPE liner:** The purpose of the LLDPE geomembrane liner is to act as the low permeability ($1x10^{-9}$m/s) barrier minimising infiltration of rainwater and migration of landfill gas through the capped landfill. A geomembrane is used when low permeability clay is not available locally. Whilst some clay will be excavated as part of the proposed development, it is unlikely that the volume and properties of the clay onsite would meet the EPA guidance requirements. The LLDPE geomembrane will be a 1mm thick liner will which will be laid on top of the gas collection geocomposite.
- **Surface Water Drainage Geocomposite:** The surface water drainage geocomposite will be the same or similar material to the gas collection geocomposite. This fulfils the function of the 0.5m drainage layer proposed in the EPA Landfill Site Design Manual. Its purpose is to provide flow capacity above the LLDPE liner for rainfall which infiltrates through the overlying subsoil and topsoil.

- **Subsoil (850mm minimum) and Topsoil (150mm minimum):** Subsoil and topsoil will be sourced from onsite excavations, or imported where required and will be placed in layers in accordance with the requirements of Series 600 of the NRA Specification for Roadworks. Care shall be taken during placement to avoid damage to the underlying geocomposites and geomembrane.

2.5.20.2.3 Confirmatory Slit trenches

To date, the extent of the waste footprint at each of the sites has been determined through a combination of borehole, trial pit and geophysical survey investigations. Prior to installation of the capping systems a series of slit trenches will be excavated along the current interpretation of the waste perimeter to determine if any movement (inwards or outwards) of the perimeter is required.

2.5.20.2.4 Capping detail at slopes

At parts of the northern perimeters of landfill waste where the existing slope fall steeply, in particular in the north east of Site 2, a reinforced earth slope will be required to aid the construction of the landfill capping system. The capping material will be benched into the existing slope where the gradient is 1(V):5(H) or steeper and the newly formed slope will be at a gradient of 1(v):3(h). The typical cross-section detail for the edge of capping on slopes is shown in Section E-E on Atkins planning drawing 5186693/HTR/01/DR/0611.

In other areas where the existing slope is shallower along the perimeter of the landfill waste, the fill required for the capping system can be tied back gradually into the existing ground level beyond the extents of the landfill.

2.5.20.3 Landfill Gas Management Design

At all five sites, despite their age, waste is currently generating a residual amount of landfill gas and will continue to do so for some years. Landfill gas migrates along the path of least resistance. At present, the gas simply migrates towards the surface of the landfills. In areas where the existing cover material is not well compacted the landfill gas will migrate through the cover material and into the atmosphere. In areas where the existing clay cover material is well compacted the landfill gas will be prevented from venting through the surface and will therefore migrate laterally through the underlying sand and gravel deposits. This lateral migration of landfill gas is evident in a number of boreholes which have been drilled outside of the waste areas.

With the installation of a low permeability capping layer the gas will be prevented from venting through surface of the landfill and will therefore build up in pressure and eventually migrate laterally beneath the edges of the sites, potentially towards residential units. To prevent this occurring a gas management system must be incorporated into the rehabilitation measures.

The proposed landfill gas management measures are described in detail in the Landfill Gas Management Strategy in **Volume 3 Part 7** of this EIAR. The main gas management strategy comprises of a Virtual Gas Curtain (VGC). This is the favoured and proposed treatment measure due to its effectiveness in controlling gas migration, its durability and ease of installation.

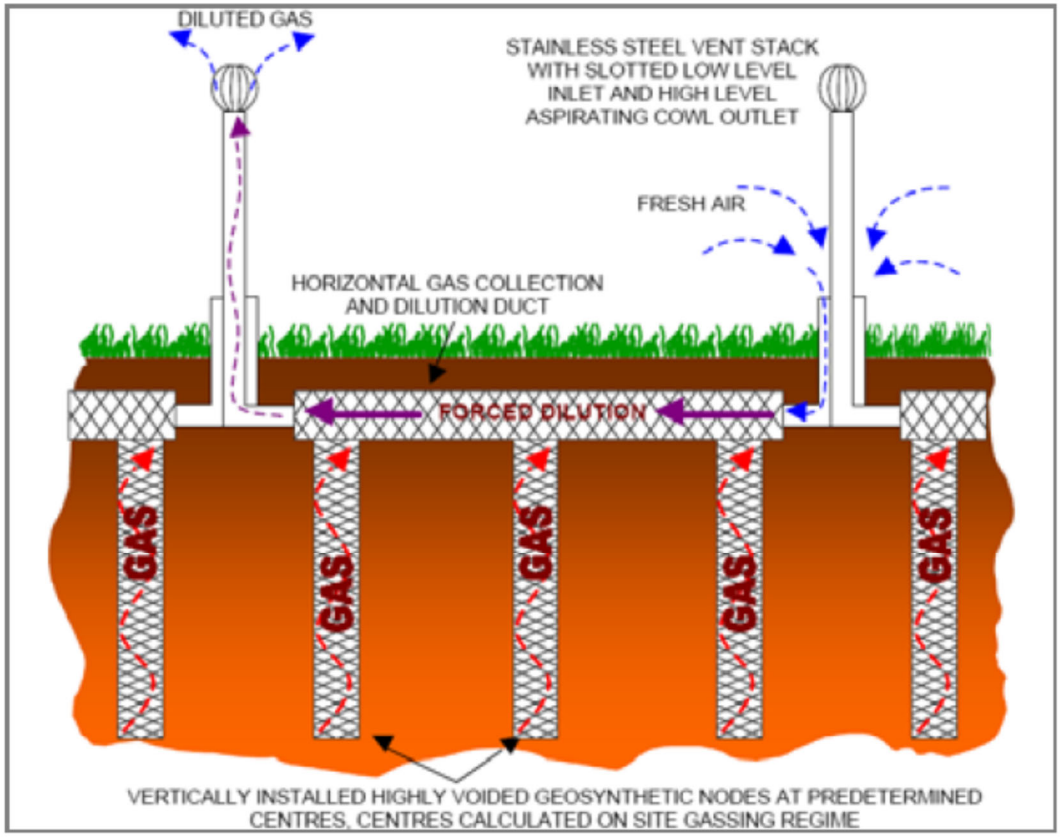
The Virtual Gas Curtain is a fully enclosed barrier that is proposed around the perimeter of each of the landfill sites. The concept of the VGC is to form a low pressure or low gas concentration area relative to the surrounding gassing ground, to encourage gas to flow towards the barrier, and allow subsequent venting to atmosphere.

Geo-composite nodes are inserted at 1m intervals along the curtain length with 3m high vent stacks located at 20 – 25 m intervals. The barrier would need to be advanced to a depth of circa 10m bgl surrounding the landfill sites to intercept any migrating gases. The width of the trench required for installation is 600mm wide and will include a headerpipe that connects all the vent nodes together.

A typical drawing of the Virtual Gas Curtain is shown in **Figure 2.28** below.

In addition, further to pumped gas trials undertaken on foot of Certificates of Authorisation issued by the EPA for sites No. 2, 3a, 3b and 3c, a pumped gas collection system and flare compound is proposed to serve sites 2, 3a and 3c. The flare required is a small 100m3 /hr Lo-Cal flare which will be provided in a small compound of approx. 6m x 6m. This is proposed to be located just to the west of site no. 3c.

Figure 2-28: Typical Drawing of Virtual Gas Curtain



2.5.20.4 Leachate Interceptor Drain

As identified through the various site investigations undertaken, infiltration of rainwater and decomposition of the waste has resulted in leachate plumes beneath the waste bodies. These leachate plumes extend a considerable distance below the waste bodies (approximately 40m below the waste in the case of Site 2) and migrate in the direction of the groundwater flow regime, generally to the north east. In some areas also, for example Site 1, there is evidence of perched leachate which is as a result of an intermediate stratum of over-compacted waste or cover material preventing or reducing infiltration of liquid beneath it and resulting in a localised head of leachate.

Given the nature of the waste and the likely ad-hoc fashion in which it was filled, it is possible that, following removal of vegetation and grading of the waste surface to receive the capping system, seepage from wet/saturated pockets of waste may result in a build-up of leachate against the underside of the capping system geocomposites. This would be more likely to occur on the down-gradient side of the waste bodies.

This leachate could then travel between the surface of the waste and the gas drainage geocomposite and make its way to the perimeter of the waste body. However, the nature of such leachate breakouts, if any, would be sporadic, localised and random to a degree. It is also more likely that leachate would seep back down into the waste body again locally without traveling to the edge of the waste.

In order to redirect any localised leachate seepages back into the waste, it is proposed that the gas drainage geocomposite shall be returned into the ground at the edge of the waste body as shown in **Drawing DG0009-02**. This will mean that any minimal amounts of leachate which may have seeped upwards into the geocomposite, will be directed back down into the waste body by the vertical element of the geocomposite. This volume of leachate would be minuscule in comparison to the total volume of leachate currently within and below the waste body.

It is also important to note that that leachate generation, and therefore the likelihood of any seepage, will be greatly reduced by the installation of the proposed best practice low permeability capping system, which will minimise infiltration of rainfall.

At Site 3B, in order to accommodate the access road which will be constructed in cut through the site, it is proposed that all of the waste beneath the pavement layers will be excavated down to clean material. As the existing ground is generally flat and there is no risk of stability issues due to a build-up of leachate head. However, a granular fill blanket will be laid at the base of the road pavement beneath the capping lining materials as shown in **Figure 2.26**, which will facilitate the draining away of leachate from the capping materials in the direction of the groundwater gradient (i.e. north-eastwards), as currently takes place.

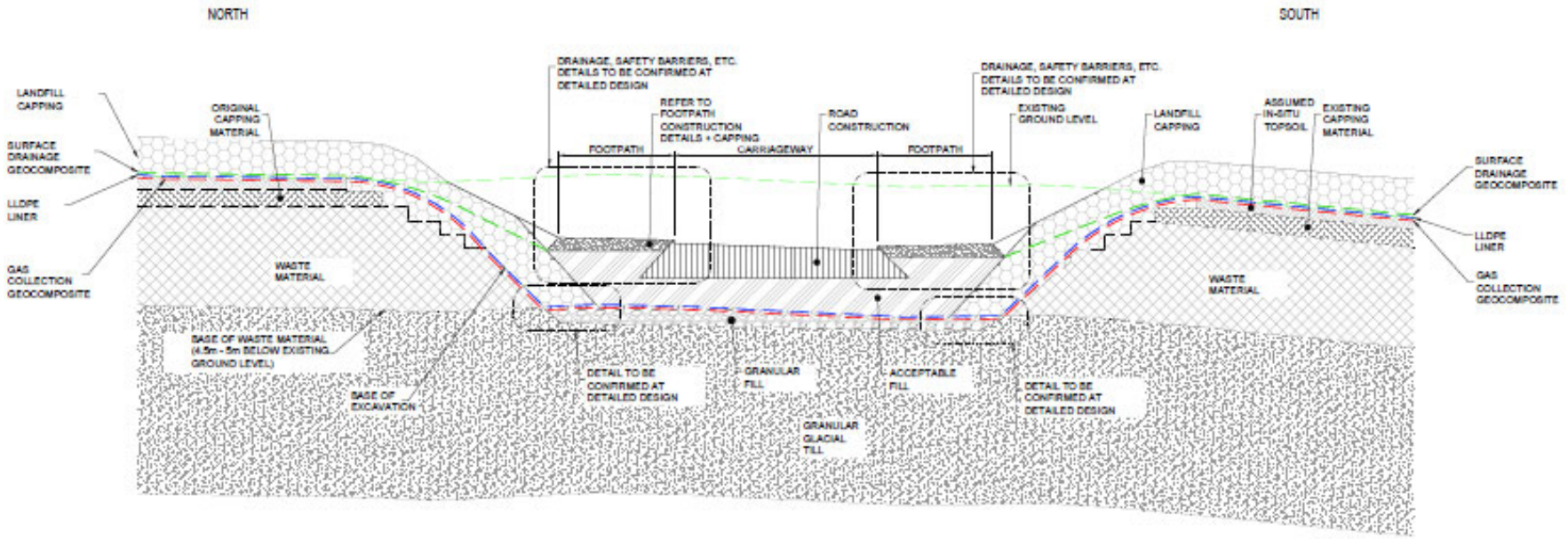
2.5.20.5 Surface Water Drainage Design

Once the low permeability geomembrane liner has been installed, infiltration of surface water through the capping system will be minimal. Surface water at finished ground level (e.g. on grassed areas, pathways, etc.) will drain overland towards the river, as currently takes place. However some infiltration of surface water will continue to occur through the soils overlying the capping system. This will need to be managed independently in a subsurface drainage system.

In order to prevent ponding of this water on the capping materials, a surface water collection geocomposite will be installed above the LLDPE geomembrane. As noted above, the surface water geocomposite will provide sufficient flow capacity above the LLDPE geomembrane to ensure that the water is drained towards the perimeter of the waste body. Here the LLDPE liner and surface water geocomposite will be continued through a subsurface drain as shown on **Drawing DG0009-02**. This will consist of a perforated pipe installed at a depth of 1.2m bgl, within a granular stone-filled trench. The plan layout of this subsurface drain is shown on **Drawings DG0010-02 and DG0010-03**. This subsurface drain will be laid at grade with the existing site topography for Sites 1 and 2 and will be connected by a series of manholes. This subsurface drain will connect to the main development surface water drainage system, prior to outfalling to the river. However, the manner by which this subsurface drainage attenuates, and its effect on the peak flow and greenfield run-off rate is described below:

- Based on a permeability of 1 x 10^{-5} m/s for the backfill and a hydraulic conductivity of 1 x 10^{-4} m/s for the surface water geocomposite in the capping system (which is 1m minimum below the finished ground surface), the average time of concentration in the sub-surface infiltration drain is approximately 23.5 days.

Figure 2-29: Cross Section through Proposed East-West Link Road at Landfill Site 3B



Source: Atkins Drg No. 5186693/HTR/01/DR/0606

- In a storm event, the precipitation which does not flow as surface run-off will infiltrate through to landfill cover soils, attenuating naturally through the cover soils as it does so, until it hits the geocomposite, where it will be further attenuated at $1x10^{-4}$m/s. This attenuation and lengthy time of concentration means that there will not be a peak flow from the subsurface infiltration drain and therefore will be no increase to the greenfield run-off rate.
- Even when the ground is already saturated prior to a storm event, the cover soils would not have capacity to hold the water so the majority of the water flows as surface run-off, as would occur naturally in the absence of a capping system.
- To summarise, any infiltrating water will be naturally attenuated through the capping cover soils and surface water geocomposite as it makes its way to the perimeter drain. Due to the lengthy time of concentration, there will be no peak flow associated with the sub-surface infiltration drain.

At Site 3B, as the road is to be constructed in cut through the waste, any surface water infiltrating through to the capping system will be allowed to discharge to the road surface water drain on either side of the carriageway as shown on the cross section in **Figure 2.26**. To the north of the road cut, the waste footprint remaining following construction of the road will be approximately 300m^2 of grass surface. Therefore the anticipated infiltration of surface water through to the capping system will be negligible, so no subsurface drainage is proposed on the north of the road.

2.5.20.6 Excavation and Removal of Waste

2.5.20.6.1 Site 1

Where construction of the landfill capping system is to occur at the perimeter of the waste and the existing slopes are at a gradient of 1(V):5(H) or steeper, the capping material will require benching into the existing slope. The waste material excavated during this process will be removed off site to a licenced waste facility.

2.5.20.6.2 Site 2

Where construction of the landfill capping system is to occur at the perimeter of the waste and the existing slopes are at a gradient of 1(V):5(H) or steeper, the capping material will require benching into the existing slope. The waste material excavated during this process will be removed off site to a licenced waste facility.

Waste will also be removed during the slope stabilisation process as described in Section 2.5.19.3 below.

During the piling process for the road embankment which traverses the southern point of Site 2 (piling options shown on Atkins Drawing 5186693/HTR/01/DR/0607-0608), waste will be brought to the surface and will require removal off site to a licenced waste disposal facility.

2.5.20.6.3 Site 3B

It is proposed to construct a new access road through Site 3B. As shown on Atkins Drawing 5186693/HTR/01/DR/0606 and **Figure 2.26** in order to accommodate the required levels for the road, the final profile level of Site 3B must be lowered. This will be achieved through the excavation of waste from Site 3B and transportation to a licenced waste disposal facility.

Waste within Site 3B currently extends to 4-4.5m bgl. It is proposed that all waste within the footprint of the road pavement in Site 3B will be excavated down to clean material and removed offsite. The estimated volume of waste to be excavated and removed off site is 6,920m3. The remaining waste at Site 3B will be capped as described above.

2.5.20.7 Building Protection Measures

Buildings will be designed with protection measures installed. The ERA undertaken for the sites determined the site risk classification with respects to CIRIA C665, Assessing risks posed by hazardous ground gases to buildings (subsequently replaced with BS 8485:2019 – Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (BSI, 2019)) and the UK National House Building Council (NHBC) Traffic Light System. These guidance define gas protection scores for different types of buildings within areas of different risk. The Gas Management Strategy by RPS lodged with this application has applied the classification system to the site and specified the need for building protection

measures to be incorporated into the detailed design of the building foundations and basements. These measures will typically comprises of slabs, voids, etc.

As set out in the Gas Management Strategy submitted with this application, the exact nature of these protection measures will be designed at detailed construction design phase when the foundation details of each building are finalised.

2.5.21 Settlement

It is likely, given the history of Site 1, 2, 3A, 3B and 3C that only low levels of compaction of waste occurred during filling operations. As such, with the installation of a minimum of 1.3m of cover soils above the waste and additional fill above this to make up the finished ground level, this loading will result in settlement of the landfill areas. During the detailed construction design consideration will therefore be given to the inclusion of a geogrid system in the capping system to reduce differential settlement.

In addition, the earthworks programme for the Phase 1 development should be devised to include for the surcharging of Site 1, 2, 3A, 3B and 3C with clean excavated material at an early stage in the development works (once the slope stabilisation works on Site 2 have been completed and prior to installation of the capping system) so that post-capping settlement of the landfill areas is reduced as much as possible.

2.5.21.1 Slope Stabilisation

In order to accommodate both the construction of the landfill capping system and the Phase 1 development, slope stabilisation measures will need to be installed in four landslip areas previously identified to the north of Site 2.

This will need to be done at an early stage in the Phase 1 development and prior to the installation of the capping system or loading/surcharging on the landfill areas. These measures have been designed by Atkins and are discussed below.

2.5.21.1.1 Section A- Atkins Planning Drawing 5186693/HTR/01/0609

The typical cross-section for the slope stabilisation works in Section A is shown on Atkins planning drawing 5138958/HW/0605.

As part of the stabilisation works in this section all material above the slip surface (yet to be determined) will be excavated and replaced with acceptable fill material at a gradient of 1(V):3(H). The toe of the new slope will then extend slightly further toward the river than the existing toe. Above the shoulder of the existing top of the slope, the earthworks will be cut in order to provide a shallower gradient of 1(V):4(H). This area can then be considered to be part of the park. Additional fill may be placed on the area above the proposed remediation area if required.

The new fill material will be benched into the existing slope where the gradient is 1(V):5(H) or steeper. All newly formed slopes will be backfilled following the excavation of material.

2.5.21.1.2 Section B - Atkins Planning Drawing 5186693/HTR/01/0609

The typical cross-section for the slope stabilisation works in Section B is shown on Atkins planning drawing 5186693/HTR/01/DR/0609.

It has been reported that slope failures have previously occurred at Section B, one while undertaking the geophysical surveys in May 2016 and another following this.

Stabilisation works for Section B will be similar to those proposed for Section A. Slipped material on the lower half of the slope will be excavated and the area regraded and filled with acceptable fill material at a slope of 1(V):3(H). The results of the geophysical survey showed the material underlying the slip surface to consist of natural sand/gravel. However it is possible that some slip material consists of waste. Therefore it may be necessary to treat all material to be removed as waste material.

Due to landtake constraints it will be necessary to construct a reinforced earth slope at a gradient of 1(V):2(H), with an approximate height of 5-6m. Fill will then be placed above this at a gradient of 1(V):3(H) to tie in with the top of the landfill capping to be provided in the park area. All material above the slip surface (yet to be determined) will have to be excavated.

The landfill capping system will be provided at the base of the new fill above the waste material for the upper half of the slope and, if waste is encountered, on the lower half also.

2.5.21.1.3 Section C-C – Atkins Planning Drawing 5186693/HTR/01/DR/0610

The typical cross-section for the slope stabilisation works in Section C-C is shown on Atkins planning drawing 5186693/HTR/01/DR/0610.

There is evidence of a slope failure at Section C-C. However it was not possible to inspect the slope surface due to the presence of vegetation and therefore the slope profile was estimated.

The stabilisation works for Section C-C will be the same as those described for Section A with a new approximate slope of 1(V):2.5(H). The material to be excavated at the base of the slip surface is thought to consist of natural ground. Should this be confirmed, the landfill capping system will not be required in this area.

2.5.21.1.4 Section D-D - Atkins Planning Drawing 5186693/HTR/01/DR/0610

The typical cross-section for the slope stabilisation works in Section D-D is shown on Atkins planning drawing 5186693/HTR/01/DR/0610.

There is evidence onsite that slope failures have occurred in this area. The slope in this area is quite steep which is not adequately represented on the LIDAR survey due to the presence of vegetation.

The proposed stabilisation works for Section D-D will consist of regrading works to the area at a slope of 1(V):2(H). The existing slope will be benched prior to the placement of acceptable fill material. It is also proposed to construct a wedge of coarse granular material at the toe of the slope as scour protection for the river and relatively flat ground on the river bank.

2.6 Description of Operational Aspects of the Development

2.6.1 Public Transport Proposals

The proposed public transport strategy to serve the development incorporates the following elements, which have been agreed with the National Transport Authority (see **Appendix 2A** for confirmation of agreement from the NTA).

This Public Transport Access Strategy incorporates the following elements:

- Provision of a new bus service from Enniskerry via Fassaroe to Bray town centre, Bray DART station, and Bray DART Station Transport Interchange;
- Provision of a new bus service from Enniskery via Fassaroe to the Luas at Bride's Glen / Cherrywood;
- That the provision of the above Public Service Obligation (PSO) bus services would increase in frequency in line with demand;
- The provision of a dedicated primary school educational bus service from Fassaroe;
- Efficient and improved bus infrastructure including bus priority along the proposed routes to ensure services can operate within minimal delay; and
- Ongoing Monitoring, Evaluation and Awareness to ensure the Strategy continues to meet demand.

2.6.1.1 Provision of New Bus Services into the Development

The proposed Phase 1 development will be serviced by direct bus services providing access to the existing Bray urban area, Bray DART and Bray bus interchange with onward services to Dun Laoghaire and Dublin City Centre. In addition to this the Phase 1 development will be served by an express bus service to Luas at Cherrywood / Brides Glen that will provide onward connections along the Luas Green Line corridor serving destinations including Sandyford, Dundrum and Dublin City Centre. This will be achieved through:

- New Bus Service from Enniskerry via Fassaroe to Bray and Bray Interchange (No. 185A) - The first stage of bus service to the site will be the provision of a new bus service (referred to here after as the No.185A) from Enniskerry Village through the Fassaroe lands via Monastery Road and Ballyman Road. The advantage of a bus service running from Enniskerry is that, particularly in the early years, it can provide additional patronage from existing residents along the route as well as serving the future residents of Fassaroe. In addition, this new bus service would provide significant uplift in regular bus services from Enniskerry helping to increase the sustainable mode share of journeys from the area. The existing No.185 would remain in place at its current and future programmed services and would continue along its route from Enniskerry via the R117 "Twenty Bends", to Bray. The new 185A service will ensure that Fassaroe is served by a regular scheduled local bus service that will operate throughout the day. The service will link the development to Bray town centre and its environs providing important connections to community facilities, services, and amenities. This service would also provide interchange possibilities with the Bray DART Station and bus services operating from Bray DART interchange to Dun Laoghaire and Dublin City
- New Bus Service from Fassaroe to Luas at Cherrywood / Brides Glen (Luas XP) – this new bus service would operate an express service from the site onto the N11 via Junction 6 and from there via the N11 / M11 corridor existing at Wyattville Road junction to access the Luas Green Line at Brides Glen and or Cherrywood. The return journey would be via the J16 of the M50 and from there onto the M11/ N11 and back to Fassaroe via Jct 6 on the N11.

2.6.1.2 Increase in Frequency of Rerouted Public Transport Service

To meet the additional identified demand towards Bray town centre, Bray DART station and bus interchange, the rerouted No.185A bus service will run at an increased frequency. The increase in frequency of this rerouted service will increase over time to reflect the increasing demand as the resident population of Fassaroe expands. Initially the Luas XP service would operate for four hours in the AM period and for three hours in the PM period to coincide with tidal demand for work based trips to and from the site to destinations served by the Luas green line corridor. The frequency of Luas XP bus services would increase in line with demand as the development at Fassaroe is built out.

2.6.1.3 Provision of an Interim School Bus Service by Developer

It is proposed to provide a dedicated developer operated primary school bus service(s) from Fassaroe towards Bray where there are several primary and secondary schools which can serve demand from the Phase 1 development in advance of onsite school services at Fassaroe. This scheme will be run by the Developer and will be similar in nature to the School Transport Scheme operated by Bus Éireann on behalf of the Department of Education. This service would operate on a limited AM and PM basis to coincide with school opening and closing times to meet the anticipated demand of school based trips. The number of services in the AM and PM period will increase over time to reflect the increasing demand. This school bus service will largely operate along the No.185 route towards Bray and onwards along a predesignated route that would be defined according to pupil school destinations and would need to be agreed with all relevant stakeholders prior to commencement of this service.

Upon delivery of a future primary school at Fassaroe it is likely that the majority of future school trips would be to and from that new school and would take place via walking and cycling given the short distance of the school from its catchment. The proposed dedicated school bus services to and from Bray would therefore decrease upon the opening of the Fassaroe school and eventually cease.

It is proposed given their age profile that secondary school student travel from Fassaroe would be met by the proposed new regular bus service from Fassaroe, the No.185A, as outlined in section 2.6.1.1.

2.6.1.4 Commitment from Developer to Provide Interim Bus Service if Required

The optimal scenario for public transport services to Fassaroe is that from the first phase of development all scheduled bus services will operate Public Service Obligation (PSO) contract(s) under the management of the National Transport Authority. However, in the event that there is a delay to the commencement of the agreed public bus services set out above, the Applicant commits to providing a private bus service option as an interim solution to provide certainty that Phase 1 residents will be facilitated with bus service connections in the immediate term.

2.6.1.5 Bus Priority Measures and Enhancements

To facilitate Phase 1 development at Fassaroe, bus priority measures will be undertaken on Upper Dargle Road including the approach to Sunnybank junction by Wicklow County Council in line with the requirements of BETS. This is programmed for completion by Wicklow County Council by mid-2023. These will tie in with existing priority infrastructure on Dublin Road and Castle Street and further enhancements here which will be delivered on foot of the NTA's Route 13 Bray Core Bus Corridor project which is a BusConnects programme.

In addition, Wicklow County Council is undertaking further works at Bray Bridge and Main Street which will further extend the Bus Connects proposals south of the river in Bray offering fully enhanced bus priority measures from Fassaroe to Bray Main Street and DART Station. The Bray Bridge scheme consists of footbridges on either side of the existing bridge and the provision of a southbound bus lane on the existing bridge. The design of this scheme is being coordinated with the Council's Main Street Decongestion Scheme. The latter is, inter alia, being designed to improve bus priority on Main Street. The Bray Bridge scheme is programmed for construction completion by Wicklow County Council Q3-2023, in line with occupations in Fassaroe.

In addition to these significant bus priority improvement schemes, detailed design is currently ongoing on the Bray DART Station Transport Interchange scheme. This scheme is being implemented by Wicklow County Council to improve bus interchange at the station together with enhanced pedestrian and cyclist access. This scheme is expected to be completed by mid-2023.

Internally within the development bus priority measures will be provided to ensure that the proposed bus services operate with minimal delay to ensure journey time reliability and viability of services through patronage. Bus priority measures include:

- A bus lane in each direction from the south eastern end of the Neighbourhood Centre through to Junuction 6 roundabout with the N11;
- Provision of a bus gate facility at Junction 6 roundabout with the N11 to provide priority for buses access the N11 on bound ramp.

2.6.2 Other Sustainable Travel Modes

As set out in section 2.5.3 above, it is proposed to provide a safe segregated cycle / pedestrian track from Fassaroe to Upper Dargle Road at the La Vallee roundabout including a new pedestrian / cycle bridge across the N11. From here there is existing pedestrian footpath provision along Upper Dargle Road and onwards to Bray Town Centre and Bray DART station. The town centre and Bray DART station is also accessible by bicycle along the Upper Dargle and Lower Dargle Road. The Bus Priority measures to be undertaken along Upper Dargle Road noted at **section 2.6.1.5** above will also benefit cycling conditions along this route.

In addition, Wicklow County Council proposes to deliver the Dargle River Greenway Scheme which will comprise a new bridge over the Dargle River near the La Vallee roundabout to the lands opposite known as the Rehills Site. A further bridge will be provided to the east connecting into the Peoples Park through which the Greenway will connect to Main Street. On completion, Fassaroe residents will be able to cycle to Bray town centre in 8 minutes and Bray DART in 14 minutes via a fully segregated safe cycle route. It is estimated that pedestrians will be able to walk from Fassaroe to Bray town centre in 40 minutes along this same route.

2.6.3 Roads / Vehicular Connections

2.6.3.1 Vehicular Traffic Flow

The proposed roads infrastructure to be provided as part of the Phase 1 development is described in sections 2.5.2 and 2.5.3 above.

The east west Link road connection the N11 to Ballyman Road will be completed prior to the occupation of any development at Fassaroe.

Berryfield Lane currently provides an east west connection through the Fassaroe lands to Ballyman Road. Part of this lane however is not a public road. To maintain the local access nature of this lane traffic calming measures are proposed. This will maintain its current boreen type character and will act as a shared route for local existing vehicular traffic as well as pedestrian and cycle flow arising from the proposed development.

The proposed Berryfield Avenue will intersect Berryfield Lane in two locations. Access to Berryfield Lane will be provided in both directions at each of these intersections maintaining access for existing residents along the lane. At the western intersection of Berryfield Lane and Berryfield Avenue a revised entrance arrangement is proposed for access by one existing resident who has consented to the proposed new arrangement and to the making of the application. The entrance to Berryfield Lane from Ballyman Road will also remain unchanged.

2.6.3.2 Traffic Management Measures at Fassaroe Interchange

The Bray Environs Transport Study 2019 requires Traffic Management Measures at Fassaroe Interchange to be set out in a Traffic Management System Framework to be prepared by Wicklow County Council and agreed with TII. Following detailed traffic modelling exercises, a number of traffic management measures have been agreed between TII and WCC to facilitate a Phase 1 proposed development at Fassaroe.

These traffic management measures comprise the following.

CCTV Camera and Traffic Counters - A CCTV camera will be provided at the interchange which will be connected to the Dublin Traffic Management and Incident Centre. The preferred location for this will be agreed prior to installation. Detection loops will be provided on both on-ramps in conjunction with traffic signals as part of the installation and operation of ramp metering. These loops will also be used as traffic counters to monitor traffic movements entering the N11 at Junction 6;

Queue Detection and Traffic Monitoring Units (TMU's) - TMUs will be installed on the N11 mainline on the approach to the junction in both directions. The location of these will be agreed with TII, noting the presence of an existing TMU 500m north of the southbound off-ramp at Junction 6. The recommended option for traffic management at N11 Junction 6 is to maintain the existing priority operation of the two roundabouts. The results of the modelling for all scenarios including priority operation indicate that there are minimal queues and delays on all arms of the roundabouts at Junction 6 and therefore the installation of queue detection on the N11 off-ramps is not required;

Appropriate Traffic Signals at N11 Junction 6 – The results of the modelling undertaken ultimately concluded that traffic signals are not recommended at Junction 6. Whilst signals have a small benefit to travel times on the N11, the installation of signals would have a significant negative impact on traffic travelling through the two Junction 6 roundabouts, including ultimately significant queues and delays on multiple arms with potential to impact on the N11 mainline. These queues and delays would also have a corresponding significant negative impact on the public transport bus routes travelling across the N11 through Junction 6. In order to provide the ability to control traffic accessing the N11 when necessary, ramp metering signals will be introduced on the northbound and southbound on-ramps at Junction 6 with associated traffic detection and control equipment to allow demand management to be employed, if necessary. These measures, in coordination with the CCTV cameras and traffic monitoring equipment will allow for appropriate control of traffic at N11 Junction 6 when required;

Assessment of Potential for Additional Storage on Diverge Lanes – in all modelled scenarios with the retention of the current roundabout priority control there is minimal queueing and delays on all arms of the Junction 6 roundabouts, including the N11 diverge lanes. Therefore, no additional storage on these lanes is required;

Appropriate Safety Standards - No changes to existing road geometry or junction controls are proposed;

Compatibility of Framework with M11 Junction 4 to Junction 14 Improvement Scheme - The scope of the Traffic Management System Framework incorporates the retention of the current roundabout priority operation and the introduction of ramp metering at the two on ramps along with provision of CCTV cameras and traffic monitoring equipment. In this context it can be concluded that these recommendations would not prejudice, and would be compatible and complementary with, the progression of the N11/M11 Junction.

2.6.4 Energy Efficiency and Sustainability of Buildings

2.6.4.1 Residential

2.6.4.1.1 Houses

Passive house principles will be adopted within the proposed development. There is an emphasis on the embodied qualities of the dwellings to maximise their performance and minimise their energy footprint. Passive house principles will be adopted to reduce the energy demand with features including:-

- Superior levels of insulation,
- Increased levels of air tightness,
- Improved Low E windows
- Use of refined building details that reduce heat loss and minimise thermal bridging.

With the greatly improved levels of air tightness achieved, a heat recovery ventilation (HRV) system is also proposed to be installed in the houses to minimise the heat loss associated with fresh air delivery into the units. The system installed tempers the incoming fresh air with the outgoing stale discharge.

All of the above factors combine to deliver houses that are the benchmark for commercial house building and fall within the definition of Passive house performance. From a space heating measure the houses need to consume less than 1.5 litre of heating oil, per square meter, to be considered passive. This equates to circa 15 kWh/m^2.yr. To achieve such high performance levels the proposed houses will deliver the following enhancements of the 2011 Part L Building Regulations:-

- Wall U values 35% better than Regulations
- Air tightness 60% better than Regulations
- Windows 30% better than Regulations

Having reduced the energy requirement by maximising energy efficiencies and minimising wasted energy, the final pillar of energy optimisation in the houses is addressing the draw on grid electricity. It is proposed that the houses in Fassaroe incorporate photovoltaic solar panels to deliver their Part L renewable contribution. To optimise the energy the panels generate within each house and not “spilling” to the grid, a controller is available that will divert surplus electrical power to the calorifier. The controller also informs the homeowner of the benefits delivered by the PV panels and when they can schedule equipment operation (washing machines / dishwasher) to utilise the peak panel output.

Based on the proposed design the houses within the development will achieve an A2 BER rating.

2.6.4.1.2 Apartment Buildings

For the apartments a district heating system is proposed. This centralises the generation of thermal energy on site and distributes it to all the apartment residences. It is a progressive approach to heating and hot water generation which offers efficient, safe and secure heat. District heating is well established in Europe and it has also been provided on a number of sites in Ireland. Cosgrave Property Group has previously delivered over 1500 apartments using this technology with the most efficient plant, the lowest installed capacity per unit (averaging less than 4kW per unit) and the least transmission losses of any site (on a unit average).

The district heating is engineered with the environment and the end user/consumer in mind. Optimum sizing of the plant for Fassaroe will be prioritised to maximise efficiency of the overall system. District heating is a superior heating system when compared with the standard gas or electrical heating alternatives that are common in apartments. Specific benefits relate to the ongoing maintenance and monitoring of the central plant, the elimination of hot water cylinders in the apartment with the instantaneous generation of hot water and the optimum condensing boiler efficiency with flow temperatures of 60^{o}C. By centrally the heat generation and providing a networked solution around the site the potential to harness a waste heat source in the future is viable. This could be from a data centre, waste processing facility or other industrial process.

With district heating systems, there are no hot water storage cylinders and the related standing losses. The consumer is only charged for the hot water used and there is the added space freed up within apartments. The centralised boilers also remove the risk of carbon monoxide poisoning. There will be a heat meter located in each apartment sub-station, these carry the CE mark and conforms with EU heat metering

requirements. The heat consumed is logged at a central computer and is also displayed on the meter for the occupant to refer to and, the billed amount can then be verified.

Renewable energy contribution is achieved by installing local combined heat and power (CHP) engines on site. The engines burn gas and deliver heat and electricity to the apartment block, with the heat going into the districting piping systems and the electricity used for running the DH scheme, communal lighting and powering e Car charging points.

The apartment designs will achieve an A2 BER rating / ratings for the majority of the units.

2.6.4.2 Neighbourhood Centre

The retail unit spaces will be constructed by the Developer to a shell and core level. A gas and electrical supply will be provided to each unit as well as the other utilities to allow for the tenant fitout. As per the SEAI guidelines the units will be rated on the basis of an air conditioning / heat pump system and natural ventilation. On this basis a provisional rating of A3 (on the NEAP scale) or better is expected be achieved. If incoming tenants choose to complete their fit out using high performance heat pump air conditioning units a final BER of A2 is possible.

2.6.4.3 Creche

The Creche space will be constructed by the Developer to a shell and core level. A gas and electrical supply will be provided to the creche as well as the other utilities to allow for the tenant fitout. The gas is most likely to be used for kitchen consumption. As per the SEAI guidelines the units will be rated on the basis of an air conditioning / heat pump system and natural ventilation. On this basis a provisional rating of A3 (on the NEAP scale) or better is expected be achieved. If incoming tenants choose to complete their fit out using high performance heat pump air conditioning units a final BER of A2 is possible.

2.6.4.4 Kiosk

The Kiosk spaces will be constructed by the Developer to a shell and core level. A gas and electrical supply will be provided to the kiosk as well as the other utilities, including a set of district heating F & R connections to allow for the tenant fitout. The gas is most likely to be used for catering consumption. As per the SEAI guidelines the units will be rated on the basis of an air conditioning / heat pump system and natural ventilation. On this basis a provisional rating of A3 (on the NEAP scale) or better is expected be achieved. If incoming tenants choose to complete their fit out using high performance heat pump air conditioning units a final BER of A2 is possible.

2.6.5 Operational Waste Management and Disposal Proposals

In line with the waste hierarchy, and national targets to increase recycling rates, residents at the development will be encouraged to minimise the amount of waste they produce, and recycle wherever possible. The waste storage and collection facilities at the development will therefore be well designed and located in appropriate areas in order to maximise effective waste management. The refuse that will be collected will include household domestic waste, non-domestic refuse, dry recycling, glass/bottle recycling and organic waste.

The preferred option for the storage and collection of segregated household waste for houses is the provision of individual storage containers for each house. All containers for waste, including recyclable material, should be easily accessible to both the occupier and waste collector. Waste containers will be adequately labelled to ensure the correct types go into the relevant bin.

Communal waste storage areas are provided to serve apartment blocks. In the case of Blocks 1-3 and the Neighbourhood Centre apartments these are located within the basement / undercroft floors. For Block 4 which does not have a basement they are provided in a single storey bin and bicycle store attached to the block. The communal facilities will include a security door to each of the storage areas; each of the communal storage areas will have good ventilation; signage will be provided to ensure residents are aware which bins are to take the various types of waste, so as to encourage proper segregation. In addition, the waste collection point will be clearly designated as a waste storage area through the use of signage and/or floor markings.

Segregated waste collection facilities for the retail units at the Neighbourhood Centre will have easy access for the café and retail units.

Waste will be collected from the site by a licensed waste collector.

A detailed operational waste management plan for the site is provided at as part of the SHD application.

2.7 Description of Construction Works

The key aspects of the construction proposals for the Fassaroe development are set out below. A Construction Environmental Management Plan is also provided at **Appendix 2B**.

2.7.1 Sequencing of Works / Phasing

The general sequencing / phasing of works at the site will be as set out below. There will be two general phases of construction as identified as Phase 1a and 1b on **Figure 2.11** above.

- Secure site boundaries with temporary fencing.
- Establish contractors compound(s).
- Commence construction of proposed new main access road from eastern side of site to western side of development areas, as far as ESB substation (including provision for rerouted 38kV ESB lines) – including all associated roadside landscaping, drainage and utilities.
- Commence construction of new tower structures and underground route for rerouted twin 110kV lines, and for rerouted 38kV line.
- Commence land fill remediation works at Landfill Sites Nos. 1 & 2 (including provision for rerouted 38kV ESB lines).
- Commence construction of Phase 1a residential zone.
- Continue construction of western end of distributor road to Ballyman Road (including works to and remediation of landfill Site Nos. 3A, 3B and 3C).
- Complete remediation of Landfill Site Nos. 1 and 2 and set out as District Park.
- Construct Kiosk in Creche.
- Complete ESB diversion works and decommission existing.
- Complete remediation of Landfill Site Nos. 3A, 3B and 3C and Link Road.
- Continue / complete Phase 1a development.
- Commence Phase 1b including construction of Creche.
- Continue / complete Phase 1b including Neighbourhood Centre.

2.7.2 Site Entrance and Access

Access to the lands are from the N11. The road access into these lands has already been partially upgraded on the eastern side. This roads infrastructure was previously constructed as part of a permitted commercial development which was not subsequently constructed. These constructed roads and roundabouts, now referred to as Fassaroe Avenue form part of the application site. The new main access road through the overall lands will connect into this.

The access road through the site will be one of the first parts of the development to be constructed to open up access to the development areas. The road will be constructed in two rolling phases from east to west. The first phase will comprise Berryfield Avenue from the east of the site as far as the ESB substation. This will provide all necessary access for the initial phases of construction and will also facilitate the timely diversion of the various ESB lines. The construction of the western part of the access road will form a continuous process to provide access to the Landfill sites 3A, 3B and 3C and which will ensure that the road is fully operational by the time of occupancy of the first houses at Fassaroe.

Each of the proposed development / construction areas will be easily accessed off the distributor road at local access points. Due to the nature of the site layout with various development areas accessed off the

distributor road it will be possible to construct the residential areas in a number of different sequences while ensuring minimal inconvenience from construction traffic associated with the later phases on residents of the initial phases of development.

All construction traffic will access the lands from the N11. The access from Ballyman Road will not be opened until prior to the occupation of the initial phases of the development.

Local access for existing residents will be retained along Berryfield Lane for the duration of construction. Access will be maintained to Berryfield Lane from both the east and west throughout the construction period. It is noted that Berryfield Lane is not formally a through road but is regularly used by local traffic as such. During construction of the new distributor road at the two points where it crosses Berryfield Lane there will be some interruptions to local access. In these periods the through route along Berryfield Lane will be restricted when the crossing points are under construction. This may cause some temporary inconvenience to residents, ESB workers and users of the pitches as they may be required to follow detoured routes for a period of time.

2.7.3 Construction Compound

A construction site compound will be established at the site and the working area fenced off to provide a secure site. Due to the scale of development and the phased approach to development this compound will move positions throughout the construction period.

The construction compound will accommodate a site office and staff welfare facilities (including a canteen, drying room, toilets and first aid) as well as storage areas for materials, waste areas and plant and machinery. All surplus plant and materials shall be stored in this location when not in use and will be secured here at night when the site is not operational.

An electricity connection will be provided to the site at the outset. However, it will also be necessary on occasions to use diesel generators. A fuel storage area will be provided at the site compound.

Temporary portable toilet facilities will be provided within the compound. These units will be maintained and the waste collected therein will be disposed of using an appropriately licensed contractor.

As with the main scheme construction works, activities associated with the construction compound will be subject to restrictions on the nature and timing of operations so that they do not cause undue disturbance to neighboring areas and communities. The location of the compound(s) will vary depending on the phasing of the works and the location of the different elements associated with the overall scheme (road, commercial buildings, house building, and retail development). Outside of the main construction compound locations, there may be a number of smaller local work compounds throughout the site which may be used by the Contractor for staff welfare facilities, to store materials for short term use and for plant to park overnight. All vehicle maintenance and refueling will take place at the main compound(s).

Prior to the commencement of construction works, the construction compound locations will be identified in a detailed Construction Management Plan (CMP). This will be submitted to Wicklow County Council for approval prior to the commencement of construction works.

2.7.4 Site Security

Security at the site will be established prior to the commencement of the works and will be incorporated within the Health & Safety Plan for Construction Stage. Given the scale and phased approach to this development parts of the site will be occupied and operational while construction is ongoing in other areas. Unauthorized access will be prevented to live construction areas. Site personnel and visitors will be controlled to ensure orderly development.

Authorization procedures and work permit systems will be established prior to commencement of the works and must be incorporated within the Health & Safety Plan for Construction Stage.

2.7.5 Road Cleaning / Wheel Washing

The contractor will ensure that suitable facilities for vehicle cleansing and wheel washing will be provided at all egress points to the site. Furthermore, and as required, the contractor shall ensure that the existing roads are kept in a satisfactory condition during the course of the works.

2.7.6 Construction Plant and Machinery

It is expected that the following (non-exhaustive list) items of construction plant and machinery will be used during the course of construction associated with this development:-

- Hydraulic Excavators;
- Dump Trucks;
- Cranes;
- Piling Rig;
- Concrete Pump (Lorry mounted);
- Dumpers;
- Site Generators;
- Four-Wheel Drive Vehicles;
- Cement Mixers;
- Miscellaneous Power Tools;
- Rock breakers;
- MEWP's;
- Scissor lifts;
- Teleporters;
- Water pumps;
- Concrete skips;
- Compacting rollers and whacker plates;
- Trench boxes (for holding up the sides of deep excavations);
- Bobcats;
- Mortar silo's;
- Block grabs;
- Scaffolding;
- Graders;
- Concrete floats;
- Kerb grabs;
- Surveying equipment (levels, lasers, GPS setting-out equipment);
- Access towers;
- Ladders.

2.7.7 Construction Material Requirements

Construction materials required for the Phase 1 development will be typical materials for urban development with the most common building materials comprising of cement, steel, wood, aggregates, bricks and blocks, concrete including ready mix concrete, clay / soils, glass / windows, insulating materials and roofing tiles / slates amongst others.

Construction material for individual structures will be delivered to site on a continual basis as required and will have associated traffic movements spread across the overall construction programme. There are a number of aspects of the proposed development however which require large volumes of material to be delivered to site during specified periods of the construction of Phase 1 and which are expected to result in a number of peak construction traffic phases. These are associated with the fill requirements for the remediation of the historic landfill and the laying out of the district park and with the cut and concrete pours associated with the construction of the Apartment Blocks 1,2, 3 and the Neighborhood Centre and their basements.

As set out in **Section 2.5.17** there is a deficit of approximate 130,000m^3 of fill material which will need to be imported to the application site. A large proportion of this deficit is driven by the historic landfill capping material requirements for the remediation measures as granted under the Certificates of Authorisation issued by the EPA. Approximately 25,000m^3 of this total will comprise of the regulation sand layer material required in the capping. The remaining 105,000m^3 approx. will comprise of subsoil and topsoil.

The concrete pours for the basements of the Apartment blocks the neighbourhood centre will likely average concrete pours of 400m^3 /day, around three times every two weeks, for a duration of 3 - 4 months to get up to ground level. Based on this calculation the volume of concrete pour for Apartments Blocks 1,2 3 and Neighbourhood Centre are expected to be circa 9,600m^3 each. These construction elements (and associated construction traffic flows) will not occur concurrently

2.7.8 Construction Working Hours

The timing of construction activities, working hours and the rate of progress of construction works are a balance between efficiency of construction and minimising the impact on the local community and road users. Constraints will be specified in the contract documents, generally restricting working hours on the proposed development.

Typically, construction working hours adjacent to residential areas or sensitive noise receptors will be limited to:

- 7am - 7pm, Monday to Friday; and
- 7am - 2 pm, Saturday
- Sunday – no working
- Bank and Public Holidays – no working

However, given the nature of the proposed apartment buildings and the Neighbourhood Centre, the construction will require regular large concrete pours which in turn require significantly longer working days. It is not unusual that such activities would require construction blocks of up to 15 hours approx. Given the nature of construction and a range of influencing factors it is not possible to predict or programme far in advance the exact dates on which extended construction hours will be necessary. It is proposed that the developer however will provide notification to the Planning Authority a week in advance of these occurrences.

2.7.9 Construction Programme

The indicative programme for the construction of the development is set out in **Table 2.12** below. This presents a four year programme which includes timelines for the various elements of the development which will overlap in many cases. It is possible however that the duration of each element may take longer than estimated and the overlap of phases may be shortened. This programme also assumes a speedy commencement of construction following receipt of permission. It is possible, however, that the commencement of the construction may take longer to allow for compliance agreements, etc. Having regard to these potential practical implementation requirements, planning permission is sought for a total period of 8 no. years.

Table 2.12: Indicative Construction Programme

Development Element	Approximate Duration	Approximate Timeline
Site Development Works, Distributor Road Construction, ESB Diversions	12 months	Q3 2022 – Q3 2023
Landfill Remediation, associated landscaping, district park	16 months	Q4 2022- Q1-2024
Phase 1a Residential and creche	16 months	Q1 2023 – Q2 2025
Phase 1b Residential	14 months	Q1 2024 – Q2 2025
Neighbourhood Centre	12 months	Q2 2025 - Q3 2026

2.7.10 Health and Safety

2.7.10.1 General Procedures

The following Legislations, Regulations and any other relevant Regulations apply on this project:

- Safety Health and Welfare at Work Act 2005 as amended.
- Safety Health and Welfare at Work (Construction) Regulations 2013 to 2020.

The requirements of the above Legislations and Regulations shall be complied with by all duty holders appointed to carry out the works.

2.7.10.2 H&S Procedures for Localised Excavation Works at Landfill Sites

During the localised excavation works for landfill remediation the waste material will be exposed, increasing the risk for a windblown litter. Waste material and contaminated material may also be exported offsite attached to equipment and machinery.

To mitigate the impacts arising from the exposure of waste and excavation from the historic landfill sites, the following measures will be implemented:-

2.7.10.2.1 Site Access

To protect the personnel outside the work area and for proper control of the areas being worked in, it will be necessary to take complete and secure possession of the site. Secure temporary fencing shall be erected around the waste excavation area. An area shall be delineated around the proposed excavation which will be regarded as a safety zone beyond which the contractor's plant shall not be permitted to leave unless it undergoes full decontamination to ensure waste is not exported from site.

Measures will be required to ensure that only authorised persons can enter the work area and that they are trained, competent and inducted for the operations being carried out within the site. The contractor must put in place rigorous accident and emergency procedures and ensure that all persons on site are familiar with these.

Due to the nature of the material in question, all excavation and movement of waste should be carried out by mechanical means.

2.7.10.2.2 Personal Protective Equipment

Strict rules and standards will be enforced regarding PPE around the works area. This will include at a minimum helmets, gloves, tyvek suits, steel toed boots and safety glasses. Appropriate respiratory equipment will be maintained on site and there will be ongoing monitoring for gaseous hazards. The monitoring will be agreed with the contractor but provision must be made for raising the alarm, emergency procedures and a plan for alerting those outside the work areas.

In addition, suitable hygiene and welfare facilities and PPE should be provided in accordance with the requirements of the Safety, Health and Welfare at Work (General Application) Regulations 2007, Safety Health and Welfare at Work (Exposure to Asbestos) Regulations 2006 and 2010 amendments and the Safety Health and Welfare at Work (Construction) Regulations 2013 to manage potential risks to construction workers.

2.7.10.2.3 Dust Suppression

The excavation of the works must be planned to minimise the risk of any material becoming airborne through the creation of dust. The contractor will have to put measures in place for dust suppression (water bowser) and have regard to weather conditions during the works to avoid run-off or severe dryness which could lead to problems with containment.

2.7.10.2.4 Gas and Odour Control

The anaerobic decomposition of putrescible waste generates landfill gas which comprises methane and carbon dioxide. Gas monitoring carried out on Site 3B to date has consistently recorded methane

concentrations ranging from 25.8% v/v to 70.4% v/v and carbon dioxide ranging from 17.2%v/v to 36.6%v/v. Therefore it is expected that methane and carbon dioxide will be encountered during the Site 3B excavations.

A detailed construction methodology for the excavation works shall be prepared by the contractor and communicated to all site personnel to ensure that no confined spaces or trenches deeper than 1m are created during the excavation of waste. Where confined spaces or trenches greater than 1m are created, gas detection equipment and appropriate breathing apparatus should be used by all personnel in the vicinity of the confined space/trench.

The works must be planned to minimise the risk of the release of odours and gases to surrounding areas including the contractor's compound and the wider community. Site operatives in the Site 3B area will be instructed to report all unusual, concentrated or significant odours on-site, so that measures may be taken to identify the source of the odour and eliminate it. Gas monitoring techniques will be put in place by the contractor. For nuisance odours, automated odour control systems may need to be put in place, as necessary, to periodically release a fragrance to mask or neutralise unpleasant odour. A wheel-washing facility shall be established for trucks leaving the site to minimise the transport of potentially odorous clay particles onto adjacent roads.

A no smoking policy will be strictly enforced onsite.

2.7.10.2.5 Exposed Waste Material

During the excavation works the waste material will be exposed, increasing the risk for windblown litter. Waste material and contaminated material may also be exported offsite attached to equipment and machinery.

To mitigate the impacts arising from the exposed waste the following measures will be implemented:

- The contractor shall excavate the waste in areas as small as possible in order to limit the exposure of the waste. The contractor shall prepare an excavation plan which supports this ethos;
- Should excessive wind conditions prevail, such that there is a risk of uncontrolled exposure to the waste with the consequences of it becoming windblown then the excavation shall cease until the weather becomes more amenable to the safe excavation of the waste. Any exposed areas of waste shall be covered with compacted clean material at the end of every working day as a minimum, in order to minimise the exposure of the waste to the winds;
- An area around the proposed excavation will be delineated which will be regarded as a safety zone beyond which the contractor's machinery is not permitted to leave unless it undergoes full decontamination;
- Only fully sealed containers shall be used for the removal of waste offsite; and
- Prior to demobilisation, the contractor shall properly decontaminate all equipment and appropriately dispose of the decontamination water, field waste and contaminated personal protective equipment (PPE).

2.7.10.2.6 Asbestos

During the site investigations to date only 1 of 53 samples of waste tested positive for asbestos. This waste was in Site 1. Nonetheless there remains a risk that asbestos or Asbestos Containing Material (ACM) could be uncovered during the excavation of waste in Site 3B. It shall therefore be a requirement that the contractor for the works has in place, prior to the works, an Asbestos Management Plan, prepared in accordance with the following guidance and regulations:

- AGS 2012, Interim Guidance ' Site Investigation Asbestos Risk Assessment for the Protection of Site Investigation and Geotechnical Laboratory Personnel';
- CIRIA 2014, C733 A Guide to Understanding and Managing Risks; and
- Safety Health and Welfare at Work (Exposure to Asbestos) Regulations 2006 and 2010.

2.7.11 Construction Waste Management

In advance of works commencing on site, a detailed Construction Management Plan will be prepared and submitted to WCC for agreement. This Plan will include a waste management plan which meets the requirements of the DoEHLG *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects* (DoEHLG, 2006). Where waste generation cannot be avoided this will maximise the quantity and quality of waste delivered for recycling and facilitate its movement up the waste hierarchy away from landfill disposal and reduce its environmental impact.

The outline / structure of the Construction and Demolition Plan for the proposed development is set out below. The Waste Management Plan will include but will not be limited to:-

- Details of main contractor including nominated project manager;
- The names, roles, responsibilities and authority of key personnel involved in waste management on site and in the design team;
- Estimates of waste generation including the types and quantity of wastes generated;
- Types and quantities of excavation material;
- Measures to reduce waste generation;
- The amounts of material intended to be stored temporarily onsite and the location of such storage;
- Measures to prevent nuisances, etc.;
- Authorised waste hauliers with appropriate and up-to-date Waste Collection Permits;
- Recycling and disposal sites, including copies of permits / licences for waste facilities; and
- Any other relevant item during construction which may be brought to the attention of the design team or the contractor which should be reasonably addressed and inserted into the Waste Management Plan.

The following procedures should be included in the plan where relevant:-

- Procedure for the control of sub contracts, if applicable, which must include the assessment of the sub contractors waste management policies and control capabilities, and the identification and implementation of additional controls needed on such sub-contractors to fulfil the design teams and contractors' obligations in respect of waste management;
- Procedure for dealing with waste management including liaison with third parties, statutory bodies, waste hauliers, waste disposal facilities and other companies;
- Procedure for the excavation and handling of waste materials to prevent nuisance;
- Procedure for the segregation and proper storage of materials onsite to facilitate reuse and recycling;
- Procedure for the management of any hazardous or contaminated waste;
- Procedure for the control of all documentation relating to the handling, transportation and disposal of waste; and
- Procedure for the management review/audits to monitor and demonstrate control over the implementation of the Waste Management Plan.
- Possibilities for re-use of clean non-hazardous excavation material as fill on the site or in landscaping works will be considered following appropriate testing to ensure material is suitable for its proposed end use. Where excavation material may not be re-used within the proposed works the Contractor will endeavor to send material for recovery or recycling so far as is reasonably practicable. Further details on the reuse of excavated material is presented in section 14.
- A soil management plan covering the reuse of soils on site will be prepared and will address any issues associated with the excavation, movement and reuse of materials.
- The contractor will ensure that any interim storage or waste management facilities for excavated material have the appropriate waste licenses or waste facility permits in place.

In addition to the above. during the construction phase the following mitigation measures are recommended:-

- **Source Segregation: Where** possible metal, timber, glass and other recyclable material will be segregated during construction works and removed off site to a permitted/licensed facility for recycling. Waste stream colour coding and photographs will be used to facilitate segregation;
- **Material Management:** 'Just-in-time' delivery will be used so far as is reasonably practicable to minimise material wastage; and
- **Waste Auditing:** The Contractor will record the quantity in tonnes and types of waste and materials leaving site during the construction phase. The name, address and authorisation details of all facilities and locations to which waste and materials are delivered will be recorded along with the quantity of waste in tonnes delivered to each facility. Records will show material which is recovered and disposed of.

2.8 Capping System Construction Quality Assurance (CQA)

2.8.1 CQA Plan

As part of the design, a CQA Plan will be prepared for the installation of the capping system in accordance with the requirements of the *EPA Landfill Manual: Landfill Site Design*. The CQA Plan will set down the procedures for sourcing, transporting, placing, testing, repairing and protecting the capping materials prior to, during and after construction. The CQA Plan will set out the roles and responsibilities of the various parties on site and the reporting to be provided by the manufacturer, installer and CQA Monitor. This plan will help to ensure the design of the capping system is not compromised during its construction.

2.8.2 CQA Supervision

Third party supervision of the capping works by a specialist CQA consultant is required by the *EPA Landfill Manual: Landfill Site Design* and will be provided by a suitably qualified and experienced company. The CQA contractor will be responsible for overseeing the capping works and ensure that the main contractor adheres to the Works Requirements. A CQA validation report will be submitted to the EPA following the construction for the capping system. The CQA validation report will set out all aspects of the construction from supply through to final placement and testing.

A quality control system will be put in place for all documentation relating to the capping works. All documentation will be kept on-site and available for inspection at all times. CQA documentation will include the following:

- Delivery, handling and storage of materials,
- Geomembrane panel layout and programme,
- Geocomposite panel layout and programme,
- Monitoring programme,
- Geomembrane seam testing,
- Geocomposite seam testing,
- Soil inspection, and
- Laboratory testing results.

2.9 Risk of Major Accidents or Disasters

The potential hazards with the on site landfills include explosion / flammability, asphyxiation, chronic exposure, odour, and vegetation die-back.

However with construction methods and the landfill radiation measures proposed there will be no unacceptable risk to site or adjacent site users existing or proposed.

No other particular risk of potential major accidents or disasters during construction or operation are identified. The CEMP provided at Appendix 2B incorporates an emergency response plan in the unlikely event of such occurring.

2.10 Alternatives Considered and Assessed

The subject lands are zoned for specific uses under the Bray Municipal District Local Area Plan 2018. In this regard the scope of consideration of alternatives is limited in the first instance as the LAP establishes the principle of development proposed.

2.10.1 Nature and Extent of Development Proposals

A number of alternatives to the nature and extent of the development presented in the application have been considered in the course of the application development and pre-application consultation processes. The starting point for the applicant in defining a scope of proposed development was the Bray MD LAP 2018.

The LAP identifies that development within the Fassaroe Action Area Plan be carried out in phases. The LAP identifies two main phases, of which Phase 1 would comprise of the following:

- Road link from N11 to Ballyman Road
- Passive Park (minimum of 8ha)
- Active Open Space / Sports Zone (minimum of 14 ha)
- Site identified and reserved for school campus
- Neighbourhood Centre
- Up to 2,000 residential units

2.10.1.1 Initial Development Considered by Applicant comprised up to 2,000 units

In order to align as closely with this phasing as possible at initial informal pre-application discussions undertaken with Wicklow County Council, a scheme which would include up to 2,000 residential units was discussed by the Applicant. In light of the provisions of the Bray and Environs Transport Study 2019 however which provided a policy framework for a more refined phasing of development at Fassaroe, Wicklow County Council advised that a reduced scale of development be followed for the first phase application.

2.10.1.2 Reduced Scale Development Considered at s247 pre-application with Wicklow County Council – 1,084 No. units and no Neighbourhood Centre

Formal section 247 pre-application consultation was undertaken with Wicklow County Council on the basis of a development which incorporated the following:

- Road link to connect N11 to Ballyman Road
- Pedestrian / cycle connection across the N11 to connect to Dargle Road
- Remediation of 5 No. historic landfill areas
- 15.4 ha of new District Park / Active Open Space (plus 3.1ha pitch previously provided in Fassaroe by the Applicant)
- Creche (approx. 750 sq.m.)
- 1,084 residential units of which 487 No. are houses and 597 No. are apartments with local public and communal open space provision
- Retail unit / kiosk in District Park
- Demolition of existing dwelling at Berryfield Lane

No neighbourhood centre development was proposed to be delivered as part of this application at this stage. This was in response to a reason for refusal attached to a previous application at Fassaroe for 658 No. dwelling which found that the proposal for a c2,963sq.m. Neighbourhood Centre at the time (which had

been proposed at the scale provided for in the relevant development plan at the time) was excessive for the initial scale of development proposed.

Regarding the scale of residential development proposed Wicklow County Council noted that the Roads and Transportation requirements for first 650 No. units are set out in the Bray Environs Transport Study and that those in the control / responsibility of the applicant will be incorporated into the application / delivered with the development.

For proposal of housing units above 650 No. units WCC noted the need for an Implementation Plan to be agreed by WCC / other agencies. WCC advised that separate meetings should be progressed between Atkins on behalf of the Applicant and WCC Roads Dept / other agencies to progress this. WCC advised that applicant should endeavour to have an agreed Implementation Plan before an application was lodged with ABP.

WCC advised that it could not confirm approval for the full quantum of residential units proposed in the absence of an agreed Implementation Plan.

With regard to the absence of a Neighbourhood Centre proposal WCC advised it was satisfied that the Neighbourhood Centre would be delivered as part of a later stage of the overall development at Fassaroe when an adequate on-site population is in situ. It advised that it was satisfied in principle with the proposal to serve a local retail need for the initial stages of the development from a kiosk / retail unit in the proposed Park.

2.10.1.3 Refined Proposals Considered at initial Pre-application Consultation Stage with An Bord Pleanála – 1,161 No. units and no Neighbourhood Centre

The content of development presented to An Bord Pleanála was altered from that presented to Wicklow County Council to address a number of the comments of the Local Authority and through design refinements. The content of the development proposed comprised:

- Road link (2.4km) connecting N11 to Ballyman Road
- Pedestrian / cycle bridge connection across the N11 to Dargle Road
- Remediation of 5 no. historic landfill sites in line with Certificates of Authorisation issued to Wicklow County Council by the EPA in 2019
- 15.4 ha of new District Park / Active Open Space (plus 3.1ha pitch previously provided in Fassaroe by the Applicant)
- 733sq.m approx. crèche with capacity for approx. 138 no. childcare spaces
- 1,161 no. residential units comprising 496 no. houses and 665 no. apartments
- Retail unit / kiosk (108sq.m.) in district park
- Demolition of an existing dwelling at Berryfield Lane

Following an initial meeting with An Bord Pleanála, the Board issued a letter advising the prospective applicant to address a number of matters in further consultation documentation to be submitted to An Bord Pleanála. A number of the items raised related to the scope of the development proposed, in particular to the number of housing units proposed and the absence of neighbourhood centre provisions.

2.10.1.4 Revised Proposals presented as Pre-application Clarification

The scope of the development was revised by way of clarification to An Bord Pleanála as follows:

- Total residential units proposed now reduced to 697 no. residential units, comprising 288 no. houses and 409 no. apartments
- Stage 1 of Neighbourhood Centre to be provided comprising retail / retail services / commercial / café space, with residential development overhead. A community concierge area was also proposed be provided at the neighbourhood centre which will serve the entire Fassaroe future development.

The basis for the revision to the number of residential units was to align the scale of proposed residential development to the Phase 1a provisions of the Bray Environs Transport Stud, in the absence of an agreed Implementation Plan for further phases beyond c.650 No. houses. Neighbourhood uses were proposed to be provided to ensure an appropriate level of on site services and amenities for the initial population. The full Neighbourhood Centre provisions for the full build out of Fassaroe were not included however to ensure the level of retail provision would not be excessive for the initial phase of population at Fassaroe. The Stage 2 of the Neighbourhood Centre will be provided with a later phase of the overall development at Fassaroe as the on-site population expands.

2.10.1.5 Scope of Development of Current Proposals

The scope of development now presented in this final application to An Bord Pleanála has been subject of some further slight refinements to reduce the number of units proposed to 650 No. which exactly mirrors the number of units mentioned in the Bray Environs Transport Study 2019 for the initial phase of development at Fassaroe.

2.10.1.6 Difference in Environmental Impacts

Reducing the scale of development proposed in this application from the initial proposal of 2,000 units to 650 units per the current application will reduce the level of direct environmental impacts by reducing the amount of lands being developed and the level and duration of construction activity on site, as well as the number of future residents and operational activity arising at the site. However, as the lands are in any case zoned for development, and are planned to be subject of future phased planning applications the environmental impacts within the wider Fassaroe area in the long term are likely to be similar to those expected from a 2,000 unit development proposal.

2.10.2 Surface Water Drainage Options

In the course of previous development proposals considered at this site in 2016 the Design Team initially looked at a SUDS approach to the development which would collect surface water from much of the development area and attenuate it within the proposed ponds in the District Park. Water would be released from these ponds at a controlled rate in line with current natural runoff rates.

However having assessed this option it was noted that it would give rise to reductions in the level of groundwater recharge. This was identified as a potential source of adverse impact on the Ballyman SAC as it could have led to notable reductions in groundwater which could have potentially affected the petrifying spring locations within Ballyman Glen for which the SAC is designated. A proposal incorporating soakaways within all of the proposed development areas is therefore incorporated in the proposed application documents. This allows water to percolate to ground at pre-development infiltration rates. The surface water network also connects to the ponds within the District Park to allow water from storm events to be attenuated and discharged to the County Brook at controlled runoff rates. This does not lead to loss of groundwater recharge, as such storm events would have resulted in direct runoff to the stream in any case.

2.11 Potential Cumulative Environmental Impact Considerations

There are no other notable developments currently proposed within the Fassaroe area. The main potential for cumulative impact in the immediate vicinity arises from the future development of the remainder of the Action Area lands which allow for considerable amounts of future mixed use high density development. While this EIAR relates to the current Phase 1 application proposals specifically the following specialist environmental assessments also have regard to the potential future nature of cumulative impacts that may arise due to the future development of the entire Action Area lands.

A notable permitted development in the slightly wider area is the Irish Water reservoirs at Ballyman which have been granted permission and which will ultimately serve much of the new development lands of the southern part of Dun Laoghaire Rathdown County Council and northern Wicklow, including the Fassaroe lands themselves.

3 RATIONALE FOR DEVELOPMENT AND POLICY CONTEXT

3.1 Policy Based Rationale for Proposed Housing Development

The rationale for this development is grounded in National, Regional and Local planning policy provision.

3.1.1 National Policy Context

3.1.1.1 Housing for All – A New Housing Plan for Ireland, September 2021

'Housing for All - a New Housing Plan for Ireland' is the government's housing plan to 2030. The government's overall objective is that every citizen in the State should have access to good quality homes:

- to purchase or rent at an affordable price
- built to a high standard and in the right place
- offering a high quality of life

The government's vision for the housing system over the longer term is to achieve a steady supply of housing in the right locations with economic, social and environmental sustainability built into the system.

It is estimated that Ireland will need an average of 33,000 new homes to be provided each year from 2021 to 2030.

The policy has four pathways to achieving housing for all:

1. supporting home ownership and increasing affordability
2. eradicating homelessness, increasing social housing delivery and supporting social inclusion
3. increasing new housing supply
4. addressing vacancy and efficient use of existing stock

The pathways contain actions to be taken by government departments, local authorities, State agencies and others. The pathways are supported by actions to enable a sustainable housing system.

The proposed Phase 1 development at Fassaroe will deliver on three of these pathways. At 650 No. dwellings it will directly increase new housing supply. It also has a Part V and social housing component which will be delivered within the first construction phase which will have a substantial impact on social housing lists within the Bray Municipal District. The proposed development with its range of different house types and sizes will enhance choice and availability within Bray thereby supporting home ownership and increasing affordability.

3.1.1.2 Project Ireland 2040: National Planning Framework (NPF)

In 2018, the Government published Project Ireland 2040: *National Planning Framework (NPF) which sets out "the Government's high-level strategic plan for shaping the future growth and development of our country to the year 2040"*. The NPF outlines a national target to deliver 550,000 additional households by 2040. For the Eastern and Midland Region, the NPF has a population growth target between 490,000 – 540,000 additional people up to 2040.

The proposed development includes 650 no. residential units on appropriately zoned lands. Based on an average household size of 2.7 persons per dwelling (based on 2016 Census data for Wicklow) this development will provide accommodation for approx. 1,755 No. additional persons, thereby making a significant contribution to this Objective.

3.1.2 Regional Planning Policy Context

3.1.2.1 Eastern and Midland Regional Assembly, Regional Spatial and Economic Strategy 2019 – 2031 (RSES)

Bray is identified in the Eastern and Midland's Regional Spatial and Economic Strategy (RSES) as one of three 'Metropolitan Key Towns'. These towns are strong active towns within the Dublin Metropolitan Area with high quality transport links and capacity for increased residential and employment densities. In terms of strategic development of these Towns, the RSES confirms that they should be developed at an appropriate scale as part of the overall development of the wider metropolitan area.

The RSES identifies that Bray is the largest town in County Wicklow, with a population of 32,600 in 2016, and strategically located at the eastern gateway to the County, with access to the N/M11 corridor (including M50), DART/rail line and quality bus service. It records that it is a strong active town that provides higher order services, including tertiary education, health, cultural and leisure facilities and is a major retail and shopping destination, attracting people from the surrounding towns and villages

With reference to residential development specifically the RSES sets out that population growth in Bray has been modest compared to other settlements as expansion of the town is constrained by the coast to the east, Bray Head/Sugarloaf mountains to the south and the N/M11 to the east. The RSES states that in order for Bray to fulfil its growth potential, the lands at Fassaroe to the west of the N/ M11 are targeted for new housing, employment and major community and sports facilities, along with development of lands at Old Connaught (Conna)-Fassaroe, which are within Dún Laoghaire-Rathdown.

RPOs 4.37 and 4.40 of the RSES have specific regard to the development of Bray and note the importance of the westward extension of the town into Fassaroe.

3.1.3 County Planning Policy Context

3.1.3.1 Draft Wicklow County Development Plan 2021 – 2027

The population of Bray Metropolitan Key Town is targeted to increase from 29,646 in 2016 to 40,425 in 2031 under the Draft Wicklow County Development Plan 2021 – 2027.

3.1.3.2 Wicklow County Development Plan 2010 - 2016

The Wicklow County Development Plan 2010 was prepared in the context of the Regional Planning Guidelines for the Greater Dublin Area 2010 – 2022. In that context the RPGs had indicated that 42% of the growth allocated to County Wicklow should be directed to the Metropolitan Area settlements of Bray and Greystones, with the remainder of the growth allocated to be distributed around the County, with the majority being directed into the growth towns.

The predicted population growth set out in the County Development Plan was for a population of 45,000 in 2022 from its measured population of 28,814 in 2006. The Plan notes that in order for Bray to fulfil its growth potential, lands at Fassaroe to the west of the N/M11 are targeted for new housing and other facilities.

3.1.4 Local Planning Policy Context

3.1.4.1 Bray Municipal District Local Area Plan 2018

The Bray Municipal District Local Area Plan 2018 (Bray MD LAP) sets out that in considering how and where to grow the town further, the historical development and physical limitations must be recognised. The solution for the growth of Bray has a number of elements, one of which is:

> *"The development of a major new centre at Fassaroe, west of the M11, targeted to be developed as a mixed residential, open space, community and employment area, with the potential to meet up to 60% of the new housing need of the settlement."*

The Bray MD LAP sets out a residential strategy for the municipal district with five key objectives, one of which is:

> *"To promote and facilitate the rapid delivery of the maximum number of housing units in the key development areas of Fassaroe and the former Bray golf club".*

The Bray MD LAP identifies a total future provision of approximately 4,000 No. residential units for the full build out of the zoned lands. The LAP also identifies employment, recreational, educational, retail and commercial uses within the area.

3.2 Transport Policy Context

The transport policy context for the proposed development is established at a Regional and Local level.

3.2.1 Regional Transport Policy Context

3.2.1.1 Draft Transport Strategy for the Greater Dublin Area, 2022 – 2042

While not yet finalised, the Draft Transport Strategy for the Greater Dublin Area sets out the framework for investment in transport infrastructure and services over the next two decades to 2042. The Draft Transport Strategy sets out transport policy to serve amongst other areas the town and surroundings of Bray. Chapter 12 of this EIAR which comprises a Traffic and Transportation Impact Assessment provides more detail on the specific public transport proposals within the Strategy which are of relevance for Bray including Fassaroe. In summary however, it includes proposals for:

- BusConnects Core Bus Corridor from Bray to Dublin City Centre
- Extension of the Luas Greenline southwards to serve Bray and Environs
- DART+ Coastal South
- Park and Ride Facilities at Fassaroe

3.2.2 Local Transport Policy Context

3.2.2.1 Bray and Environs Transport Study, 2019

The Bray and Environs Transport Study (BETS) is a joint undertaking between the National Transport Authority (NTA), Transport Infrastructure Ireland (TII), Wicklow County Council (WCC) and Dún Laoghaire-Rathdown County Council. A primary purpose of this study was to seek to facilitate the land use objectives of Wicklow County Council and Dún Laoghaire-Rathdown County Council as provided in statutory plans and policy documents.

The Study identifies a first phase of development in Fassaroe as comprising circa 650 no. residential units and appropriate residential support facilities. It sets out several provisions for transportation infrastructure / services that are required in order to sustainably develop this first phase of development.

Due to the need to address the impact of any proposal on the existing congested national road network in advance of NDP N11/M11 Junction 4 to Kilmacanogue – Junction 14 Improvement Scheme, the BETS advises that it would be necessary for Wicklow County Council, in agreement with TII, to prepare a framework for a Traffic Management System to facilitate phase 1(a) development of the Fassaroe lands. It was recommended that the agreed framework includes in its scope the identification of traffic management measures and infrastructure to minimise the impact of the Fassaroe proposal on the mainline the N/M11 and to enhance Wicklow and TII's ability to manage traffic flow on the N11 corridor pending future national road schemes. Following detailed traffic modelling and consultation between Wicklow County Council, TII and the NTA, a Traffic Management Framework has been agreed between Wicklow County Council (WCC) and TII at this junction, incorporating an agreed set of measures to appropriately manage traffic flow and minimise the impact of traffic on the N11 and adjacent M50 mainlines. This framework agreement is presented in a *N11 Junction6 Traffic Management Framework Agreement Technical Note* by Wicklow County Council dated September 2020 and issued by email from WCC to TII and NTA on 09.09.20. A copy of this is presented in Appendix 3A. By letter dated 09.10.20 (Appendix 3B) the NTA confirmed that subject to the agreement of TII and progress on the delivery of bus priority between Fassaroe and Bray Rail station that the measures

contained in the Framework Agreement technical note were sufficient to accommodate the first phase development of approximately c.650 residential units. By Letter dated 01.10.20 TII confirmed general agreement subject of a number of provisions (Appendix 3C). A series of emails from WCC to TII followed on 8.04.21 and 12.04.21 which provided responses and commitments to TII on the various provisions raised in its letter of 01.10.20. By letter dated 16.04.21 TII confirmed that *"as a result of these commitments outlined above by Wicklow County Council, TII can now confirm agreement to the proposals outlined by Wicklow County Council for N11 Junction 6 Traffic Management Framework Agreement in order to facilitate the development of 650 residential units and appropriate residential support facilities on the lands at Fassaroe*". This letter confirming agreement with the framework is provided at Appendix 3D.

The agreed traffic management measures of the framework are provided for in the current proposed development, as discussed further in **Chapter 12**, Traffic and Transportation Assessment of this EIAR. In summary however, the measures include the provision of appropriate access roads within Fassaroe, a pedestrian and cycle bridge over the N11, traffic management measures at Fassaroe Interchange, bus priority measures on Upper Dargle Road and on Dublin Road – Castle Street and new bus services in line with a Public transport strategy for Fassaroe agreed with NTA. Confirmation of NTA agreement with the Public Transport Strategy is provided at **Appendix 2A**. The Public Transport Strategy document by Atkins Consulting Engineers is provided as part of the overall SHD application to An Bord Pleanála and is referenced for this EIAR.

In addition to the requirements of the agreed Framework, BETS also requires that the development of Fassaroe should provide fully for walking and cycling trips to all local services in the Fassaroe area. An interim bus service should be provided by the developer to connect the area to Bray DART Station in advance of demand justifying a public service. These requirements are provided for in the current application.

3.3 Policy Basis for Nature and Scope of Land Uses Proposed

3.3.1 Bray Municipal District Local Area Plan 2018

The Bray MD LAP identifies Fassaroe and an Action Area. The LAP states as follows in respect of Action Areas:

> *"'Action Area Plans' have been identified in this plan. 'Action Area Plans' are to be the subject of comprehensive (not piecemeal) integrated schemes of development that allow for the sustainable, phased and managed development of the Action Area during the plan period. Separate applications for sections of each Action Area Plan will not be considered until an overall Action Area Plan has been agreed in writing with the Planning Authority **unless** it can be shown that any application will not undermine the achievement of the overall objectives for that Action Area and would contribute its 'pro rata' share of the public infrastructure and facilities set out in this plan for that specific area."*

In advance of preparation of the current application a Proposed Action Area Plan (AAP) was prepared by the Applicant and issued to Wicklow County Council. The proposed Action Area Plan was revised on foot of comments from the Planning Authority and subsequently issued by the Applicant to the other main owner of lands within the Action Area as requested by the Planning Authority. A final revision was made to the Proposed AAP on foot of comments from WCC and reissued to the Planning Authority on 28.09.21. By letter dated 01.11.21 WCC confirmed that in principle it considers the proposed AAP to accord with the zoning objectives and overarching Action Area criteria identified in the Bray MD LAP (see **Appendix 3E**). The Planning Authority also clarified its intention to issue to the proposed AAP to all stakeholders encompassed by the Action Area boundary before final assessment and approval.

Thus, while not formally approved by WCC, the Planning Authority has confirmed in writing that in principle the proposed AAP accords with the zoning objectives and Action Area criteria. Furthermore, the Statements of Consistency document by RPS which accompanies the SHD application also sets out how the application proposals accord with the Action Area criteria and how it contributes its pro rata share of public infrastructure. In this regard, the current application content complies with the policy requirements of the Bray MD LAP in respect of the Action Area.

The Bray MD LAP Action Area criteria outline two main phases of development for Fassaroe as follows:

Phase 1	Road link from N11 to Ballyman Road Passive Park (minimum of 8ha) Active Open Space / Sports Zone (minimum of 14ha) Site identified and reserved for school campus Neighbourhood Centre Up to 2,000 residential units
Phase 2	Identification and reservation of site for additional primary school Remainder of residential units

The current proposed application comprises the initial stage of the 'Phase 1' as identified in the LAP. With 650 No. residential units it comprises approx. 33% of the 'Phase 1' housing provision. The restriction of the current application to 650 No. units is based on the provisions of the Bray and Environs Transport Study set out below.

In terms of the other 'Phase 1' elements identified in the LAP, the application provides fully for the road link, passive park (well in excess of the required 8ha) and school campus reservation. It also delivers 3.8ha of new active open space (in addition to 3.1ha previously provided to Enniskerry AFC at Fassaroe). It provides for a first phase of the Neighbourhood Centre to ensure an appropriate early provision of onsite services. This is restricted to a first phase of Neighbourhood Centre to protect against an oversupply of retail on site before a suitable population level is reached.

3.3.2 Bray and Environs Transport Study, 2019

The Bray and Environs Transport Study has guided the content of the current application by identifying a 'Phase 1(a)' extent of development at Fassaroe and setting out transport measures required to deliver this initial phase of development. The BETS states as follows:

> *"Phase 1(a) of the development of Fassaroe would comprise c.650 residential units and appropriate residential support facilities."*

The measures identified to deliver this scale of development include the traffic management measures and transport measures identified at section 3.2.2.1 above. These measures are provided for in the current application and are agreed with the relevant stakeholders of TII and NTA. The current proposal comprises of 650 No. residential units in line with these provisions of BETS.

4 POPULATION AND HUMAN HEALTH

4.1 Introduction

This chapter of the EIAR describes the existing environment in respect of population and human health, and assesses the likely impacts of the proposed scheme on land use, amenity and community services and tourism and recreational amenities. Mitigation measures are proposed, where deemed necessary, in order to reduce, and if possible remedy, potential adverse effects on the receiving environment that may occur as a result of the proposed development.

Population and Human Heath comprise one of the most important elements of the *"environment"*. Any potential impact on the status of population by the proposal must therefore be comprehensively assessed. The primary objective in respect of this is to ensure that people experience no significant unacceptable diminution in aspects of *"quality of life"* as a consequence of the construction and operation of the proposed development. Relevant components of *"Population and Human Health"* in this section of the EIAR include land use, employment, and community aspects. Health and safety aspects of the proposed development are also considered.

Information on the demographic and employment characteristics of the resident population within the catchment area that are considered of relevance is provided. This information is sourced from the Census of Population of 2006, 2011 and 2016, the Labour Force Survey and the Live Register. As a point of note, the economic impact of the COVID-19 pandemic has been appropriately taken into account insofar as possible.

In addition to the impacts on population and human health dealt with under this chapter, indirect impacts on population and human health are also considered in Chapter 7 – Water Services, Hydrology and Flood risk; Chapter 8 – Air Quality and Climate; Chapter 9– Noise and Vibration; and Chapter 10 – Landscape and Visual.

4.2 Methodology

4.2.1 Identifying Appropriate Content

The Environmental Protection Agency's (EPA) *Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*, 2017 describe the possible content to be contained within the Population and Human Health section of an EIAR and has informed the content of this chapter.

Aspects identified in the Draft Guidelines to be considered under this heading are Employment, Amenity and Human Health. The Draft Guidelines note that *"the legislation does not generally require assessment of land-use planning, demographic issues or detailed socio-economic analysis. . . . This should be avoided in an EIAR, unless issues such as economic or settlement patterns give rise directly to specific new developments and associated effects".*

The Draft Advice Notes on Current Practice in the preparation of Environmental Impact Statements originally published by the EPA in 2002, and the revised version which was published in draft format in September 2015 (EPA 2002, 2015), also provide guidance on the content of a chapter dealing with 'Human Beings'. The Draft 'Advice Notes on Current Practice in the preparation of an EIS' (draft version, September 2015) set out a framework methodology which has been followed in preparing this assessment. Issues under the general heading of Population and Human Health are stated to include:

- **Economic Activity –** Will the development stimulate additional development and/or reduce economic activity, and if either, what type, how much and where?
- **Social Consideration** - Will the development change patterns and types of activity and landuse?
- **Land Use –** Will there be severance, loss of rights of way or amenities, conflicts, or other changes likely to ultimately to alter the character and use of the surroundings?
- **Tourism –** Will the development affect the tourism profile of the area?
- **Health –** Have the vectors through which human health impacts could be caused been assessed, including adequate consideration of inter-relationships between those assessments?
-

With reference to Human Health assessment, the Draft *Guidelines on the Information to be Contained in Environmental Impact Assessment Report* note that while no specific guidance on the meaning of the term Human Health has been issued in the context of Directive 2014/52/EU, the same term was used in the SEA Directive (2001/42/EC). In this regard, the Commission's SEA Implementation Guidance states 'The notion of human health should be considered in the context of the other issues mentioned in paragraph (f)'. (Paragraph (f) lists the environmental factors including soils, water, air, etc.) This is consistent with the approach set out in the 2002 EPA Guidelines where health was considered through assessment of the environmental pathways through which it could be affected, such as air, water or soil, viz: 'The evaluation of effects on these pathways is carried out by reference to accepted standards (usually international) of safety in dose, exposure or risk. These standards are in turn based upon medical and scientific investigation of the direct effects on health of the individual substance, effect or risk. This practice of reliance upon limits, doses and thresholds for environmental pathways, such as air, water or soil, provides robust and reliable health protectors [protection criteria] for analysis relating to the environment.' In an EIAR, the assessment of impacts on population & human health should refer to the assessments of those factors under which human health effects might occur, as addressed elsewhere in the EIAR e.g. under the environmental factors of air, water, soil etc.. The Advice Notes provide further discussion of how this can be addressed."

Having regard to these various provisions of the Guidelines and Advice Notes and to the particular nature of this development which will introduce a new resident and visiting population into the Fassaroe area this chapter assessed potential impact on human beings under the following headings:

- Population
- Employment
- Community Facilities and Amenity
- Tourism and Leisure
- Land Use
- Human Health

4.2.2 Baseline Information

The baseline information was primarily established through desk-based research and supported and verified as appropriate through site visits / field work.

In terms of population and employment, the primary source of data on demographic trends is the Central Statistics Office (CSO) Census of Population. The most recent Census was carried out in 2016 and provides demographic information at State, County and local levels. The 2016 Census results were also compared against the results of the 2011 Census of Population (2011 Census).

A desktop study was carried out using the following datasets and sources of information to establish an initial understanding of the study area and the likely significant impacts that may occur.

- Central Statistics Office, Census Data (www.cso.ie);
- Wicklow County Development Plan 2016-2022;
- Bray Municipal District Local Area Plan 2018-2024;
- Bray Town Development Plan 2011-2017;
- Fassaroe Masterplan 2010;
- Fáilte Ireland;
- GeoDirectory;
- CORINE National Landcover Data (2018);
- Regional Spatial and Economic Strategy for the Eastern and Midland Region (2019-2031);
- National Planning Framework: Project Ireland 2040;
- Office of Public Works (OPW), The Planning System and Flood Risk Management (2009);
- Aerial photography and historic mapping;
- Consultation.

Information pertaining to population and general socio-economic data was sourced from the Central Statistics Office (CSO), Wicklow County Development Plan 2016-2022 and the Bray Municipal District Local Area Plan 2018-2024.

Identification of sensitive communities and land uses as well as amenities and services in the vicinity of the site was undertaken by a mix of site visits, review of digital mapping, aerial photography and development Plan and local area plan mapping.

4.2.3 Assessment Methodology

The methodology used for this assessment has been informed by the Environmental Protection Agency (EPA) *Draft Guidelines for Information to be Contained in EIAR* (2017), in accordance EIA requirements of codified EU Directive 2011/92/EU as amended by EU Directive 2014/52/EU, per current Planning Legislation, concerning EIA assessment: *Planning and Development Act, 2000 (as amended) (Part X)* and in *Part 10 of the Planning and Development Regulations, 2001 (as amended).*

When considering and assessing impact on Population and Human Health regard was had to the criteria of Annex III of the EIA Directive as appropriate. Those of relevance comprise:

- the magnitude and spatial extent of the impact (for example geographical area and size of the population likely to be affected);
- the nature of the impact;
- the intensity and complexity of the impact;
- the probability or likelihood of the impact;
- the expected onset, duration, frequency and reversibility of the impact.

The assessment also considers the 'quality' of the effects, i.e. whether they are positive, neutral or negative; its duration; and the type, i.e., whether direct or indirect.

For the final impact assessment and ratings regard has also been had to the possibility of effectively reducing the impact and also potential for cumulation of the impact with other existing or approved projects.

The rating of the Significance of the Effect is based on an assessment largely of the Magnitude of the Impact (graded from high to negligible, based on a consideration of character, duration, probability and consequences) combined with the Value (graded from High to Negligible, based on a consideration of significance/sensitivity) of the human environment aspect.

The Significance of Effect can be described as Profound, Very Significant, Significant, Moderate, Slight, Not Significant or Imperceptible (**Table 4.1**) and is assigned based on a combined evaluation of effect magnitude and asset significance (**Table 4.2**).

Table 4-1: Significance of Effects (per EPA Draft EIAR Guidelines 2017)

Significance	Description
Imperceptible	An effect capable of measurement but without significant consequences
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences
Slight	An effect which causes noticeable changes in the character of the environment but without affecting its sensitivities
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends
Significant	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment
Profound	An effect which obliterates sensitive characteristics

Table 4-2: Significance of Effects Matrix (after EPA Draft EIAR Guidelines 2017)

Magnitude of Impact	**High**	Not Significant/ Slight	Moderate/ Significant	Significant/ Very Significant	Very Significant/ Profound
	Medium	Not Significant	Slight	Moderate/ Significant	Significant/ Very significant
	Low	Not Significant/ Imperceptible	Slight/ Not Significant	Slight	Moderate
	Negligible	Imperceptible	Not Significant/ Imperceptible	Not Significant/ Slight	Slight
		Negligible	**Low**	**Medium**	**High**
		Value/Sensitivity of the Asset			

4.3 Receiving Environment

4.3.1 Population

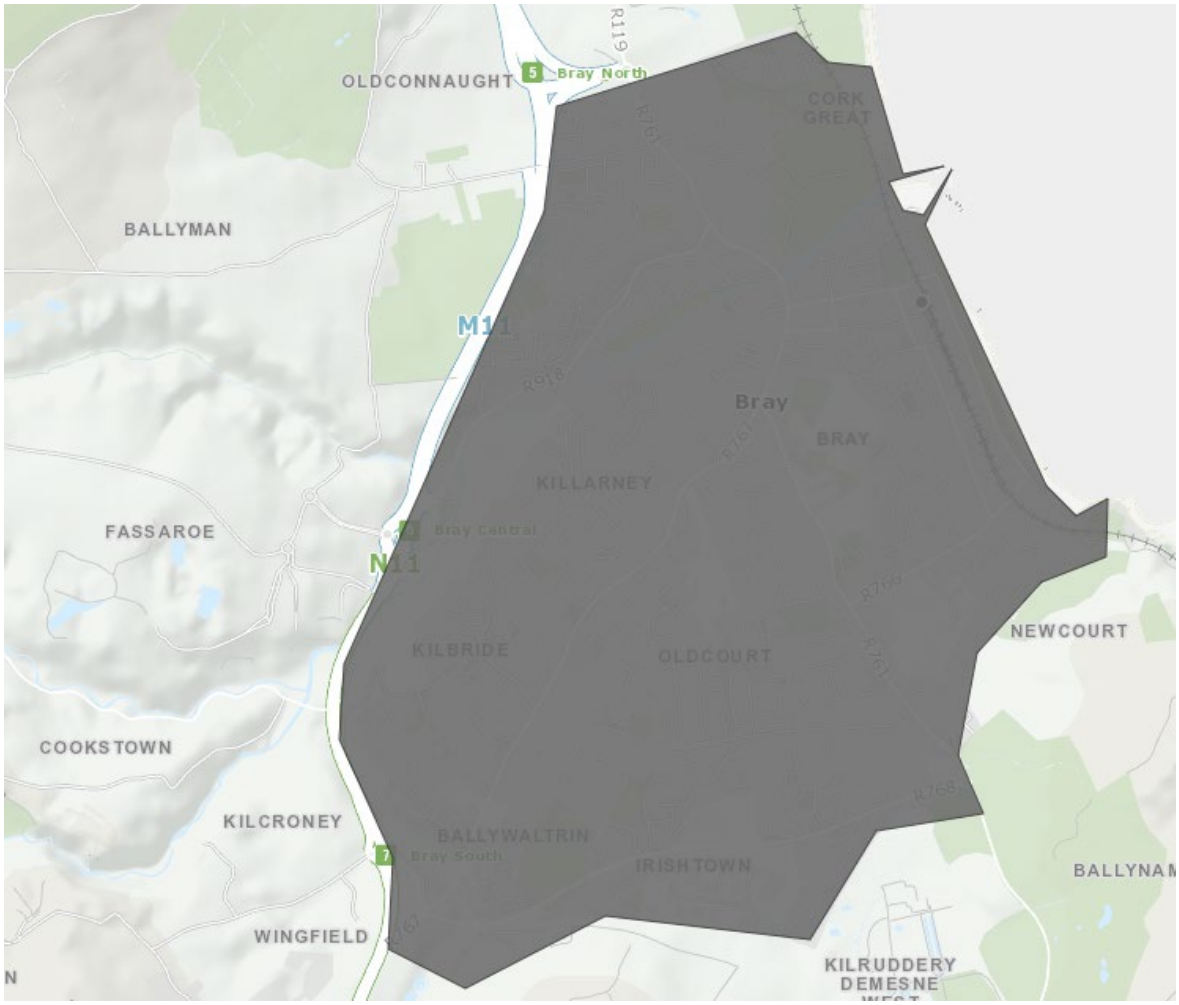
4.3.1.1 Existing Population

The subject site is located at Fassaroe which is largely undeveloped with a modest existing population. Existing residences within the area closest to the application are located at Berryfield Lane and Thornhill Road. Other nearby residences exist at Kilbride Lane and Ballyman Road.

4.3.1.2 Population of Bray

Although the application site is to the west of Bray and situated in the Electoral Division of Kilmacanogue, the proposed development comprises part of a planned urban extension of Bray with Fassaroe designated to accommodate its planned growth. Bray is acknowledged in the Wicklow County Development Plan and the Bray Municipal District Local Area Plan as being significantly constrained and is unable to accommodate the scale of development required to support planned growth. As such, this study concentrates on the settlement of Bray. **Figure 4.1** below shows the designated settlement for Bray as defined by the CSO.

Figure 4-1: Bray Settlement Boundary (Source: CSO)



The most recent Census for which local population information is available is the 2016 Census. This indicates that the population of Bray was 32,600 (see **Table 4.3**).

Table 4-3: Population Levels in Bray in 2006, 2011 and 2016 (Source: CSO 2006, 2011, 2016)

	2006	2011	2016	% change 2006 - 2016
Bray	**31,850**	**31,872**	**32,600**	**+2.3%**
Wicklow	126,194	136,640	142,425	+12.9%
Leinster	2,295,123	2,504,814	2,634,403	+14.8%
State	4,239,848	4,588,252	4,761,856	+12.3%

As can be seen from the table, growth rates in the Bray area between 2006 and 2016 were significantly slower than was experienced in Wicklow, Leinster and indeed around the country, reflecting the significantly constrained nature of the town. This low growth rate is a longstanding issue for Bray, as is highlighted within the County Development Plan and Local Area Plan, which both acknowledge the constraints to the growth of the town.

The slow population growth rates experienced in Bray in the period 2006 – 2016 is reflective of the heavily constrained nature of this part the Greater Dublin Area, which has seen strong development pressure over the past 20 years and where significant physical constraints are now impeding further development options.

The Wicklow County Development Plan 2016 – 2022 identified Bray as a Metropolitan Consolidation Town. It identified Bray to grow to a population of 40,00 by 2028. The Draft Wicklow County Development Plan 2021 -2021 identifies Bray again as a metropolitan Key Town and has a population growth target for the population of the town of 40,425 persons by 2031.

Bray is identified as a Metropolitan Key Town in the Eastern and Midlands Regional Spatial & Economic Strategy. With reference to residential development in Bray the RSES states as follows:

> *"Population growth in Bray has been modest compared to other settlements as expansion of the town is constrained by the coast to the east, Bray Head/Sugarloaf mountains to the south and the N/M11 to the east. In order for Bray to fulfil its growth potential, lands at Fassaroe to the west of the N/ M11 are targeted for new housing, employment and major community and sports facilities, along with development of lands at Old Connaught (Conna)-Fassaroe, which are within Dún Laoghaire-Rathdown. The delivery of new mixed-use development of Bray Golf course and Harbour Lands will provide for consolidation within the established town."*

4.3.2 Employment and Economic Activity

The 2016 Census was examined to determine trends in relation to employment, including the number of persons at work, unemployment levels and the sectoral composition of the population, based upon principal economic status. The Census indicated that 88% of the labour force were in employment, at the time, in Bray. This was an increase from the 82% who were in employment at the time of the 2011 Census.

The labour force in the area grew by 1.1% in the period 2011 – 2016, from 15,761 to 15,927, and in the same period the amount of people at work grew by 8.2%, from 12,945 to 14,001. The number of unemployed people within the study area reduced by 890 (31.6%), from 2,816 to 1,926, in the same period.

Table 4-4: Employment and Labour Force Figures for Study Area (Source: CSO 2011, 2016)

	Year	Bray
Persons at Work	2011	12,945
	2016	14,001
Labour Force	2011	15,761
	2016	15,927
Unemployed	2011	2,816
	2016	1,926

The changes in persons at work, labour force and unemployed in the study area are indicative of the turnaround in circumstances experienced across the country since the economic downturn 2008. However, these figures may not be indicative of current economic conditions resulting from impacts of the COVID-19 pandemic.

A more accurate recording of unemployment rates can be seen from the Live Register figures recorded by the Central Statistics Office. These monthly published records give a more up-to-date picture of economic conditions. The number of persons on the Live Register of unemployment rose in the State from 186,702 in February 2021, to 163,248 in February 2022, a decrease of 12.6%. The number of persons on the Live Register decreased in County Wicklow from 5,292 to 4,741 (10.4%) in the same period. Similarly in Bray, there was a decrease from 2,372 in February 2021 to 2,080 in February 2022, a reduction of 12.3%. This indicates clearly that there has been an overall increase in employment levels both nationally and locally in the last year, which is indicative of the economic recovery from the impacts of COVID-19. It is clear that the relative impact locally in County Wicklow is less severe than the overall national impact.

Information on 'population by socio-economic group' is available on a localised basis from the 2016 Census. By examining the current occupations of those at work, and the previous occupations of unemployed and retired persons, it is possible to categorise the relevant individuals by socio-economic group. All other persons are classified to the socio-economic group of the person in the family on whom they are deemed to be dependent.

Table 4.5 shows the absolute number of persons and the proportions of the population respectively by different socio-economic groupings, in relation to Bray, Wicklow County and the State for comparative purposes.

Table 4-5: Numbers of Persons by Socio-Economic Grouping, 2016 (Source: CSO 2016)

Area and Grouping	Employers & Managers	Higher & Lower Profess'al	Non-Man. & Man. Skilled	Semi-Skilled & Unskilled	Own Account Workers	Farmers Agric. Workers	Unknown	Total
State	512,377 (**13.6%**)	720,110 (**19.2%**)	1,088,101 (**29%**)	444,047 (**11.8%**)	154,426 (**4.1%**)	160,843 (**4.3%**)	675,409 (**18%**)	3,755,313
Wicklow	27,559 (**19.5%**)	27,321 (**19.4%**)	36,880 (**26.2%**)	16,084 (**11.4%**)	8,876 (**6.3%**)	5,492 (**3.9%**)	18,766 (**13.3%**)	140,978
Bray	5,887 (**18.4%**)	6,513 (**20.3%**)	9,314 (**29.1%**)	4,021 (**12.5%**)	1,776 (**5.5%**)	51 (**0.2%**)	4,497 (**14%**)	32,059

Bray differs somewhat from national averages in terms of the make-up of its workforce, with differences in the proportional distribution of jobs in most cases. The main significant similarity is in the proportion of semi-skilled and unskilled workers. The largest difference is in the category of employers and managers, with 18.4% of Bray's workforce working in this area compared to 13.6% nationally. The very low contribution of agriculture to the local industry is reflective of Bray's urbanised nature, while the comparatively high proportion of employer and managerial workers is reflective of Bray's location in the Dublin commuter belt.

Key Economic Activities

The Bray Municipal District Local Area Plan 2018-2024 sets out that Bray as the largest town in the county, and as such, it is an important settlement for the economy of the County Wicklow. Key employment areas are concentrated within the core settlements of Bray, including the Industrial Development Agency Business Park, and the settlement centres of Enniskerry and Kilmacanogue. Some of the key priority industries located within the Study Area include:

- Tourism
- Retail and retail services
- Film Industry, including Ardmore Studios
- Knowledge, High-Technology and Service Based Industries, including software development, data processing, electronic commerce

4.3.3 Community Facilities and Amenity

The baseline survey undertaken identified 259 no. social infrastructure sites within 3km of the development site. These sites were broken down into categories and are outlined below. A listing and location of the facilities and services is included in Appendix 4A of this report.

4.3.3.1 Education and Childcare

63 no. education and childcare facilities were identified within 3km of the site. 36 no. of these are creches, Montessori or playgroup services. 15 no. are primary education facilities and 10 no. are second-level education. The remaining 2 no. facilities are third-level colleges of further education or training institutions. The distribution of these services are shown on **Figure 4.1** and **Figure 4.2**. They are also listed in **Appendix 4A**.

Figure 4-2: Distribution of Pre-School Education and Childcare Facilities within 3km of Application Site

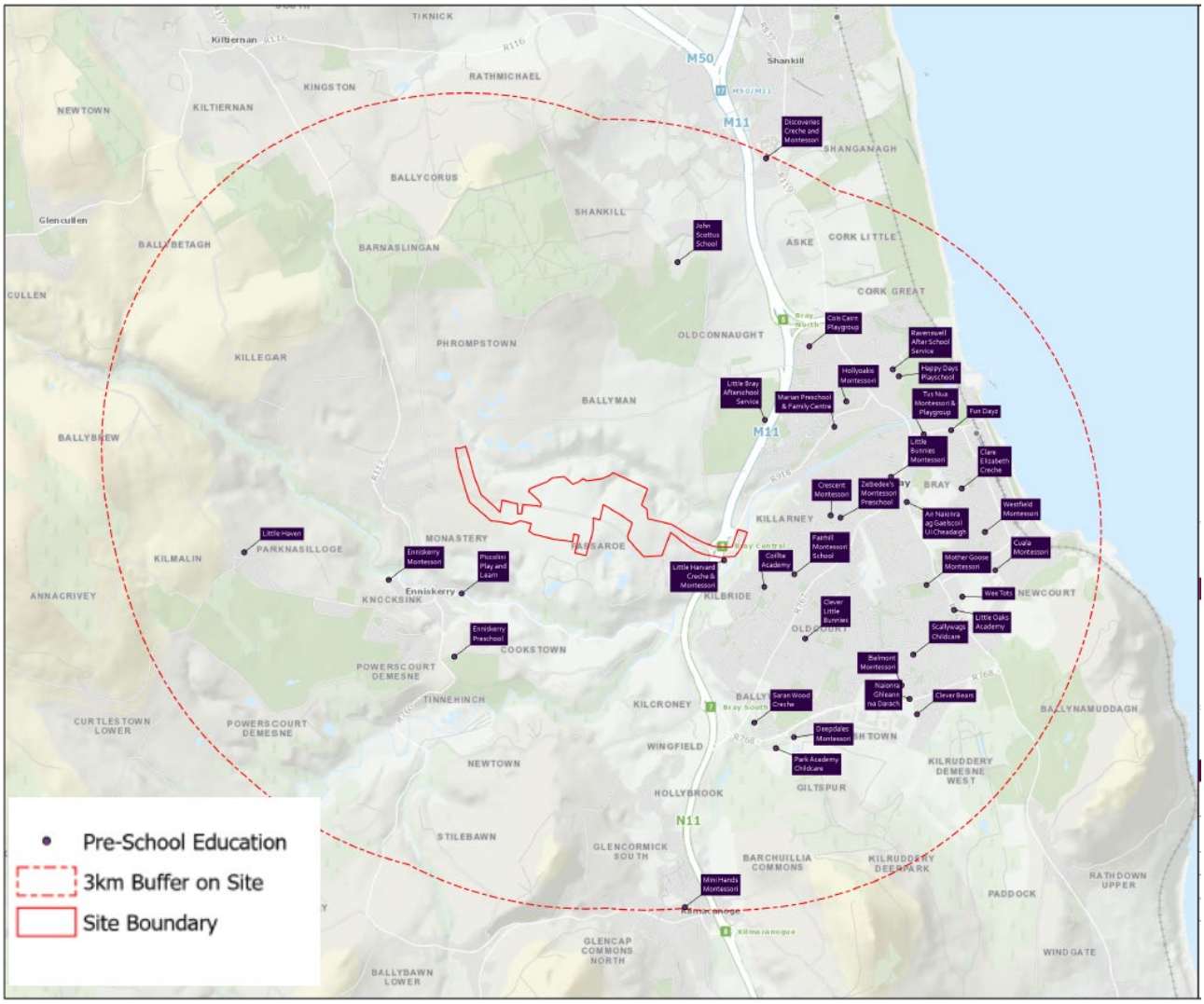
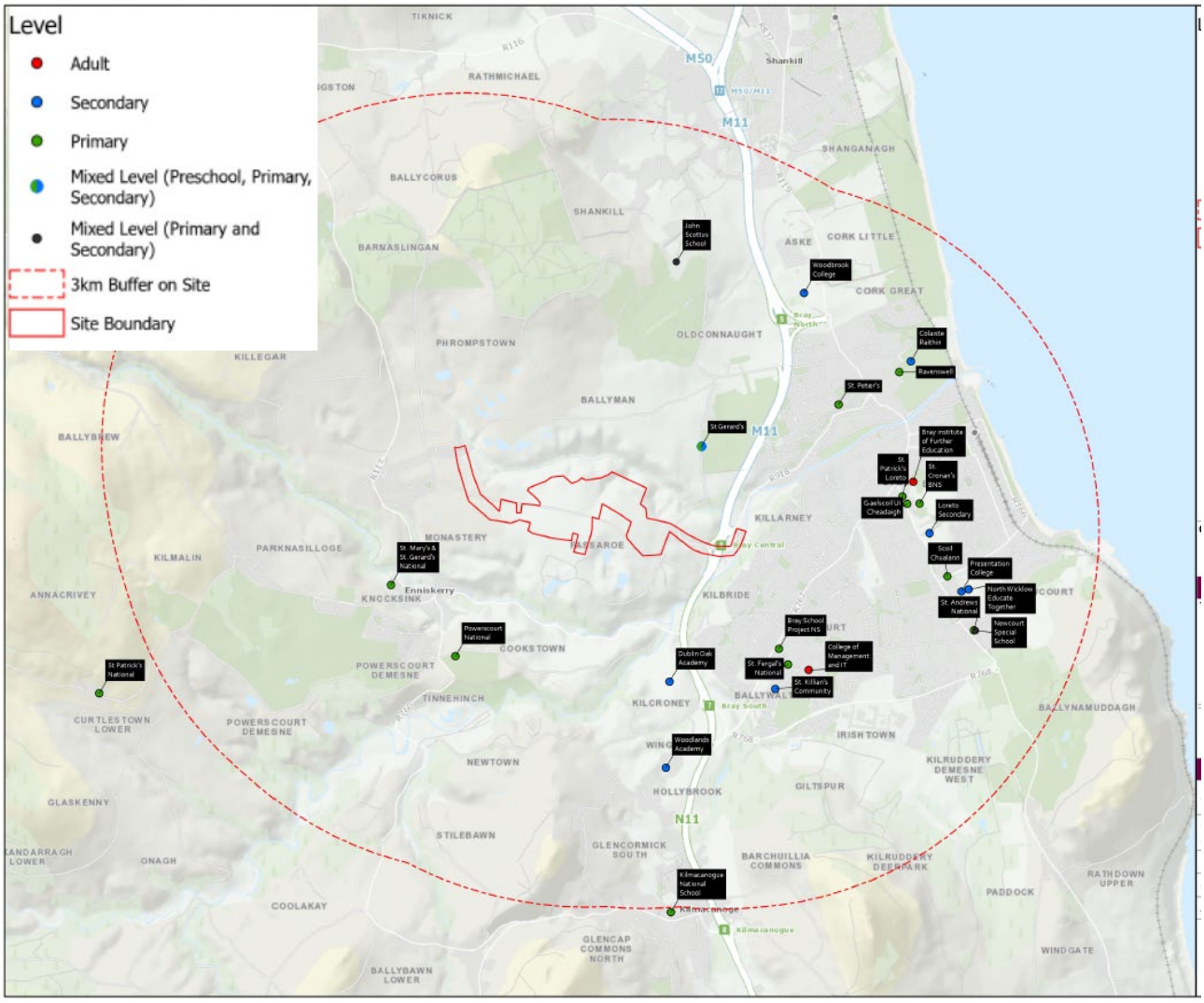


Figure 4-3: Distribution of Primary, Secondary and Adult Education Facilities within 3km of Application Site



4.3.3.2 Sports and Recreation

There are 58 no. facilities for sports and recreation identified within the 3km accessible zone. These include 10 no. GAA and football clubs, 6 no. parks with facilities including playgrounds and football fields, and 15 no. fitness facilities including gyms and sports pitches. There are also 6 no. golf clubs and a variety of recreational activity centres such as scout halls, youth clubs and niche activities. The majority of these facilities such as sports clubs and playgrounds cater to youth recreation and provide an essential service to the area. See **Appendix 4A** for details. See **Figure 4.3** for general distribution of these services and **Appendix 4A** for detailed list.

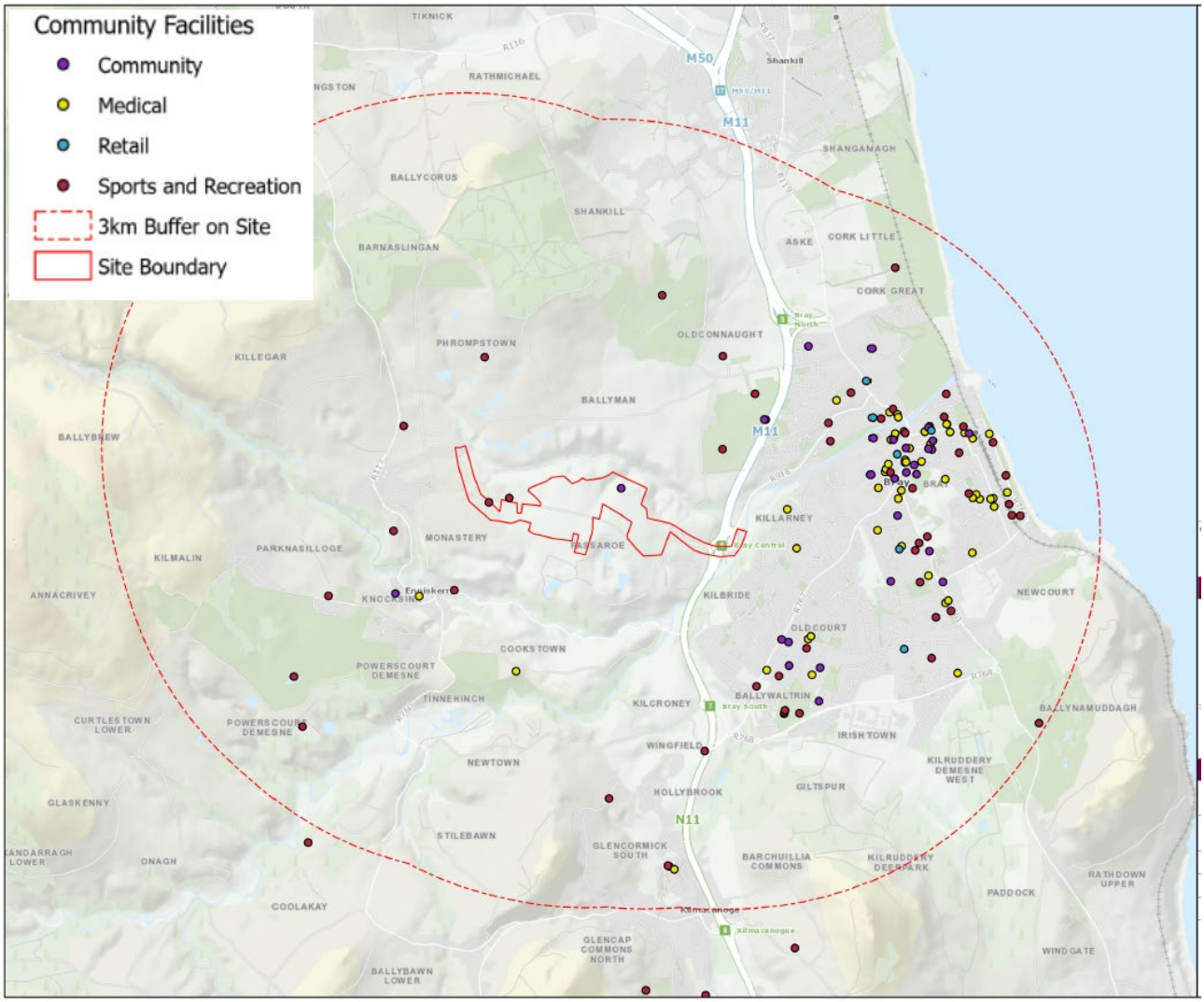
4.3.3.3 Health and Wellbeing

There are 52 no. facilities providing health and wellbeing services within 3km of the site. 8 no. of these are primary care and GP services, with 11 no. specialist care locations. The catchment area also includes 11 no. nursing homes and elderly care facilities, 11 no. dental practices, and 11 no. pharmacies. See **Appendix 4A** for details. See **Figure 4.3** for general distribution of these services and **Appendix 4A** for detailed list. See **Figure 4.3** for general distribution of these services and **Appendix 4A** for detailed list.

4.3.3.4 Community Services

28 no. community service facilities were identified within the 3km zone. These include 15 no. support and family services, along with a number of other facilities including youth reach programmes, libraries, and parish/neighbourhood centres. See **Figure 4.3** for general distribution of these services and **Appendix 4A** for detailed list.

Figure 4-4: Distribution of Sports, Medical and Various Community Facilities within 3km of Application Site



4.3.3.5 Retail

There are 5 no. supermarkets in Bray. Along with this, the Florentine Centre development in Bray town centre is currently under construction. This will serve as a retail centre for the town.

4.3.3.6 Faith

There are 35 no. facilities centred around faith and religion. These include a number of different churches, cemeteries and religious groups. See **Figure 4.4** for general distribution of these services and **Appendix 4A** for detailed list.

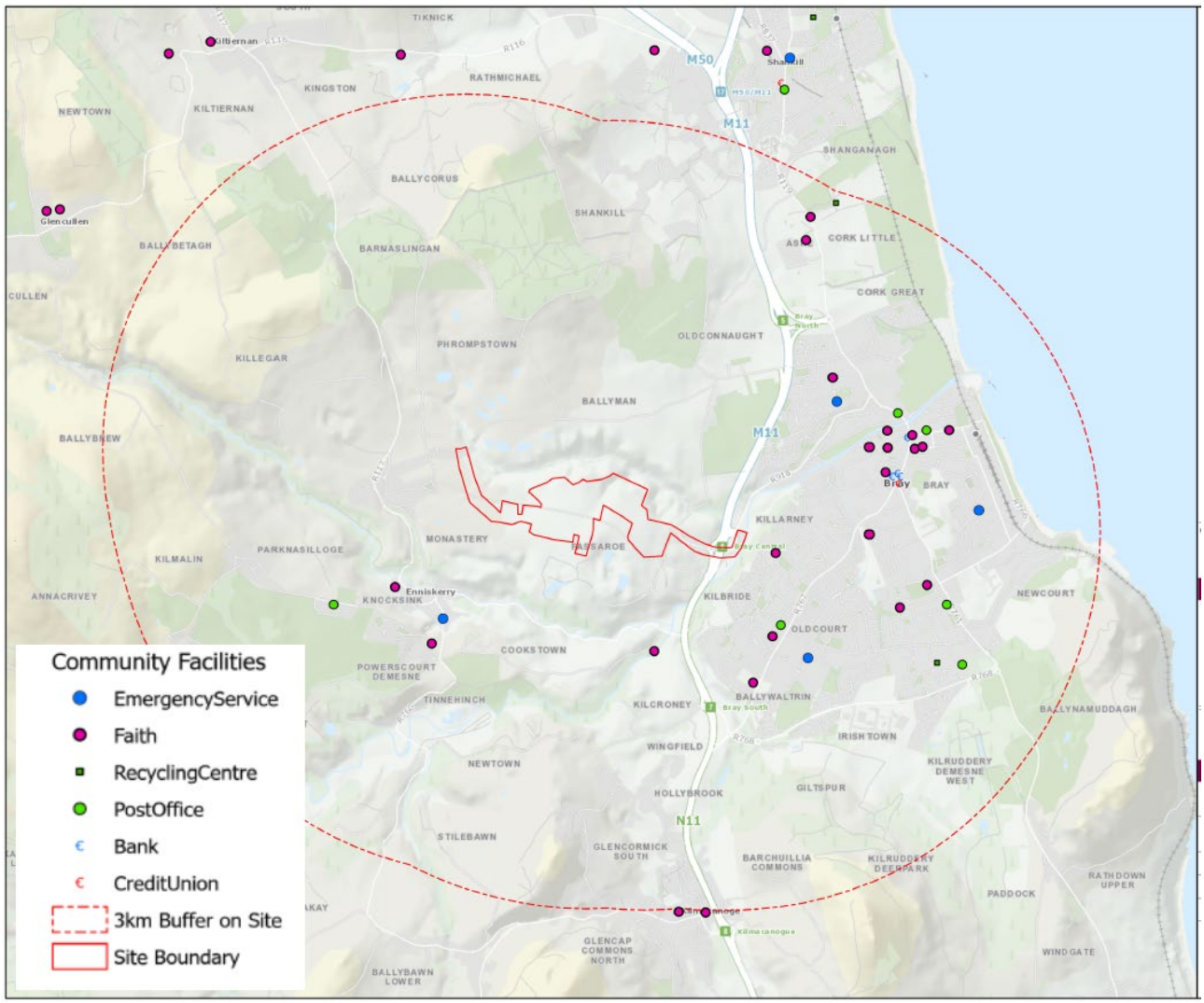
4.3.3.7 Emergency and Other Services

There are 9 no. emergency services in the area. These are 4 no. Garda stations, 3 no. fire stations and 2 no. ambulance services.

There are also 8 no. post offices, 4 no. recycling centres, and 7 no. banks and credit unions in Bray and the surrounding areas.

See **Figure 4.4** for general distribution of these services and **Appendix 4A** for detailed list.

Figure 4-5: Distribution of Emergency Services, Faith, Financial and Waste Facilities within 3km of Application Site



4.3.4 Tourism and Leisure

4.3.4.1 Regional / County Tourism

Tourism is one of the major contributors to the national economy and is a significant source of full time and seasonal employment. During 2019 (the most recent pre-Covid pandemic year with annual Fáilte Ireland figures available), the total tourism revenue generated in Ireland was estimated to be approximately €9.5 billion, an increase of approximately 1.5% from 2018. Overseas visitors rose to over 9.67 million people in 2019, from 9.61 million in 2018, constituting an increase of 0.7% over a 12-month period (Fáilte Ireland, 2021).

Ireland is divided into 8 tourism regions. The Study Area is contained within the Mid-East / Midlands region. The information on overseas tourists and revenue for the Mid-East / Midlands are contained in **Table 4.8**. In 2019, the number of overseas visitors to the Mid-East / Midlands region totalled 954,000, which comprised 9.9% of the National total tourism figures for the State. In terms of revenue generated from tourism, the Mid East region generated €348 million from overseas visitors in 2019, comprising a total percentage share of 3.7% of the State's revenue from tourism. In this regard, it is clear that the Mid East region is a contributor to the tourism sector in terms of visitor numbers and revenue generation.

Table 4-6: Regional Tourism Performance in the Mid-East / Midlands Region (Fáilte Ireland, 2021)

	Britain	Mainland Europe	North America	Other Areas	All Overseas	Northern Ireland	Domestic Trips
Mid-East / Midlands Numbers (000s)	411	335	153	55	954	170	1,513
Mid-East / Midlands Revenue (€m)	117	136	68	28	348	52	240
Total State Numbers (000s)	3,487	3,609	1,902	676	9,674	1,277	11,621
Total State Revenue (€m)	1,022	1,853	1,705	592	5,174	402	2,146

Fáilte Ireland's Tourism Facts of 2019 (published March 2021) includes attendance numbers at popular visitor attractions and identifies the top fee-charging and free attractions within Ireland. The nearest identified top attraction is Powerscourt House, Gardens and Waterfall which is roughly 3km to the south west and had 487,876 visitors in 2019. The Powerscourt Estate is comprised of Powerscourt House and landscaped gardens which originally dated back to the 14th Century but was redeveloped in the 18th century, and Powerscourt Waterfall, which is Ireland's highest waterfall at 121m. Powerscourt Demesne is listed on the National Inventory of Architectural Heritage (NIAH) and is considered to be of international importance. Also in County Wicklow, Glendalough Monument and Site located circa 25km to the south was also listed on the top attractions, with 732,362 visitors in 2019. In addition, a number of attractions in Dublin were listed, including the Guinness Storehouse, Dublin Zoo, the National Gallery of Ireland, and the National Botanic Gardens.

Other visitor attractions in the Bray area include Kilruddery House and Gardens and the National Sea Life Centre. Kilruddery House and Gardens date back to the 1820s and is, according to the NIAH, "*one of the finest examples of the Elizabethan Rural style in the country*". Kilruddery Demesne West is listed on the NIAH and is considered to be of *national* importance.

4.3.4.2 Amenity and Leisure

The concept of amenity is not defined under Irish planning legislation. For the purposes of describing the existing environment, the concept of amenity is defined as recreational, community, leisure or human assets such as defined walking routes, natural features etc.

In terms of the receiving environment for the proposed development, there are a large number of community facilities within the study area, identified as part of this assessment by a combination of available mapping and site visits.

In terms of recreational facilities, there are five golf courses (Woodbrook Golf Club, Old Conna Golf Club, Dun Laoghaire Golf Club, Bray Golf Club, and Powerscourt Golf Club) in the area; a range of sports facilities including Bray Emmetts GAA Club, Bray Wanderers AFC, a leisure centre at the Royal Hotel, Shoreline Leisure Centre (Inc. swimming pool), Glenview Health and Leisure Club, Bray Bowl, County Wicklow Lawn Tennis Club and Bray Hockey Club; and the National Sea Life Centre. Outside of Bray, Enniskerry Football Club is also in very close proximity to the application site along Berryfield Lane.

There are a number of churches, cemeteries and graveyards in the study area, the majority of which are concentrated within the existing Bray built-up area.

In terms of outdoor activity amenities, there are a number of signposted walking and cycling routes in the area, in the form of trails and along local roads. For example, the Bray Cliff Walk travels along the coast providing a walking connection to Greystones, and the Bray Head Walk is a comparatively short walk to the highpoint to the south of Bray, providing long ranging views of the town and surrounding landscape.

There are also a number of woodland walking routes in the area, including at Knocksink Wood, Cloon/Curtlestown and Lackan Wood.

The Cycle Ireland website (www.cycleireland.ie) was consulted in relation to local cycling routes and there is a scenic cycling route between Bray and Powerscourt, which travels southwards from Bray, towards the Glen of the Downs, before crossing the N11 and travelling along northwards to Enniskerry and back to Bray. Other local roads are likely to be used for recreational cycling by local residents, as is the case throughout the country.

There are a number of watercourses in the area, all of which confluence with the Dargle before it enters the Irish Sea and provide opportunities for angling. The County Brook runs along the northern boundary of the application site before joining the Dargle east of the M50 motorway, while the Glencullen River runs alongside the R117 regional road, south of the application site, before joining the Dargle west of the M50. The Kilmacanoge and Swan Streams also flow from the south, through the built-up area of the town, before joining the Dargle. Inland Fisheries Ireland (IFI) commissioned a research project on the socio-economic context of recreational angling in Ireland. The research found that up to 406,000 individuals participated in recreational angling in Ireland in 2012. The IFI 2018 Annual Report sets out the socioeconomic contribution of angling as amounting to €836 million per year and over 11,000 jobs. The research by IFI demonstrates the importance of the angling industry to the national and local economy.

There are a number of equine establishments within the area, including riding schools, livery yards, etc, which attract the visiting community to the area.

Bray Harbour is home to Bray Sailing Club. In addition, there are other berthing facilities available around the harbour for pleasure craft. Bray Rowing Club is also located along the seafront.

4.3.5 Land Use

The application site is located to the west of Bray, and to the west of the N11 / M11. The site is comprised primarily of agricultural land. One-off housing, as elsewhere in Ireland, is a feature of the area, with a number of existing residential properties located along both sides of Berryfield Lane, which adjoin the application site. These dwellings are a mixture of detached and semi-detached, single and two-storey dwellings.

Similar to Berryfield Lane, there are a number of one-off houses situated along either side of Thornhill Road to the north east of the site which connects Fassaroe to Ballyman Road at Old Conna. St. Gerards School and campus which caters for Montessori, junior and senior students is also located on Thornhill Road. There is a recycling facility operated by Greenstar located to the west of Thornhill Road, north east of the subject site. This warehouse and storage facility accepts material from the public for sorting and redeployment to specialist recycling facilities at a later stage.

Additional adjoining and nearby sensitive lands to the overall site include the Ballyman Glen SAC to the north of the site and Dún Laoghaire Golf Club which is located directly north of Ballyman Glen, to the north west of the masterplan site.

There are three playing pitches located on Berryfield Lane to the adjacent of the subject site which comprise both a grass surfaced pitch as well as an astro-turf / all-weather pitch utilised by Enniskerry Youth Club. Parking and a clubhouse / changing facilities are also located on the same site as the pitches.

Roadstone operate a storage and cement batching facility to the south of the subject site at the site of a former quarry.

There are no extant planning permissions on land adjoining the site which would affect the proposed development.

4.3.6 Human Health

The Department of Health published a document entitled 'Health in Ireland: Key Trends 2019' which provides a summary of statistics on health and healthcare over the past ten years. The document sets out the Ireland has the highest self-perceived health status in the EU, with 83% of people rating their health as Good or Very Good. The number of people who reported a chronic illness or health problem is also better than the EU average at around 28% of the population.

In terms of Study Area specific statistics relating to health, **Table 4.9** below sets out the population by general health for the State, Wicklow and EDs as contained within the Census 2016 data published by the CSO. 89% of the EDs identified their health as being Very Good or Good, which is broadly in line with the figures for Co. Cork (88%).

Table 4-7: Population by General Health 2016

General Health	State 2016	Wicklow 2016	EDs 2016
Very Good	59%	62%	62%
Good	28%	26%	27%
Fair	8%	8%	7%
Bad	1%	1%	1%
Very Bad	0%	0%	0%
Not Stated	3%	3%	3%

4.4 Potential Impacts

4.4.1 Construction Phase

4.4.1.1 Population

Existing Population

The construction phase of the proposed development will result in the creation of a large construction site which will have temporary construction traffic and noise related impacts which have the potential to affect the existing local residential community.

These impacts have potential to effect the local residential community by causing inconvenience, delays and nuisance. Construction traffic will access the site from the N11 / M11 to the east so will have only minimal implications for residents at Ballyman Road or Thornhill Road. The residences with greatest potential to be affected are those in closest proximity to the application site, along Berryfield Lane. However, as construction traffic will not access via Berryfield Lane the potential for impact here will also be minimised. Nevertheless, given the general proximity to a working construction site these residences would potentially experience a slight to moderate temporary adverse impact, whilst for those residences further to the west and north would experience a potential short-term, slight adverse impact only.

Chapter 9 of this EIAR contains a detailed impact assessment of potential construction noise and its implications for nearby existing residents. The assessment concludes that for the majority of the construction phase the predicted noise levels at the nearby sensitive receptors will be within the daytime noise limit of 65 dB L_{Aeq}. recommended in BS5228-1:2009+A1:2014 Code of Practice of Noise and Vibration Control on Construction and Open Sites Part 1: Noise. There are specific aspect of the construction which will likely give rise to exceedances above this level on occasion for short periods of time. These cases however are below the duration criteria recommended in the Design Manual for Roads and Bridges and will not be significant. Overall for short periods of time a number of local residents will experience slight to moderate negative impacts but for the majority of the time impacts will be slight only, and generally will occur during standard construction hours.

Population Growth

The proposal is unlikely to result in any notable change to the permanent population of the area during the construction phases. There may be a slight increase in the temporary population of the area, as a result of the employment of workers from outside the local area who may choose to reside in the immediate local area during the construction process. However, given the location of the site in the Greater Dublin Area is it likely that construction workers will mainly travel from their existing places of residences with no real impacts on local resident population levels.

4.4.1.2 Employment

It is expected that the majority of the construction work force would travel from existing places of residence to the construction site. However, local employment from within the Bray and wider Wicklow area is also expected.

The construction of the entire proposed Phase 1 development is expected to be undertaken within a period of 4 years on site, and will generate construction employment directly on-site, with peak periods of construction likely to require up to 300 no. on-site construction personnel. This is a significant workforce which will be drawn largely from the wider Greater Dublin Area.

The development will also benefit support industries such as building suppliers and local services throughout this process. The employment of large numbers on site during construction will also have a positive impact on services within the local area including retail and hospitality in particular. The construction phase therefore is considered to have the potential to have a moderate, short-term positive impact on the economy and employment of the local and wider area.

4.4.1.3 Community Facilities and Amenity

Although community facilities such as community and leisure centres are likely to be used more regularly as a result of the temporary working population resident in the local area, the impact of the construction phase of the proposal on such facilities is likely to be imperceptible.

4.4.1.4 Tourism and Leisure

The construction of the proposed development will not impact on existing access to or use of local and county wide tourism facilities or leisure facilities. The only slight impacts identified during construction are on the users of the local Enniskerry AFC facility. There is potential for slight negative impacts due to traffic, noise and dust associated with the construction activity. Such impacts however are not incompatible with the football activity at the site and accordingly effects on the users of the facility are deemed to be slight negative only.

4.4.1.5 Land Use

As construction activity extends across the application site the existing agricultural uses will cease to accommodate the development. This is in accordance with the zoning objectives for the site however, so the effects are not considered to be adverse. Rather the construction activity will facilitate the planned future land uses for the site which is a positive impact.

The existing surrounding agricultural, waste and residential uses in the vicinity of the site will be unaffected by the construction phase of the development. These will continue to operate as existing.

4.4.1.6 Human Health

The construction phase of the development will have impacts related to generation of dust and release of odours with potential for impact on human health. As noted in **Chapter 8, Air Quality and Climate**, dust dispersion across the development site and out into the wider environment from construction activity will be determined primarily by meteorological factors including levels of rainfall, wind speed and wind direction. Based on TII guidance and the scale of the proposed development there are several residential/commercial properties located within 100 metres of the works particular along Berryfield Lane and along Thornhill Road that could potentially be affected. These properties are likely to experience a 'temporary slight adverse' dust impact during construction in the absence of additional mitigation. Additional mitigation for these properties

is presented in **Chapter 8 section 8.5**. All other properties are located outside of the 100 metres threshold and hence, these properties will experience no adverse dust impact from the proposed construction phase.

Chapter 8 also identifies the potential for disturbance of the areas within and around the historic landfills to generate lateral or vertical pathways for the escape of landfill gas. The fugitive release of this landfill gas has the potential for the generation of odour nuisance through the release of trace gases (such as H_2S and mercaptans) within the landfill gas. The work at the landfills also has potential to development of additional pathways for landfill gas migration during construction. There are a number of existing residential properties located to the south of the Landfill Site 2 where the proposed road alignment is planned. Similarly, the Enniskerry Football Club grounds are located adjacent (c. 500 metres southwest) to the area where the proposed road cuts through Landfill Site 3B. These properties are predicted to experience a 'temporary slight adverse' impact from landfill odours in the event that any landfill gas is released during the works. Other receptors in the area will likely experience negligible impacts. Mitigation for these properties is presented in **Section 8.5.2** of **Chapter 8**.

The construction works have potential for impact on the health of construction workers. This relates in particular to the remediation works to the historic landfill sites. While the remediation proposals for the landfill site are to cap them, thereby minimising interaction with the waste bodies themselves, there is some localised excavation works and slope stabilisation works. Contractor operatives working on or close to the historic landfills may be exposed to flammable gases (methane, hydrogen sulphide) during excavations and site clearance. In the absence of mitigation measures this could potentially have moderate to significant adverse impacts on health.

The construction stage could also give rise to windblown contaminated litter during excavation / works to the landfill sites which would have potential adverse impacts on human health.

The development incorporates the demolition of an existing dwelling at Berryfield Lane. It is possible that this building may contain asbestos which would be harmful to construction workers health.

4.4.2 Operational Phase

4.4.2.1 Population

Existing Population

The nature and appearance of the application site will be transformed as a result of the proposed development. The proposal will result in the creation of a significant amount of built form on lands to the north and south of Berryfield Lane, to accommodate new residential populations. For the existing population at Fassaroe, this transformation is likely to have a moderate to significant impact at least in the immediate term, due to significantly altered levels of activity in the area and also due to the transformation of short-range views for some of the occupiers of these properties. These changes however are in accordance with the zoning policies for the lands and over time as the character of the area transforms with the development and the residents become used to the changed nature of the landscape, such impacts will lessen. The quality, scale, and nature of the development will be compatible with the existing residential development in the area.

The proposed development will result in a significant increase in local amenities for the existing resident population at Fassaroe through the delivery of large scale public open space areas and local services and facilities. The lands will also be served by public transport connecting to Bray and the Brides Glen Luas which will be a notable positive impact.

For residents in the wider Bray area, the provision of the District Park facilities, which will be easily accessible by foot, cycle and public transport will be a significant positive impact on the wider populations of Bray, Enniskerry, and Old Connaught.

The proposed development will give rise to a significant increase in the permanent population of the area, as a result of the provision of 650 no. new residential units. The proposed pedestrian and cycle bridge across the N11 / M11 will provide the residents of these units with convenient and safe access to Bray town centre and the existing services and facilities. Along with this, the existing No. 185 bus route provides a connection between Fassaroe and Bray town centre.

Population Growth

The proposed development comprises of 650 No. dwellings. Based on an average household size of 2.7 persons (State average 2016 Census) this could potentially accommodate of the order of 1,750 No. persons in the future. In the initial years of occupation of the Phase 1 development the average household sizes could reasonably be expected to be lower than this. Even based on a low average household size of 2.3 persons this would equate to a population of approximately 1,500 persons. Based on the 2016 population figure of 32,600 for Bray this would be a 4.6% increase in population of the town, which is a significant growth increase in line with the strategic policy for the town.

4.4.2.2 Employment and Economic Activity

The development will lead to a significant boost to local businesses due to the influx of a significant new permanent resident population in the area. While there will be retail and neighbourhood facilities provided on site at Fassaroe, these will serve day to day convenience requirements. For higher order services the residents of Fassaroe will be served by the existing services of Bray town centre. This increased support for services in Bray is likely to have a moderate, permanent positive impact on businesses within Bray and the surrounding area.

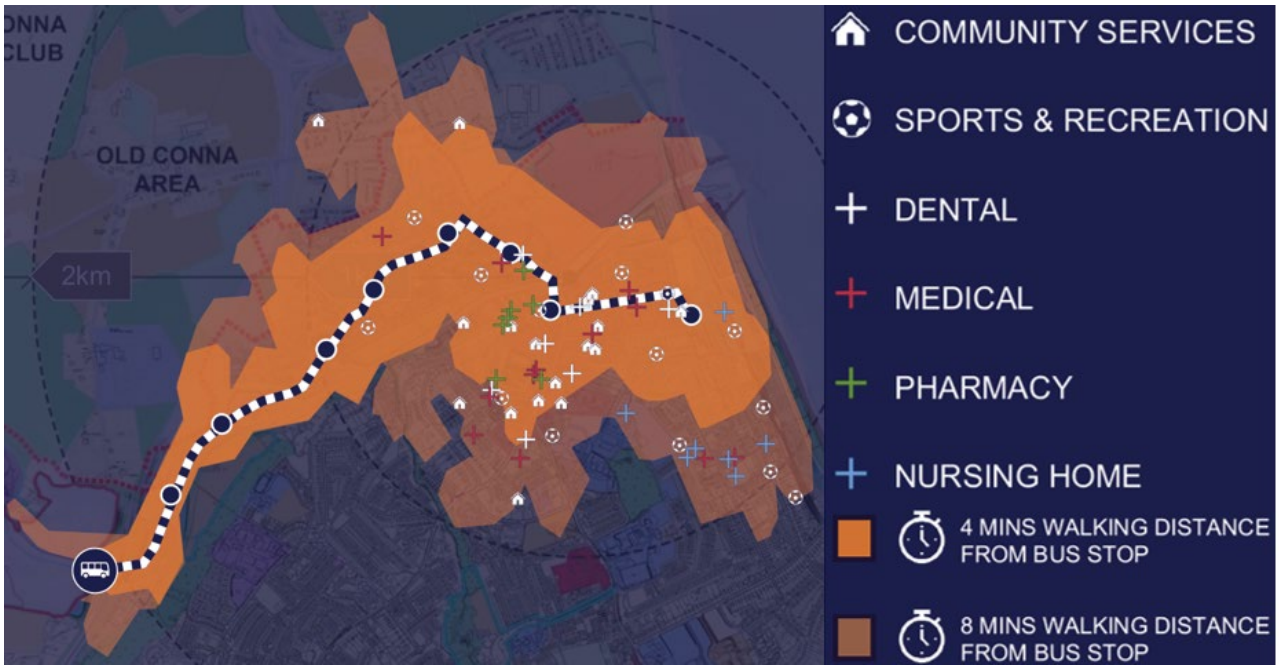
The proposed development will generate employment directly on site to serve the proposed retail, commercial, childcare and concierge uses. It will also indirectly generate employment for landscape / district park maintenance works, waste management services, general site management services (management companies, etc.). These are moderate positive employment impacts.

4.4.2.3 Community Facilities and Amenities

The development will lead to a significant boost to local community and leisure facilities, and local clubs due to the influx of a new permanent resident population in the area. This influx of new residents is likely to have a moderate, permanent positive impact on community facilities within Bray and the surrounding area.

Easy access by future residents of the Fassaroe development to these existing services will be a significant positive impact for these residents. The services will be accessible by foot or bicycle and / or public transport. The proposed new No. 185A bus route (approved in principle by NTA) which will connect Fassaroe to Bray town centre provides convenient access to a number of existing community facilities in Bray town centre.

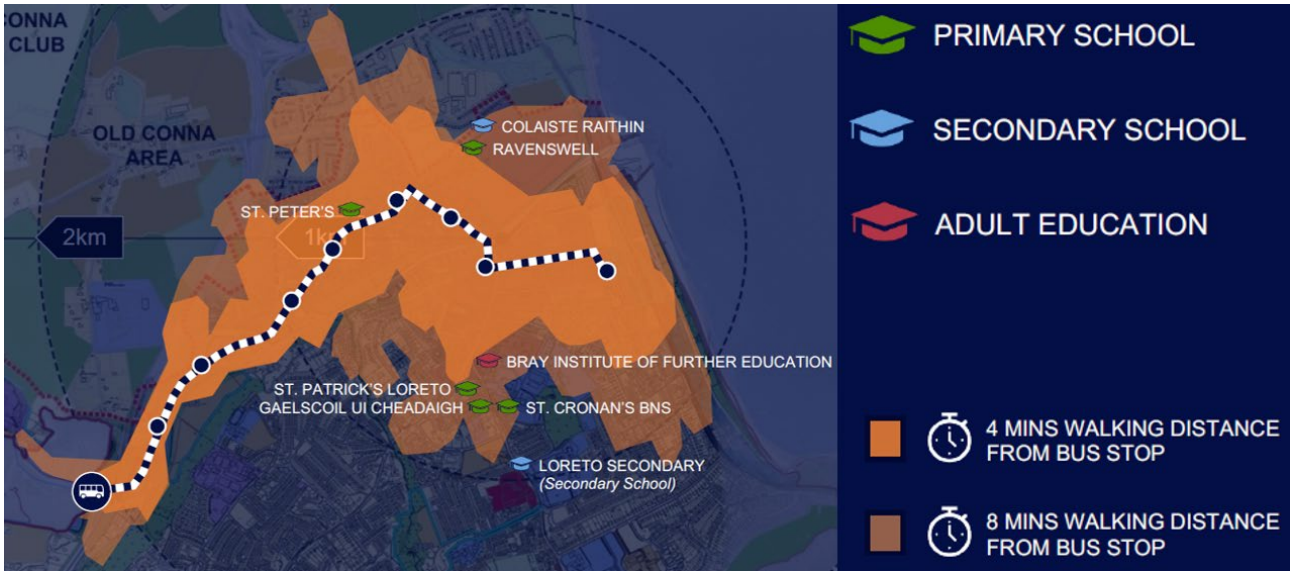
Figure 4-6: Access to Existing Local Services from Fassaroe via Public Transport



The proposed development would also impact on community facilities throughout the operational phase. The additional residential population would assist in sustaining local sporting clubs, such as Bray Emmetts, Enniskerry YFC, etc., and the numerous Golf Clubs in the area, providing a slight, long-term positive impact.

There may be a slight, temporary negative impact on schools in the Bray / Enniskerry area before a new school is provided in Fassaroe. However, it is expected that once this is constructed and opened, the impact on schools in the wider area will be imperceptible. The Department of Education is already in discussion with the Applicant with a view to constructing a school at Fassaroe, so it is likely that a school will be in place on site in any event by the time demand from residents reaches a significant level. In the meantime there are a number of existing schools in Bray that are within the catchment of the No.185A bus route and which will also be served by a developer school bus service.

Figure 4-7: Access to Existing Local Schools from Fassaroe via Public Transport



The provision of a district park along with multiple smaller pocket and linear parks throughout the development will create a long-term positive impact to the community.

4.4.2.4 Tourism and Leisure

The proposed development is not considered likely to have a significant impact on tourism within Co. Wicklow. The increased local population will likely avail of local tourist facilities but the overall impact will be slight to negligible.

In terms of more local serving leisure and recreational facilities, the new resident population will likely boost memberships and provide ongoing support for established clubs, societies and teams. This is in general a positive impact.

4.4.2.5 Land Use

The commencement of development at Fassaroe with this Phase 1 development will be the first step in developing a new growth centre at Fassaroe in line with the land use policy for the area set out in the Bray MD Local Area Plan. As the population grows with the and future phase development it will in turn provide support for the development of employment uses at Fassaroe, again in line with land use planning policy.

The development will result in the loss of some agricultural lands. The current agricultural activity on the application lands is not intense and does not support any unusual or niche activities. Given the extent of agricultural land available in the wider area the loss of some agricultural land use at Fassaroe will have an overall negligible impact on the agricultural sector.

4.4.2.6 Human Health

The operational phase of the development has potential to impact on human health in a number of aspects:

- Impact on air quality due to traffic emissions.
- Impact on air quality due to release of gases from historic landfills.

The potential for impact on air quality due to traffic emissions is assessed in **Chapter 8 - Air Quality and Climate**. Using the Design Manual for Roads and Bridges (DMRB) screening air dispersion model, pollutant concentrations with the development in operation were predicted at the sensitive receptors adjacent to the development site identified at Berryfield Lane and Thornhill Road. The modelling assessment undertaken determined that the levels of airborne pollution at the closest residential receptors will remain below the statutory limits for the protection of human health and the WHO guidelines for all future scenarios except for PM10 . This however is already above the PM10 WHO guideline in the baseline as a result of solid fuel domestic heating, so is not a consequence of the proposed development. Overall, there will be an 'imperceptible' increase in annual average of NO2 and PM10 at local residential receptors. These road traffic impacts during the operation phase are considered 'negligible' for air quality as set out in Chapter 8, and consequently for also 'negligible' for human health. Please refer to Chapter 8 for more detail.

Chapter 8 - Air Quality and Climate also considers potential impacts on sensitive receptors, which would include existing nearby residents) and future residents of the scheme, from landfill gas from the historic landfill sites. Despite their age, waste is currently generating a residual amount of landfill gas and will continue to do so for some years. With the installation of the proposed low permeability capping layer the gas will be prevented from venting through the surface of the landfill and will therefore build up in pressure and eventually migrate laterally beneath the edges of the sites, potentially towards residential units. To prevent this occurring the proposed rehabilitation measures also incorporate a proposed gas management system. The proposed landfill gas management measures are described in detail in the Fassaroe Historical Landfills, Gas Management Strategy document by RPS, 2022 which forms part of the SHD application. This Gas Management Strategy is as approved to Wicklow County Council by the EPA in 2019 through the Certificate of Approval process. The main gas management strategy comprises of a Virtual Gas Curtain (VGC). This is the favoured and proposed treatment measure due to its effectiveness in controlling gas migration, its durability and ease of installation.

The Virtual Gas Curtain is a fully enclosed barrier that is proposed around the perimeter of each of the landfill sites. The concept of the VGC is to form a low pressure or low gas concentration area relative to the surrounding gassing ground, to encourage gas to flow towards the barrier, and allow subsequent venting to atmosphere. In addition, a pumped gas collection system and flare compound is proposed to serve sites 2, 3a and 3c. With these standard landfill design measures in place, the potential for fugitive losses of methane is significantly reduced. Any potential losses will be short term and temporary and will readily dilute and disperse with no significant impact for air quality including odour for the area, and consequently no significant impact for human health.

A Human Health Risk Assessment was undertaken initially to inform the Fassaroe landfill remediation proposals as part of the Environmental Risk Assessment (ERA) undertaken for the sites by RPS. A copy of the ERA, 2018 as submitted to the EPA as part of the Certificate of Authorisation application by Wicklow County Council is provided at **Volume 3 Part 3 of this EIAR**. Data confirming the contamination status of soils at the site was derived from multiple stages of investigation, the most recent and comprehensive data being provided by the ground investigation undertaken by RPS in 2015. A Tier 1 qualitative risk assessment qualitatively identified each of the Source-Pathway-Receptor components that are present on site, which forms the basis of the risk assessment approach. A Tier 2 risk assessment was undertaken which aimed to identify contaminants of concern and their spatial distribution and requires benchmarks against which to compare the concentrations of soil contaminants. This identified that contaminant concentrations are generally below the selected screening criteria for a public open space (parks) use.

The risk assessment identified elevated concentrations of Polycyclic Aromatic Hydrocarbons (PAHs) within the landfill materials in Site 1, elevated concentrations of lead and PAHs within the landfill materials in Site 2 and elevated concentrations of PAH within the capping materials in Site 2. In addition, asbestos containing materials was encountered at one location within the landfill materials in Site 1. However, despite the presence of elevated concentrations of contaminants and the presence of asbestos within the landfilled materials, it was considered that future site users are unlikely to be exposed to the contamination due to the depth at which the contamination is present (>1.0 m). In any event, the current proposals, and as permitted by the EPA in the Certificate of Authorisation process include a landfill capping system, as described in

Chapter 2 of this EIAR and in more detail in the Historic Landfill Remediation Strategy Report, RPS, 2022 which forms part of the planning application documentation.

On the basis of the current SHD proposal and having regard to the additional data collected since the CoA was issued an Addendum to the Environmental Risk Assessment has been prepared by RPS and is provided at **Volume 3 Part 4** of this EIAR. As set out in section 3.3.11 of that report, "*the further data collection has provided no information of relevance to the Human Health Risk Assessment, focusing on ground gas. The further data collection does not change the conceptual model considered within the previous assessment.*"

Furthermore section 3.3.11 of the Addendum to the Environmental Risk Assessment specifically addresses the current development proposals subject of the application. It notes that the Certificates of Authorisation issued by the EPA confirmed that all of the landfills would be capped, effectively breaking all pathways other than inhalation of volatiles. Thus, in the absence of any proposed enclosed structures within the landfills it is considered that the proposed capping will essentially mitigate the risk to end users of the landfill sites (in this case users of the District Park) from any unforeseen contamination and therefore the risk assessment is not considered to require update.

The Addendum to the Environmental Risk Assessment concludes that a gas management strategy is also required, which is in line with the remediation measures already permitted by the Certification of Authorisation issued by the EPA.

A Gas Management Strategy, RPS, 2022 is provided with this application and forms part of the current proposals. This strategy includes a Virtual Gas Curtain for passive venting, a pumped gas collection system, barrier-in ground as noted above and in addition also includes building protection measures to be incorporated within the proposed buildings of the scheme. These measures will typically comprise floors slabs / membranes and passive venting (voids) for the development proposed within this application. The exact detail of these building protection measures will be incorporated at detailed construction design when foundations are detailed and will comply with the requirements of BS 8485:2019 – Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (BSI, 2019) and the UK's National House Building Classification Traffic Light System. By complying with these standards there will be no residual implications for any significant impacts on human health.

The Gas Management Strategy proposals and the EPA Certificates of Authorisation provide for ongoing monitoring of the sites at Fassaroe. This monitoring will demonstrate the remediation measures, in particular, the Virtual Gas Curtain, are working and identify any changes in the gas regime as a result of the remedial works, flaring and development works. This can be achieved with real time ongoing monitoring in the first instance. Alarms can be installed also to give advanced warning when gas levels exceed certain pre-set criteria. Over time it is possible that the monitoring results may show that the NHBC (National House Building Council, UK) Traffic Light System Classifications of parts of the application site are reduced. However, for the purposes of this Phase 1 application the classifications as identified in the Gas Management Strategy will be applied to the building protection measures employed on site for the development permitted.

On the basis of the proposals set out in the Gas Management Strategy in line with the requirements of BS 8485:2019 – Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (BSI, 2019) and with regard to the NHBC Traffic Light Classification system applied there will be a negligible potential impact on human health.

During the excavation works the waste material will be exposed, increasing the risk for windblown litter. Waste material and contaminated material may also be exported offsite attached to equipment and machinery. This could have potential for moderate negative impacts.

During the site investigations to date only 1 of 53 samples of waste tested positive for asbestos. This waste was in Site 1. Nonetheless there remains a risk that asbestos or Asbestos Containing Material (ACM) could be uncovered during the excavation of waste in Site 3B. This could have potential for negative impacts on human health for contractors.

4.4.3 'Do-Nothing' Scenario

Under the 'Do-Nothing' scenario, the proposed residential development would not be undertaken, and the area would not benefit from additional housing supply. No impact will occur on land use, however, population will likely be affected, resulting in slow growth rates in Bray due to the lack of sufficient land elsewhere to facilitate the growth of the town. The growth rates envisaged under the Regional Spatial Strategy for Bray and the Core Strategy of the Wicklow County Development Plan would likely fail to be achieved. This has the potential to result in a long-term, moderate adverse impact on existing community facilities, services and amenities and businesses in the local area.

A failure to deliver the proposed development would mean that there would be a shortage of new housing provided to accommodate the planned growth of Bray and its environs. In this scenario, the opportunity to sustainably extend Bray would be difficult to achieve.

To do nothing with regard to the subject lands will not lead to any profound, irreversible or life-threatening consequences.

4.4.4 Potential Cumulative Impacts

The future development proposals for the overall Action Area Plan at Fassaroe (the full build out of zoned lands at Fassaroe) will result in increased residential and working communities in the area in future years. This is a significant positive impact for Bray town as it will provides the necessary growth requirements for the area, and for the County. The increased numbers of residential units and employment opportunities will enhance the overall community character of the area and deliver a sustainable new community with appropriate levels of recreation, social amenities and services.

In the meantime, there are no other identified existing permitted or proposed large scale developments at Fassaroe which would result in cumulative impacts on Population or Human Heath.

4.5 Mitigation Measures

4.5.1 Construction Phase

4.5.1.1 Population

The following general mitigation measures will be implemented during the construction phase of the proposed development at Fassaroe which will minimise potential adverse impacts due to traffic or noise during construction.

- A construction management plan and associated construction traffic management plan shall be developed, to minimise construction related inconveniences. Both plans will be agreed in advance with the Local Authority.
- Appropriate temporary signage will be put in place during construction.
- Provision will be made for reasonable and safe facilities for pedestrians and cyclists during the construction period.
- Construction materials, where possible, will be sourced locally in order to reduce potential traffic delays and to support the local economy.
- Normal Health and Safety standards will also be applied during the construction phase to mitigate against any potential adverse impacts on workers at the site or on residents or other road users during the construction period.

In addition, please refer to mitigation measures relating to air quality and noise control set out in **section 8.5 of Chapter 8** and **section 9.6 of Chapter 9** which will minimise adverse impacts for local residents.

4.5.1.2 Employment

The construction phase will have positive impact on employment and local economic activity. No mitigation measures are deemed necessary.

4.5.1.3 Community Facilities and Amenity

There may be a slight increase in demand for local community facilities and amenities during construction. No adverse impacts are identified which would require mitigation.

4.5.1.4 Tourism and Leisure

No mitigation measures in respect of tourism or leisure in the wider area are need necessary. The general mitigation measures set out at section 4.5.1.1 will minimise inconveniences to users of the Enniskerry AFC.

4.5.1.5 Land Use

No mitigation measures are identified for land use activity during construction.

4.5.1.6 Human Health

To manage risk to construction workers at and in the vicinity of the former landfill sites, all relevant operatives will be suitably training in the HSA Guide to the Safety, Health and Welfare at Work General Application Regulations 2007, Part 8: Explosive Atmospheres at Places of Work.

Potential for adverse impacts on human health for construction workers were identified to:

- potential exposure of waste and gas during excavation / remedial works at the historic landfill sites, and
- potential asbestos exposure with the proposed house demolition on Berryfield Lane/

To mitigate these particular risks, the following mitigation will be employed.

Site Access

- To protect the personnel outside the work area and for proper control of the areas being worked in, it will be necessary to take complete and secure possession of the site. Secure temporary fencing shall be erected around the waste excavation area. An area shall be delineated around the proposed excavation which will be regarded as a safety zone beyond which the contractor's plant shall not be permitted to leave unless it undergoes full decontamination to ensure waste is not exported from site.
- Measures will be required to ensure that only authorised persons can enter the work area and that they are trained, competent and inducted for the operations being carried out within the site. The contractor must put in place rigorous accident and emergency procedures and ensure that all persons on site are familiar with these.
- Due to the nature of the material in question, all excavation and movement of waste should be carried out by mechanical means.

Personal Protective Equipment

- Strict rules and standards will be enforced regarding PPE around the works area. This will include at a minimum helmets, gloves, tyvek suits, steel toed boots and safety glasses. Appropriate respiratory equipment will be maintained on site and there will be ongoing monitoring for gaseous hazards. The monitoring will be agreed with the contractor but provision must be made for raising the alarm, emergency procedures and a plan for alerting those outside the work areas.
- In addition, suitable hygiene and welfare facilities and PPE should be provided in accordance with the requirements of the Safety, Health and Welfare at Work (General Application) Regulations 2007, Safety Health and Welfare at Work (Exposure to Asbestos) Regulations 2006 and 2010 amendments and the Safety Health and Welfare at Work (Construction) Regulations 2013 to manage potential risks to construction workers.

Dust Suppression

- The excavation of the works must be planned to minimise the risk of any material becoming airborne through the creation of dust. The contractor will have to put measures in place for dust suppression (water bowser) and have regard to weather conditions during the works to avoid run-off or severe dryness which could lead to problems with containment.

Gas and Odour Control

- A detailed construction methodology for the excavation works shall be prepared by the contractor and communicated to all site personnel to ensure that no confined spaces or trenches deeper than 1m are created during the excavation of waste. Where confined spaces or trenches greater than 1m are created, gas detection equipment and appropriate breathing apparatus should be used by all personnel in the vicinity of the confined space/trench.
- The works must be planned to minimise the risk of the release of odours and gases to surrounding areas including the contractor's compound and the wider community. Site operatives in the vicinity of the landfill sites will be instructed to report all unusual, concentrated or significant odours on-site, so that measures may be taken to identify the source of the odour and eliminate it. Gas monitoring techniques will be put in place by the contractor. For nuisance odours, automated odour control systems may need to be put in place, as necessary, to periodically release a fragrance to mask or neutralise unpleasant odour.
- A wheel-washing facility shall be established for trucks leaving the site to minimise the transport of potentially odorous clay particles onto adjacent roads.
- A no smoking policy will be strictly enforced onsite.

Exposed Waste Material

To mitigate the impacts arising from the exposed waste the following measures will be implemented:

- The contractor shall excavate the waste in areas as small as possible in order to limit the exposure of the waste. The contractor shall prepare an excavation plan which supports this ethos;
- Should excessive wind conditions prevail, such that there is a risk of uncontrolled exposure to the waste with the consequences of it becoming windblown then the excavation shall cease until the weather becomes more amenable to the safe excavation of the waste. Any exposed areas of waste shall be covered with compacted clean material at the end of every working day as a minimum, in order to minimise the exposure of the waste to the winds;
- An area around the proposed excavation will be delineated which will be regarded as a safety zone beyond which the contractor's machinery is not permitted to leave unless it undergoes full decontamination;
- Only fully sealed containers shall be used for the removal of waste offsite; and
- Prior to demobilisation, the contractor shall properly decontaminate all equipment and appropriately dispose of the decontamination water, field waste and contaminated personal protective equipment (PPE).

Asbestos

During the site investigations to date only 1 of 53 samples of waste tested positive for asbestos. This waste was in Site 1. Nonetheless there remains a risk that asbestos or Asbestos Containing Material (ACM) could be uncovered during the excavation of waste in Site 3B. It is also possible that there could be asbestos within the proposed building for demolition.

It shall therefore be a requirement that the contractor for the works has in place, prior to the works, an Asbestos Management Plan, prepared in accordance with the following guidance and regulations:

- AGS 2012, Interim Guidance ' Site Investigation Asbestos Risk Assessment for the Protection of Site Investigation and Geotechnical Laboratory Personnel';
- CIRIA 2014, C733 A Guide to Understanding and Managing Risks; and
- Safety Health and Welfare at Work (Exposure to Asbestos) Regulations 2006 and 2010.

It is also required to undertake an asbestos survey of the dwelling proposed for demolition prior to the construction of works. In the event that asbestos is identified this shall be addressed in the Asbestos Management Plan.

4.5.2 Operational Phase

When operational the proposed development will have significant positive impacts for both existing and new residents and workers in the area. No mitigation measures are considered necessary.

4.5.2.1 Population

No significant adverse impacts are identified for the local existing or future population during the operational stage. No mitigation measures are deemed necessary.

4.5.2.2 Employment

The operational phase of the development will have positive impacts with direct and indirect employment and positive impacts on the local economy. No mitigation measures are deemed necessary.

4.5.2.3 Community Facilities and Amenity

No adverse impacts are identified during operational phase. No mitigation measures are deemed necessary.

4.5.2.4 Tourism and Leisure

No adverse impacts are identified during operational phase. No mitigation measures are deemed necessary.

4.5.2.5 Land Use

No adverse impacts are identified during operational phase. No mitigation measures are deemed necessary.

4.5.2.6 Human Health

The landfill remediation proposals including the Historic Landfill Remediation Report, RPS, 2022 and the Gas Management Strategy, RPS, 2022 as set out in the application documentation will ensure that there is a negligible potential for impact on human health. These mitigation measures by design are in accordance with the Certificates of Authorisations granted by the EPA and are in line with the requirements of the requirements of BS 8485:2019 – Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (BSI, 2019) and with regard to the NHBC Traffic Light Classification system.

A monitoring plan will also be adhered to on site to ensure all measures operate as required.

No further mitigation measures are deemed necessary.

4.6 Predicted Residual Impacts

4.6.1 Construction Phase

There will be some slight adverse impacts to the local community arising during the construction phase. These impacts will be minimised through construction and traffic management processes proposed in the mitigation sections above. There will however inevitably be a residual slight negative impact on local residents during periods of peak activity and when active works are close to existing residents.

These impacts will be slight only, of a temporary nature and limited duration. They will be typical of any urban construction activity.

4.6.2 Operational Phase

Overall, if the suggested mitigation measures are provided, the advantages of the proposed scheme considerably outweigh any localised disadvantages and the local community, as a whole, will benefit from the development of the proposed scheme.

The provision of additional housing, office space and community facilities, as part of a sustainable urban extension of Bray, will significantly assist in sustaining planned population and economic growth in Bray and indeed in surrounding settlements in both Wicklow and Dublin.

4.6.3 Cumulative Impact

The future development of the entire Action Area Plan lands would deliver a new sustainable community to the area in accordance with Development Plan provisions. It will have an overall significant positive impact on Human Beings in the area in general. Applications for future phases of development will also be subject to separate future assessment.

4.7 Monitoring and Reinstatement Measures

Other than the post remediation landfill monitoring required under the EPA Certification of Authorisation and the further monitoring proposed in the Gas Management Strategy no further monitoring is considered necessary with reference to Population and Human Health.

5 BIODIVERSITY

5.1 Introduction

5.1.1 Scope of Chapter

This chapter outlines the biodiversity (floral and faunal features) of the receiving environment within the planning application area and within a wider Zone of Influence (ZoI) in the vicinity of the proposed development at Fassaroe. It comprises information as required by Annex IV to the EIA Directive to be contained in an EIA Report (EIAR), in respect of flora, fauna and avifauna:

- Establish baseline ecological data for the proposed development site;
- Determine the ecological value of the identified ecological features;
- Identify, describe and assess the likely significant effects of the proposed development on biodiversity (flora and fauna);
- Propose effective mitigation measures to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on biodiversity; and
- Identify any residual effects predicted to arise after mitigation.

The chapter addresses both terrestrial and aquatic ecological aspects within and in the vicinity of the site.

A Natura Impact Statement (RPS, 2022) has also been prepared as a separate document and is included in as part of the overall planning application documentation.

5.1.2 Relevant Guidelines

The assessment had regard to the following guidelines:

- CIEEM (2018) *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine*. Chartered Institute of Ecology and Environmental Management, Winchester;
- DoEHLG (2010) *Appropriate Assessment of Plans and Projects in Ireland Guidance for Planning Authorities*. Department of the Environment, Heritage and Local Government;
- European Communities (2000) *Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC*, Office for Official Publications of the European Communities, Luxembourg. European Commission;
- European Commission Notice Brussels C(2021) 6913 final *'Assessment of plans and projects in relation to Natura 2000 sites - Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC'* (EC, 2021);
- EC (2007) Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC - *Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the commission*. European Commission;
- EC (2013) *Interpretation Manual of European Union Habitats. Version EUR 28*. European Commission;
- EPA (2002) *Guidelines on the Information to be contained in Environmental Impact Statements*. Environmental Protection Agency;
- EPA (2017) *Guidelines on the information to be contained in Environmental Impact Assessment Reports.* Draft. Environmental Protection Agency;
- EPA (2003), *Advice Notes on current practice in the preparation of Environmental Impact Statements*. Environmental Protection Agency;
- Fossitt, J., 2000. *A Guide to Habitats in Ireland.* The Heritage Council, Kilkenny;

- HA (2001) DMRB Volume 10 Section 4 Part 4 - Ha 81/99 - *Nature Conservation Advice In Relation To Otters.* The Highways Agency;
- National Parks and Wildlife Service (NPWS) (2019) *The Status of EU Protected Habitats and Species in Ireland. National Parks and Wildlife Service*, Department of the Environment, Heritage and Local Government, Dublin, Ireland;
- NRA (2008) *Environmental Impact Assessment of National Road Schemes - A Practical Guide* Rev. 1. National Roads Authority;
- NRA (2009) *Guidelines for the Assessment of Ecological Impacts of National Road Schemes* Rev. 2. National Roads Authority;
- NRA (2008) *NRA Guidelines on Ecological Surveying Techniques for Protected Flora and Fauna on National Road Schemes*. National Roads Authority;
- NRA Various *Environmental Assessment and Construction Guidelines (both adopted and draft versions);*
- O'Neill, F.H., Martin, J.R., Devaney, F.M. & Perrin, P.M. (2013) *The Irish semi-natural grasslands survey 2007-2012. Irish Wildlife Manuals, No. 78*. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Ireland;
- Smith, G. F., O'Donoghue, P., O'Hora, K., Delaney, E., 2011. *Best Practice Guidance for Habitat Survey and Mapping*. The Heritage Council, Kilkenny.

Studies were also carried out in accordance with the following legislation:

- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) and Directive 2009/147/EC (codified version of Directive (79/409/EEC as amended ((Birds Directive)) - transposed into Irish law as European Communities (Birds and Natural Habitats) Regulations 2011;
- European Communities (Environmental Impact Assessment) (Amendment) Regulations 1999 (S.I. No. 93/1999);
- European Communities (Environmental Liability) Regulations, 2008 (S.I. No. 547/2008);
- European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 84/1988);
- Flora Protection Order, 2015;
- Planning and Development Act, 2000 (as amended);
- Water Framework Directive (2000/60/EC); and
- Wildlife Act 1976 as amended

5.2 Methodology

5.2.1 Desk Study

In addition to the documents listed in the References Section, the sources of published material that were consulted as part of the desk study for the purposes of the ecological review are as follows:-

- Review of the National Parks & Wildlife Service (NPWS) natural heritage database for designated areas of ecological interest and sites of nature conservation importance within and adjacent to the study area;
- Review of Ordnance Survey maps and ortho-photography;
- Review of the National Biodiversity Data Centre (NBDC) database for records of rare and protected species within 2km of the subject site;
- Aerial Photography;
- 1:50,000 Ordnance Survey (OS) Map; Discovery Series;
- Environmental Protection Agency mapping (https://gis.epa.ie/EPAMaps);

- Keeley, B (2015). *A Badger and Bat Assessment of the Proposed Road at Fassaroe*, Co. Dublin;
- Fassaroe Historic Landfill Environmental Risk Assessment Report, RPS, 20 July 2016;
- Engineering Report – Fassaroe Phase 1 Development, Atkins, 2022;
- Design descriptions and drawings of proposed scheme (See **Chapter 2: 'Project Description'**);
- Construction Environment & Management Plan – Fassaroe Phase 1 SHD Development, Atkins, 2022;
- Previous EIS Scoping comments by Inland Fisheries Ireland and NPWS (See **Section 5.2.1.1**: **Consultation**);
- A wide range of guidelines and best practice published by the OPW regarding the potential environmental impacts of drainage on the aquatic environment with particular reference to:
    - Environmental Management Protocols April 2011; and
    - Environmental Drainage Maintenance Guidance Notes (10 Steps to Environmentally Friendly Maintenance) April 2011.
- An Bord Pleanála Inspectors Report for previous application at the lands An Bord Pleanála Ref. PL27.248705.

5.2.1.1 Consultation

An informal EIA scoping exercise was undertaken for the current proposed development in March 2020. EIA scoping was also undertaken in 2015 to inform a previous planning application (including EIS) for a similar development proposal at the lands (proposed under Wicklow County Council Planning Ref. 16/999 / An Bord Pleanála Ref. PL27.248705). Scoping reports and letters were sent in 2015 and 2020 to relevant ecological bodies as described in **Chapter 1: Introduction**. A summary of the consultation responses is provided in **Chapter 1**. Consultation was also undertaken with Wicklow County Council as part of the Strategic Housing Development pre-application consultation process.

Relevant correspondence for the ecological assessment is summarised below in **Table 5-1**.

Table 5-1: Consultation Undertaken for the Proposed Development

Consultee	Method of Consultation	Summary of Consultation
Inland Fisheries Ireland (IFI)	Email correspondence	Response email dated 14th October 2015 identified that the proposed development is located in the catchment of the Glencullen / Cookstown River. The Dargle (an EU-Designated Salmonid System) and its tributaries support a nationally significant population of Sea trout (Salmo trutta) in addition to a significant and biologically valuable population of Atlantic salmon (Salmo salar, listed under Annex II and V of the EU Habitats Directive). All proposed works must be designed and implemented in an environmentally sound and sustainable manner and should not impact negatively on the salmonid status of this system. Best practice should be implemented at all times in relation to any activities that may impact on surface water (stream and river) or riparian habitats. Comprehensive surface water management measures (GDSDS study recommendations) must be implemented at the construction and operational stage to prevent any pollution of local surface waters. On-site attenuation ponds may be required to allow for the settlement of fine/particulate materials out of potentially discharging surface waters during construction. Petrol/oil interception (and possibly hydrobrake controls) should be in place on primary surface water discharges to protect receiving freshwaters in terms of water quality. Only clean, uncontaminated water should discharge to local surface waters. The environmentally sensitive design and implementation of surface water discharge structures would be required to ensure protection of ecological integrity at point of discharge. Watercourses should be maintained in their open natural state in order to prevent habitat loss, preserve and enhance biological diversity and aid in pollution detection. All proposed works must be designed and implemented in an environmentally sound and sustainable manner and should not impact negatively on the salmonid status of

Consultee	Method of Consultation	Summary of Consultation
		this system. Natural fish migration should be maintained by minimizing changes to the natural stream morphology and hydraulic conditions. It is essential that local infrastructural capacity is available to cope with increased surface and foul water generated by the proposed development in order to protect the ecological integrity of any receiving aquatic environment. All discharges must be in compliance with the European Communities (Surface Water) Regulations 2009 and the European Communities (Groundwater) Regulations 2010. It is recommended that the "Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites" (http://www.fishingireland.net/environment/constructionanddevelopment.htm) be consulted when planning to undertake works on this site. The maintenance of habitat integrity (both in-stream and riparian) is essential in safeguarding the ecological value of this important urban natural resource. The specific details of any works directly affecting watercourses or riparian habitats in the area must first be submitted to IFI for assessment.
The Development Applications Unit of the Department of Arts, Heritage and the Gaeltacht	Email	A response letter dated 26th November 2015 outlined the need to consider the following: • Cumulative and ex situ impacts; • Potential impacts from water and wastewater provisions; • Alien invasive species; and • Complete project details need to be considered, including construction management plans.
The Development Applications Unit of the Department of Arts, Heritage and the Gaeltacht	Email correspondence dated 12th March 2020 with EIA Scoping Document	No response received to date.
Wicklow County Council	Email	Response received on the 15th of October 2015 requested that the following is addressed: • Potential impacts of the development on Ballyman Glen SAC (It is noted you have indicated screening for Appropriate Assessment, • A Screening Document should be included in any application to assist the Planning Authority to carry out their Stage 1 AA Screening, • Impacts of the development on groundwater, Management of surface water.
Wicklow County Council	Opinion of WCC issued to ABP during pre-application discussions. Copied to prospective applicant under cover of letter dated 20.07.20	The Opinion stated as follows in respect of Ballyman Glen SAC: Any works within Ballyman Glen SAC need to be designed to the highest standard and assessed as part of the Natura Impact Statement to be submitted with the application. The boundary of the park area and the SAC needs to be treated carefully, to ensure that pedestrian movements will not result in negative impacts on the conservation values of the Ballyman Glen SAC. With reference to EIA and Appropriate Assessment the Opinion stated that: An Environmental Impact Assessment Report and a Natura Impact Statement are required with any application. The applicant should be guided by the assessments / submission with respect to the previous application on site i.e. Appeal Reference PL PL27.248705 (PRR 16/999), which identify the key issues to be examined.

5.2.1.2 Review of Relevant Planning History

Planning Application Wicklow County Council Reference 16/999 / An Bord Pleanála Ref. PL27.248705

As noted above, a planning application including EIS was previously lodged by the applicant for a similar development proposal to the current application (proposed under Wicklow County Council Planning Ref. 16/999 / An Bord Pleanála Ref. PL27.248705).

The EIS biodiversity chapter which accompanied the previous planning application was prepared by the author of this current chapter. The NPWS made submissions in the course of the application assessment by Wicklow County Council initially and thereafter by An Bord Pleanála.

At application stage with Wicklow County Council the NPWS submission recommended that all mitigation measures of the EIS be put in place and that a monitoring programme be put in place after the capping to monitor water quality in the springs. The NPWS made two submissions at appeal stage. With regard to nature conservation the first submission dated 11.10.16 noted the landfill remediation works which formed part of the application and recommended that all mitigation measures contained in the EIA be put in place. A second submission dated 31.03.17 stated that it had no objection on nature conservation grounds.

The An Bord Pleanála Inspectors Report set out a detailed Environmental Impact Assessment section. It considered the various aspects of the proposed development that may potentially impact on ecological matters. It identified likely significant impacts on ecology potentially arising from potential loss of existing terrestrial habitats; impacts on watercourses from changes in runoff and pollution; and loss of habitats for birds and bats. The Inspector noted that extensive mitigation measures to address ecology issues were set out in the submitted EIS. They included the preparation and implementation of a construction and environmental management plan; the identification of areas to be avoided during construction including wet woodland and other valuable habitats; use of badger proof fencing to the main link road and underpasses; bat protection measures by survey prior to works and replacement hedgerow planting; implementation of an invasive species management plan; and detailed drainage design to ensure that surface water flow rates are controlled. The Inspector reported as follows: *"I have considered all of the written submissions made in relation to ecology. I am satisfied that they can be avoided, managed and mitigated by the measures which form part of the proposed scheme, the proposed mitigation measures and through suitable conditions. I am satisfied that the proposed development would not have any unacceptable direct or indirect impacts in terms of general ecology"*.

5.2.2 Designated Sites

A review of European designated sites within a 15km radius of the site was undertaken (www.npws.ie). Special Areas of Conservation (SACs) are sites of international importance due to the presence of Annex I habitats and / or Annex II species listed under the EU Habitats Directive. Special Protection Areas (SPAs) are designated for birds based on the presence of internationally significant populations of listed bird species.

A review of Nationally designated sites within a 10km radius of the site was also undertaken. Natural Heritage Areas (NHAs) are sites deemed to be of national ecological importance and are afforded protection under the Wildlife (Amendment Act) 2000. The proposed Natural Heritage Area (pNHA) have not been statutorily proposed or designated, however do have some protection under Agri Environmental Options Scheme (AEOS), Coillte, County Development Plans and Licensing Authorities.

5.2.3 Field Survey

5.2.3.1 Habitats and Flora Survey

Ecological surveys were undertaken at the application site between August 2015 and September 2021. Flora and habitats within the study area were surveyed on 9th June 2021 using the methodology outlined in the guidance document *Best Practice Guidance for Habitat Survey and Mapping* (Smith et al., 2011).The habitats found in the study area were classified in accordance with the guidelines set out in '*A Guide to Habitats in Ireland*' (Fossitt, 2000), which classifies habitats based on the vegetation present and management history. The classification is a standard scheme for identifying, describing and classifying wildlife habitats in Ireland. The classification is hierarchical and operates at three levels, outlining the correlation between its habitat categories and the phytosociological units (plant communities) of botanical classifications. Dominant species, indicator species and/or species of conservation interest were recorded

and species recorded were given both their Latin and common names, following the nomenclature as given in the '*New flora of the British Isles*' (Stace, 2010). Habitat potentially linked to European Annex I habitats was assessed based on the *Interpretation Manual of EU Habitats* (European Commission, 2013) and *The Status of EU Protected Habitats and Species in Ireland* (NPWS, 2019).

Aquatic surveys were conducted by Aquens Ltd in October 2015 and September 2021. The water quality assessment was undertaken using macroinvertebrate indicators. The sampling method adopted was that applied by the EPA in the national river monitoring program (McGarrigle et. al., 2002). The survey is detailed in the Aquens report 'An Assessment of Water Quality in the Stream flowing through Ballyman Glen, Co. Wicklow', September 2021 which is enclosed at **Appendix 5A**.

A survey for Annex I habitats at Ballyman Glen was undertaken by Wetland Surveys Ireland in 2019. A copy of the Annex I Habitat Survey Report is enclosed in **Appendix 5B**.

5.2.3.2 Fauna Survey

Fauna were surveyed through observation of field signs such as direct observation, tracks, feeding signs and droppings. Habitats were assessed for their potential for use, or confirmed use, by protected species of fauna and avifauna during the initial site walkover survey undertaken by Ms Karen Banks in 2016 and a second walkover survey undertaken in April 2019. The results of the site walkovers then informed the scope of tax on specific surveys as detailed in the following sections.

5.2.3.2.1 Avifauna

A breeding bird survey of the proposed site was undertaken on 26th April 2019. The entire site was surveyed, taking in to account suitable habitat areas as previously identified in the desktop study. All species that were seen or heard were recorded. All bird locations, numbers and behaviour were recorded by annotating field maps and taking notes. Breeding evidence such as singing males, agitated behaviour, carrying food and recently fledged young was recorded. The breeding status of all species encountered during surveys were classified into four categories: Confirmed (Br), Probable (Pr), Possible (Po) and Nonbreeder (N), based on British Trust for Ornithology (BTO) categories of breeding evidence, as detailed in **Table 5.2**. The survey was conducted under dry, calm and light weather conditions.

The conservation status of bird species recorded was considered in respect of the following: Irish Wildlife Acts (Revised); Birds of Conservation Concern in Ireland (BoCCI) Red, Amber and Green lists (see Gilbert *et al*, 2021); EU Birds Directive Annex I list.

Table 5-2: BTO categories of breeding bird evidence

Breeding status	Confirmed breeder (Br)	Probable breeder (Pr)	Possible breeder (Po)	Non-breeder (N)
Observed behaviours	Distraction display or injury feigning (DD)	Pair in suitable nesting habitat (P)	Observed in suitable nesting habitat (H)	Flying Over (F)
	Used nest or eggshells found from current season (UN)	Permanent Territory (T)	Singing Male (S)	Migrant (M)
	Recently fledged young or downy young (FL)	Courtship and Display (D)		Summering non-breeder (U)
	Adults entering or leaving nest site indicating occupied nest (ON)	Visiting probable nest site (N)		
	Adult carrying faecal sac or food for young (FF)	Agitated Behaviour (A)		
	Nest containing eggs (NE)	Brood patch of incubating bird (I)		
	Nest with young seen or heard (NY)	Nest Building or excavating nest hole (B)		

5.2.3.2.2 Bats

Bat survey was undertaken at the proposed site and its environs with cognisance of the following guidelines:-

- Bat Conservation Ireland, (2010). *Guidance notes for Planners, Engineers, Architects, and Developers*;
- BTHK. (2018). *Bat Roosts in Trees – A Guide to Identification and Assessment for Tree-Care and Ecology Professionals. Pelagic Publishing, Exeter UK;*
- Collins, J. (ed.) (2016). *Bat Surveys for Professional ecologists: Good Practice Guidelines (3rd ed.). The Bat Conservation Trust, London*; and
- Kelleher, C. & Marnell, F. (2006). *Bat Mitigation Guidelines for Ireland*.

Preliminary Roost Assessment

The trees within the proposed site were surveyed in conjunction with the walkovers undertaken in 2016 and 2019 for potential roost sites and signs of bats. A detailed inspection of the exterior of trees was undertaken to look for features that bats could use for roosting (Potential Roost Features, or PRFs) from ground level. The aim of the survey was to determine the actual or potential presence of bats and the need for further survey and/or mitigation.

A detailed inspection of each tree within the site was undertaken. The inspection was carried out in daylight hours from ground level, and information was compiled about the tree, PRFs and evidence of bats. All trees, or groups of trees, surveyed were numbered and marked on a map and a description of each PRF observed was recorded. PRFs that may be used by bats include:

- Rot holes;
- Hazard beams;
- Other horizontal or vertical cracks or splits (e.g. frost cracks) in stems or branches;
- Lifting bark;
- Knotholes arising from naturally shed branches or branches previously pruned back to the branch collar;
- Man-made holes (e.g. flush cuts) or cavities created by branches tearing out from parent stems;
- Cankers in which cavities have developed;
- Other hollows or cavities;
- Double leaders forming compression forks with included bark and potential cavities;
- Gaps between overlapping stems or branches;
- Partially detached ivy with stem diameters in excess of 50mm; and
- Bat or bird boxes.

Signs of a bat roost (excluding the actual presence of bats), include:

- Bat droppings in, around or below a PRF;
- Odour emanating from a PRF;
- Audible squeaking at dusk or in warm weather; and
- Staining below the PRF.

It should be noted that bats or bat droppings are the only conclusive evidence of a roost and many roosts have no external signs. This survey was undertaken from ground level by an experienced bat ecologist. Trees were categorised according to the highest suitability PRF present. The criteria for categorisation of suitability for bats is described further in **Table 5-3**.

Table 5-3: Suitability of Habitats for Bats

Suitability	Description Roosting Habitats	Commuting and Foraging Habitats
Negligible	Negligible habitat features on site likely to be used by roosting bats.	Negligible habitat features on site likely to be used by commuting or foraging bats.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation). A tree of sufficient size and age to contain PRFs but with none seen from the ground or features seen with only very limited roosting potential.	Habitat that could be used by small numbers of commuting bats such as gappy hedgerow or un-vegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by other habitat. Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Moderate	A structure or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only- the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed).	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.
High	A structure or tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat.	Continuous, high quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. High quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, tree-lined watercourses and grazed parkland. Site is close to and connected to known roosts.

Activity Survey

Bat surveys at the proposed site were conducted by an experienced and licenced bat ecologist (Karen Banks) with cognisance of good practice guidelines, as noted at the start of this **Section 5.2.3.2.2** above. Seven dusk bat activity surveys were conducted across the site between April and September 2019 and August and September 2021 using an Anabat Walkabout detector, which records bat echolocation calls directly on to an internal SD memory card. An Anabat Express and Anabat Swift static bat detectors were left in different locations across the study area for one night per transect survey (i.e. for 1 night in April, July, August and September 2019) to supplement the activity transect survey. The Passive Monitors (PMs) were left out for 5 nights per transect in 2021 (i.e. for 5 nights in August and 5 nights in September 2021).

The location of the PMs recording at the proposed site in 2019 is illustrated in **Figure 5-1** and the location of the PMs recording at the proposed site in 2021 is illustrated in **Figure 5-2**.

Figure 5-1: Location of passive monitors recording at the proposed site at Fassaroe, 2019

Figure 5-2: Location of passive monitors recording at the proposed site at Fassaroe, 2021

5.2.3.2.3 Badger

Upon review of the results of the site walkovers undertaken in 2016 and 2019, specific badger surveys were conducted within the proposed development footprint and the blue line boundary of the site on 26th April 2019 and 4th August 2021. Badger surveys were conducted in accordance with Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (NRA, 2009).

Field signs of badger activity are characteristic and sometimes quite obvious and can include tufts of hair caught on barbed wire fences and scrub, conspicuous badger paths, footprints, small excavated pits or latrines in which droppings are deposited, scratch marks on trees, and snuffle holes, which are small scrapes where badgers have searched for insects and plant tubers (NRA, 2009).

Notes were made on signs of other mammals in order to deduce the likelihood of faint tracks and/or feeding signs belonging to badgers. The objectives of the badger surveys were to:

- Confirm whether or not badger setts occur within the area surveyed.
- Confirm where possible the status of any setts identified in surveys.
- Describe field signs of badger activity.

5.2.3.2.4 Otter

Otter survey of County Brook adjacent to the proposed site was conducted on 26th April 2019, 4th August 2021 and 24th September 2021.

The river banks were searched for field signs including:

- Sleeping and resting places including holts, couches and natal dens;
- Breeding sites;
- Spraints;
- Pathways/ trails;
- Slides;
- Hairs;
- Footprints; and
- Food remains.

Natal dens tend to be well hidden and therefore can be hard to locate. Survey for natal dens was undertaken by searching for field signs including:

- A heavily used path or paths from the water into dense cover or an enclosed structure;
- Bedding within the structure which may consist of grass, ferns or reeds (bedding may also be present in other types of resting places);
- A latrine containing a large number of spraints at the den or within 2m of it (however, it is important to note that there are often no droppings at a natal den as the female will excrete in the water to ensure that there are no signs of occupation near the natal den);
- A cub play area which may be a well-worn area around a tree or on a bank; and
- Different sized otter prints.

Bat and badger surveys of part of the Fassaroe lands were also previously conducted by ecologist Brian Keeley in September 2014 and February 2015 respectively. The results of these surveys are included in the description of survey results included in **Section 5.3.4.6** below**.**

5.2.3.2.5 Other Taxa

Reptiles and Amphibians

A survey for amphibians and reptiles was undertaken as part of the site walkover surveys undertaken on 26th April 2019, which is during the amphibian breeding season (January to May). Potential breeding sites, e.g. areas of standing water were the targeted habitats for the species surveys.

Invertebrates

Surveys for invertebrates were undertaken as part of the habitat surveys undertaken on 18th July 2019 and 4th August 2021.

5.2.3.3 Aquatic Ecology

The following surveys were carried out in the County Brook (Fassaroe Stream), north of the proposed site.

- Biological Surveys - Benthic Macroinvertebrate Sampling
- Fishery Habitat Assessments

5.2.3.4 Biological Surveys

Biological water quality surveys were undertaken in September 2021 by Aquens Ltd. Potential impact sites along the County Brook (Fassaroe Stream) were selected in consultation with RPS for survey using Arc GIS with OS 1:50,000 discovery series mapping. Detailed notes and photographs were taken at these selected sites. A copy of the Aquens report '*An Assessment of Water Quality in the Stream flowing through Ballyman Glen, Co. Wicklow'*, September 2021 is provided at **Appendix 5A**.

Benthic Macroinvertebrate Sampling

The biological water quality assessment was undertaken using macroinvertebrate indicators. These are an excellent tool when assessing water quality and they are the most common biological parameter in bio-assessment. They are easy to collect, are widespread and abundant and more importantly they exhibit differential responses to physical and chemical changes in their environment. Some macroinvertebrates are sensitive to pollution while others are tolerant. They are not affected by a temporary amelioration of pollution but provide a realistic record of the prevailing conditions, integrating the biological signal over a period of time.

Macroinvertebrate sampling took place in September 2021 at five sites on the County Brook (Fassaroe Stream) (**Figure 5.3**). Sites were located with respect to the proposed surface water discharge points (SW2 to SW4). Site 1 was above the proposed development site immediately upstream of SW4. Site 2 was between SW2 and SW3 while Site 3 was in the region of SW2 ensuring that it was above an area of extensive poaching by cattle accessing the river. Sites 4 and 5 were positioned further downstream of the proposed development. Site 4 was upstream of a drain to the river which had a heavy growth of sewage fungus at the time of sampling. The sampling method adopted was that applied by the Environmental Protection Agency (EPA) in the national river monitoring program (McGarrigle et. al., 2002). Using an FBA (Freshwater Biological Association) D-framed pond net (1mm mesh), a 2-minute, multi-habitat kick-sample was taken at each site. In addition, one minute stone-washing was also undertaken. The samples were preserved in 70% IMS and processed in the laboratory. All the macroinvertebrates were identified to the appropriate taxonomic resolution using Freshwater Biology Association taxonomic keys.

The macroinvertebrate data were used to derive a Q-value using the EPA methodology (McGarrigle et al., 2002). This Q-value system is a five point scale (Q1-Q5: with intermediate scores obtainable, e.g. Q3-4) based on the proportions of five groups of macroinvertebrates, with different pollution tolerances. Q-values and water quality classes were assigned using a combination of habitat characteristics and structure of the macroinvertebrate community within the waterbody. Individual macroinvertebrate species are ranked for their sensitivity to organic pollution and the Q-value is assessed based, primarily, on their relative abundance within a biological sample. EPA indices, EPA water quality status and Water Framework Directive (WFD) status are interpreted in **Table 5.4**.

The Environmental Quality Ratio or EQR represents the relationship between the values of the biological parameters observed for a given body of surface water and the values for these parameters in the reference conditions applicable to that body. In Ireland it is calculated as Observed Q-value/Reference Q-value (i.e.,

Q5). The EQR allows comparison of water quality status across the European Union as each member state has an EQR value for 'High'; 'Good' etc., based on an intercalibration of boundaries between water quality categories e.g., 'High-Good'; 'Good–Moderate'.

Table 5-4: EPA Q-Rating and Equivalent WFD Water Quality Status Classes

Biotic Index	EQR[1]	EPA Quality Status	Water Quality	WFD[2] Status
Q5	1.0	Unpolluted	Good	High
Q4-5	0.9	Unpolluted	Fair-to-Good	High
Q4	0.8	Unpolluted	Fair	Good
Q3-4	0.7	Slightly Polluted	Doubtful-to- Fair	Moderate
Q3	0.6	Moderately Polluted	Doubtful	Poor
Q2-3	0.5	Moderately Polluted	Poor-to-Doubtful	Poor
Q2	0.4	Seriously Polluted	Poor	Bad
Q1-2	0.3	Seriously Polluted	Bad-to-Poor	Bad
Q1	0.2	Seriously Polluted	Bad	Bad

(**Colour coding as employed under the WFD as specified in Schedule 3 of S.I. No 272 of 2009: High – blue, Good – green, Moderate – yellow, Poor – orange, and Bad – red**)

A number of other metrics were calculated to support the interpretation of water quality There included two other biotic indices (BMWP and ASPT –see **Appendix 5A**).The BMWP score is based on the presence of pollution-tolerant to pollution-sensitive families. Each family is assigned a score. The BMWP score is the sum of these family scores. Families that are sensitive to pollution are assigned higher scores than pollution-tolerant families. A high overall score indicates that the water quality is good. The ASPT is determined by dividing the BMWP score by the number of scoring taxa yielding a score between 1 and 10, values >6 usually indicate excellent water quality. In addition, taxon richness and abundances, the percentage of Ephemeroptera/Plecoptera/Trichoptera (%EPT) and EPT richness were determined.

5.2.3.5 Fishery Habitat Assessment

General physical habitat characteristics and hydromorphological features were recorded at the five macroinvertebrate / biological sampling sites including substrate, flow types and aquatic vegetation. (Fassaroe Stream) (**Figure 5.3**). These sites were assessed in terms of:-

1. Stream width and depth;
2. Substrate type, listing substrate fractions boulders, cobble, gravel, sand, silt etc.) in terms of % cover,
3. Flow type, listing sampling area type e.g. riffle, glide and pool;
4. In-stream vegetation, listing aquatic plant occurring and where relevant their percentage coverage of the stream bottom at the sampling site;
5. The degree of siltation was recorded on a scale of clean, slight, moderate and heavy, prior to kick sampling;
6. Grid references were recorded at all sites using a GPS; and
7. Site photographs were taken using a digital camera.

[1] EQR = Environmental Quality Ratio (Observed/Reference)

[2] WFD = Water Framework Directive (EPA, 2006)

Criteria Used for Assessment of Salmonid Quality

Each stream habitat section was rated for the different life stages of salmonid fish based on features listed points 1-5 above.

The more diverse the stream habitat in terms of substrate, flow rate, depth, riparian vegetation, light conditions etc., the richer the biological community is likely to be, and the more suitable it is likely to be for salmonid fish (trout and salmon).

An approximate 30-50m stretch of the stream was surveyed for potential fishery habitat along each of the five sampling sites . Assessment of the quality of salmonid spawning habitat, nursery habitat and adult habitat is based on personal expertise and on published information from Bjorn and Reiser[3], such as the following:

- Favourable locations for salmon spawning are likely to occur where the gradient of a river is 3% or less;
- Typical spawning sites are the transitional areas between pool and riffle where flow is accelerating and depth decreasing, where gravel of suitable coarseness is present and interstices are kept clean by up-welling flow;
- Salmon fry and parr occupy shallow, fast-flowing water with a moderately coarse substrate with cover;
- Deep or slow-moving water, particularly when associated with a sand or silt substrate, does not support resident juvenile salmonids;
- Suitable cover for juveniles includes areas of deep water, surface turbulence, loose substrate, large rocks and other submerged obstructions, undercut banks, overhanging vegetation, woody debris lodged in the channel, and aquatic vegetation; and
- The juxtaposition of habitat types is also important. The proximity of juvenile habitat to spawning gravels may be significant to their utilisation. In addition, adults require holding pools immediately downstream of spawning gravels in which they can congregate prior to spawning. Cover for adult salmon waiting to migrate or spawn can be provided by overhanging vegetation, undercut banks, submerged vegetation, submerged objects such as logs and rocks, floating debris, deep water and surface turbulence.

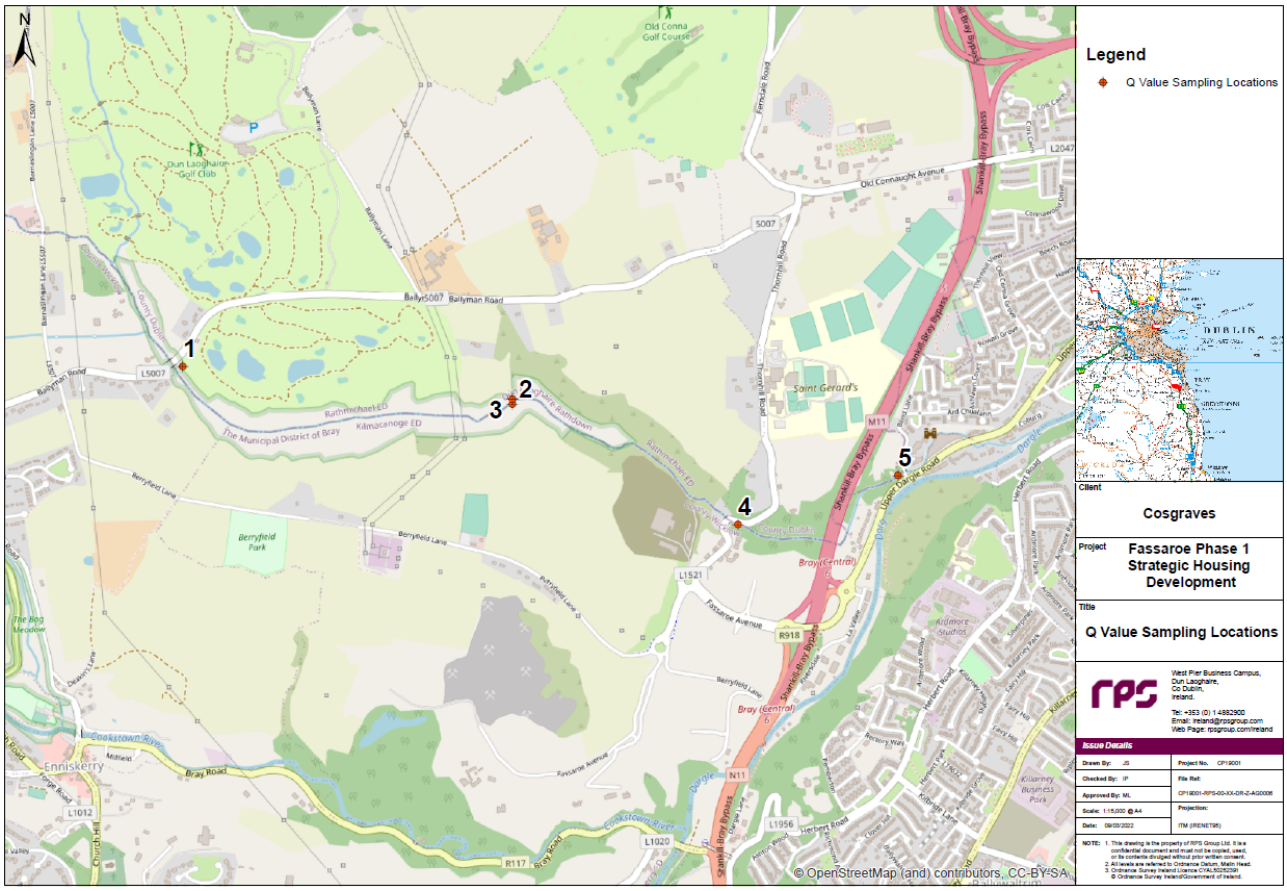
Criteria Used for Assessment of Lamprey Quality

Each stream habitat section was also rated as habitat for lamprey and crayfish based on features listed in points 1-5 above.

Lamprey habitat preferences change with the stages of their life cycle. They show a preference for gravel-dominated substratum for spawning. After hatching the larvae swim or are washed downstream by the current to areas of sandy silt in still or slow flowing water where they burrow and spend the next few years in tunnels. Lampreys therefore require mainly silt and sand dominated substratum for nursery habitat. Other important environmental characteristics for optimal ammocoete habitat are shallow waters with low water velocity, and the presence of organic detritus and/or plant material. Suboptimal habitat supporting only a few individuals may consist of a few square centimetres of suitable silt in an open, comparatively high-velocity, boulder-strewn streambed. Spate rivers with high flow velocities tend to support fewer ammocoetes because they contain smaller areas of stable sediment.

[3] Bjorn T.C. and D. W. Reiser, 1991. Habitat Requirements of Salmonids in Streams. Pages 83-138 in W.R. Meehan, editor. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. Special Publication 19. American Fisheries Society. Bethesda, MD.

Figure 5-3: Surface Water Biological Sampling Points along the County Brook (Fassaroe Stream)



5.2.4 Impact Assessment

The information gathered from desk study and survey has been used to prepare an ecological impact assessment (EcIA) of the proposed development upon the identified ecological features. The EcIA has been undertaken following the methodology set out in CIEEM (2018) and with reference to BS 42020:2013. EcIA is based upon a source-pathway-receptor model, where the source is defined as the individual elements of the proposed development that have the potential to affect identified ecological features. The pathway is defined as the means or route by which a source can affect the ecological features. An ecological feature is defined as the feature of interest, being a species, habitat or ecologically functioning unit of natural heritage importance. Each element can exist independently however an effect is created where there is a linkage between the source, pathway and feature.

A significant effect is defined in CIEEM (2018) as:

"*an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features'…. or for biodiversity in general*".

BS 42020:2013 states that if an effect is sufficiently important to be given weight in the planning balance or to warrant the imposition of a planning condition, e.g. to provide or guarantee necessary mitigation measures, it is likely to be "significant" in that context at the level under consideration. The converse is also true: insignificant effects would not warrant a refusal of permission or the imposition of conditions.

Likely significant effects are predicted on the basis of the proposed development as set out in Chapter 2: *Description of the Development*.

The valuation of ecological features is in accordance with the methodology detailed in National Roads Authority Guidelines (2009) (**Table 5-5**). To qualify as an ecological feature (referred to as key ecological receptors in the NRA Guidelines), features must be of local ecological importance (higher value) or higher as per the geographical frame of reference detailed in **Table 5-5**. Ecological features might also be important because they play a key functional role in the landscape as 'stepping stones' for migratory species to move during their annual migration cycle, as well as for species to move between sites, to disperse populations to

new locations, to forage, or move in response to climate change.[4] Features of lower ecological value are not assessed.

Table 5-5: Geographical Frame of Reference for Ecological Evaluation

Ecological Valuation
International Importance: 'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation. Proposed Special Protection Area (pSPA). Site that fulfils the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended). Features essential to maintaining the coherence of the Natura 2000 Network. Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive. Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or Species of animal and plants listed in Annex II and/or IV of the Habitats Directive. Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971). World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage, 1972). Biosphere Reserve (UNESCO Man & the Biosphere Programme). Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979). Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979). Biogenetic Reserve under the Council of Europe. European Diploma Site under the Council of Europe. Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).
National Importance: Site designated or proposed as a Natural Heritage Area (NHA). Statutory Nature Reserve. Refuge for Fauna and Flora protected under the Wildlife Acts. National Park. Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park. Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Site containing 'viable areas' of the habitat types listed in Annex I of the Habitats Directive.
County Importance: Area of Special Amenity. Area subject to a Tree Preservation Order. Area of High Amenity, or equivalent, designated under the County Development Plan. Resident or regularly occurring populations (assessed to be important at the County level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance. County important populations of species or viable areas of semi-natural habitats or natural heritage features identified in the National or Local BAP, if this has been prepared. Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county. Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.
Local Importance (higher value): Locally important populations of Priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared; Resident or regularly occurring populations (assessed to be important at the Local level) of the following:

[4] Ref Article 10 of the Habitats Directive: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31992L0043:EN:HTML

Ecological Valuation
Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality; Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.
Local Importance (lower value): Sites containing small areas of semi-natural habitat that are of some local importance for wildlife; Sites or features containing non-native species that are of some importance in maintaining habitat links.

5.3 Description of the Existing Environment

5.3.1 Designated Sites

Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) are designated under the EU Habitats Directive (92/43/EEC) and the EU Birds Directive (79/409/EEC) respectively. As such, SACs and SPAs are referred to as European sites, and form part of the Natura 2000 network of sites. Natural Heritage Areas (NHAs) are legally protected from damage from the date they are formally proposed for designation under the Wildlife Acts, while proposed Natural Heritage Areas (pNHAs) have not been statutorily proposed or designated, however do have some protection under Agri Environmental Options Scheme (AEOS), Coillte, County Development Plans and Licensing Authorities

SACs are sites of international importance due to the presence of Annex I habitats and / or Annex II species listed under the EU Habitats Directive. The northernmost boundary of the site is within Ballyman Glen SAC (NPWS Site Code: 000713). The site is designated for the presence of Petrifying Springs and Alkaline Fens; both habitats listed in Annex I of the EU Habitats Directive, the former with priority status.

SPAs are designated for birds based on the presence of internationally significant populations of listed bird species. The nearest designated SPA to the proposed scheme is Wicklow Mountains SPA (NPWS Site Code: 004040), an extensive site located approximately 4.2km to the west and south-west. The site supports nationally important populations of Merlin and Peregrine, both of which are designated under Annex I of the E.U. Birds Directive. The NIS also submitted with the current application, specifically addresses the European Sites in the context of the proposed scheme.

NHAs are sites deemed to be of national ecological importance and are afforded protection under the Wildlife Acts. In addition to its designation as an SAC, Ballyman Glen is also designated as a pNHA.

The proposed scheme is within 15 kilometres of ten SACs and four SPAs. Eight of the SACs are also designated as pNHAs, and there are a further nine pNHAs within 10km of the proposed site but no NHAs. European sites within 15km and nationally designated sites within 10km of the proposed site are detailed in **Table 5-6** and illustrated in **Figure 5-4** and **Figure 5-5**.

Table 5-6: Designated Sites within 15km of the Proposed Development

Site Name and Code	Qualifying Interests	Distance from Proposed Site (km)[5]	Connectivity with Application Site
Ballyman Glen SAC & pNHA (000713)	**Annex I Habitats** Petrifying springs with tufa formation (*Cratoneurion*) [7220] Alkaline fens [7230]	Within and directly adjacent.	Direct.
Knocksink Woods SAC & pNHA (000725)	**Annex I Habitats** Petrifying springs with tufa formation (*Cratoneurion*) [7220]	0.5km south-west.	There is no hydrological connectivity. The

[5] Measured “as the crow flies”

Site Name and Code	Qualifying Interests	Distance from Proposed Site (km)[5]	Connectivity with Application Site
	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) [91E0]		application site and this designated site are both located within the Enniskerry Gravels Groundwater body. However, review of local topography indicates that groundwater at the application site would not flow towards this designated site. No Connectivity.
Bray Head SAC & pNHA (000714)	**Annex I Habitats** Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] European dry heaths [4030]	2.7km east.	Indirect and remote connectivity via County Brook (Fassaroe Stream) which flows into the River Dargle and then into Killiney Bay.
Glen of the Downs SAC & pNHA (000719)	**Annex I Habitats** Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0]	5.7km south.	No Connectivity.
Glenasmole Valley SAC & pNHA (001209)	**Annex I Habitats** Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) [6210] *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) [6410] Petrifying springs with tufa formation (*Cratoneurion*) [7220]	12.6km north-west.	No Connectivity.
Wicklow Mountains SAC (002122)	**Annex I Habitats** Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea [3130] Natural dystrophic lakes and ponds [3160] Northern Atlantic wet heaths with *Erica tetralix* [4010] European dry heaths [4030] Alpine and Boreal heaths [4060] Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe) [6230] Blanket bogs (* if active bog) [7130] Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladani) [8110] Calcareous rocky slopes with chasmophytic vegetation [8210] Siliceous rocky slopes with chasmophytic vegetation [8220] Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0] **Annex II Species** *Lutra* (Otter) [1355]	3.8km west.	No Connectivity.

Site Name and Code	Qualifying Interests	Distance from Proposed Site (km)[5]	Connectivity with Application Site
Carriggower Bog SAC & pNHA (000716)	**Annex I Habitats** Transition mires and quaking bogs [7140]	9.7km south.	No Connectivity.
The Murrough Wetlands SAC & pNHA (002249)	**Annex I Habitats** Annual vegetation of drift lines [1210] Perennial vegetation of stony banks [1220] Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330] Mediterranean salt meadows (Juncetalia maritimi) [1410] Calcareous fens with Cladium mariscus and species of the Caricion davallianae [7210] Alkaline fens [7230]	10.8km south-east.	No Connectivity.
South Dublin Bay SAC & pNHA (000210)	**Annex I Habitats** Mudflats and sandflats not covered by seawater at low tide [1140]	10.4km north.	Remote and tenuous connectivity via the Irish Sea.
Rockabill to Dalkey Islands SAC (003000)	**Annex I Habitats** Reefs [1170] **Annex II Species** *Phocoena* (Harbour Porpoise) [1351]	6.3km north-east.	Remote and tenuous connectivity via County Brook (Fassaroe Stream) which flows into the River Dargle and then into Killiney Bay and the Irish Sea.
Wicklow Mountains SPA (004040)	Merlin (*Falco columbarius*) [A098] Peregrine (*Falco peregrinus*) [A103]	4.2km west.	No Connectivity.
South Dublin Bay & River Tolka Estuary SPA (004024)	Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Oystercatcher (*Haematopus ostralegus*) [A130] Ringed Plover (*Charadrius hiaticula*) [A137] Grey Plover (*Pluvialis squatarola*) [A141] Knot (*Calidris canutus*) [A143] Sanderling (*Calidris alba*) [A144] Dunlin (*Calidris alpina*) [A149] Bar-tailed Godwit (*Limosa lapponica*) [A157] Redshank (*Tringa totanus*) [A162] Black-headed Gull (*Chroicocephalus ridibundus*) [A179] Roseate Tern (*Sterna dougallii*) [A192] Common Tern (*Sterna hirundo*) [A193] Arctic Tern (*Sterna paradisaea*) [A194] Wetland and Waterbirds [A999]	10.3km north.	Remote and tenuous connectivity via County Brook (Fassaroe Stream) which flows into the River Dargle and then into Killiney Bay and the Irish Sea.
Dalkey Islands SPA (004172)	Roseate Tern (*Sterna dougallii*) [A192] Common Tern (*Sterna hirundo*) [A193] Arctic Tern (*Sterna paradisaea*) [A194]	8.4km north-east.	Remote and tenuous connectivity via County Brook (Fassaroe Stream) which flows into the River Dargle and then into Killiney Bay and the Irish Sea.
The Murrough SPA (004186)	Red-throated Diver (*Gavia stellata*) [A001] Greylag Goose (*Anser anser*) [A043] Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]	11.7km south-east.	Remote and tenuous connectivity via County Brook (Fassaroe Stream)

Site Name and Code	Qualifying Interests	Distance from Proposed Site (km)[5]	Connectivity with Application Site
	Wigeon (*Anas penelope*) [A050] Teal (*Anas crecca*) [A052] Black-headed Gull (*Chroicocephalus ridibundus*) [A179] Herring Gull (*Larus argentatus*) [A184] Little Tern (*Sterna albifrons*) [A195] Wetland and Waterbirds [A999]		which flows into the River Dargle and then into Killiney Bay and the Irish Sea.
Dargle River Valley pNHA (001754)	This site is located about 2 km south-east of Enniskerry. It is a section of the River Dargle with steep wooded banks. The importance of this site is that it is a fine example of a wooded valley. It is likely that this valley has been wooded for a long period and such habitats are becoming rare in north County Wicklow.	0.9km south.	No connectivity.
Powerscourt Woodland pNHA (001768)	Powerscourt Woodland is located about 2 km south-west of Enniskerry. It is largely contained within the two large demesnes of Powerscourt and Charleville and includes a 4 km stretch of the Dargle River. Although the site includes many exotic plant species, the habitats are still of interest and support an interesting flora. The mix of semi-natural habitats and estate woodland is particularly conducive to macro-fungi.	1.07km south-west.	There is no hydrological connectivity. The application site and this pNHA are both located within the Enniskerry Gravels Groundwater body. However, review of local topography indicates that groundwater at the application site would not flow towards this pNHA. No connectivity.
Great Sugar Loaf pNHA (001769)	The Great Sugar Loaf is situated about 5 km southwest of Bray. The site is of both ecological and geological interest and is also a prominent feature in the landscape of north County Wicklow.	2.1km south.	No connectivity.
Ballybetagh Bog pNHA (001202)	Knock Lake is located at Balrothery, about 3 km south of Balbriggan. It is a shallow artificial lake set in sloping farmland and has been used as a reservoir. Over time it has attained the character of a natural lake. This lake, although artificial in origin, is of importance for botanical and zoological interests. Similar such water bodies are scarce Co Dublin.	2.9km north-west.	No connectivity.
Dingle Glen pNHA (001207)	Dingle Glen is situated approximately 5 km west of Killiney. It is a dry valley formed as a glacial lake overflow channel. Formerly cleared of vegetation, a woodland cover is now regenerating. The importance in this site lies in the variety of habitats within a relatively small area. The site is secluded and not subject to much disturbance.	4.0km north.	No connectivity.
Loughlinstown Woods pNHA (001211)	This site is located about 4 km north of Bray, on the east side of the main Dublin-Bray road. It is on the north bank of the Shanganagh River at Loughlinstown. The wood was originally planted but following substantial regeneration, has produced woodland of natural character in age structure and form. This site is a good example of a demesne type mixed woodland. It is now used chiefly for amenity purposes.	4.7km north.	No connectivity.
Dalkey Coastal Zone and Killiney Hill pNHA (001206)	This site includes the coastal stretch from Scotman's Bay to south of White Rock, the Dalkey Island group and Dalkey Sound, and Killiney Hill. This site represents a fine example of a coastal system with habitats ranging from the	5.3km north-east.	Remote and tenuous connectivity via County Brook (Fassaroe Stream)

Site Name and Code	Qualifying Interests	Distance from Proposed Site (km)[5]	Connectivity with Application Site
	sub-littoral to coastal heath. The flora is well developed and includes some scarce species. The islands are important bird sites. The site also has geological importance.		which flows into the River Dargle and then into Killiney Bay and the Irish Sea.
Fitzsimon's Wood pNHA (001753)	No site synopsis available	8.3km north-west.	No connectivity.
Glencree Valley pNHA (001755)	The Glencree valley is a glacial valley which lies at the north eastern edge of the Wicklow mountains. The importance of the site is that it is a good example of a deciduous woodland even though it is rather fragmented. The presence of an upland river and boggy flushes add to the habitat diversity of the site.	4.0km south-west.	There is no hydrological connectivity. The application site and this pNHA are both located within the Enniskerry Gravels Groundwater body. However, review of local topography indicates that groundwater at the application site would not flow towards this pNHA. No connectivity.
Powerscourt Waterfall pNHA (001767)	This site is located at the eastern edge of the Wicklow mountains, about 6 kilometres from Enniskerry. The main feature of the site is a steep waterfall, approximately 100m. high, and down which the Dargle river cascades. This site is important because it has one of the most spectacular waterfalls in Ireland and it shows good exposures of schist and granite. The area is important botanically for its rare and scarce flowering plants, ferns, bryophytes and lichens.	5.3km south.	No connectivity.
Kilmacanoge Marsh pNHA (000724)	This site is located off the main Dublin to Wexford road, just south of Kilmacanoge and at the base of the Great Sugarloaf. A small stream links the site to the Great Sugarloaf NHA. The site is a well-developed mosaic of wet woodland surrounded by poor fen and wet grassland. This site is important in having a diversity of species-rich wetland habitats within a relatively small area, and particularly for the presence of some rare invertebrates.	3.4km south.	No connectivity.

Figure 5-4: European Sites within 15km of the Proposed Development

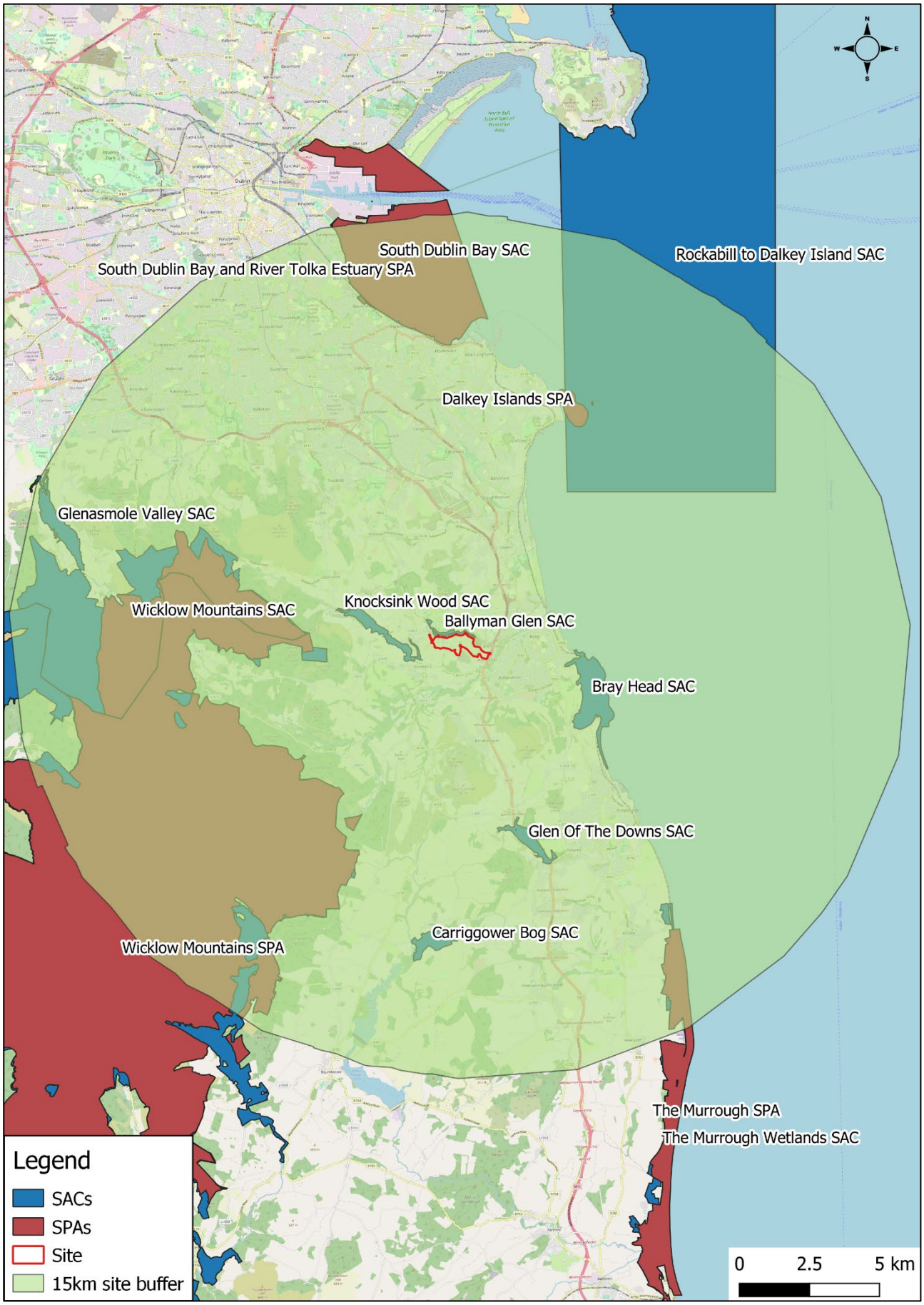
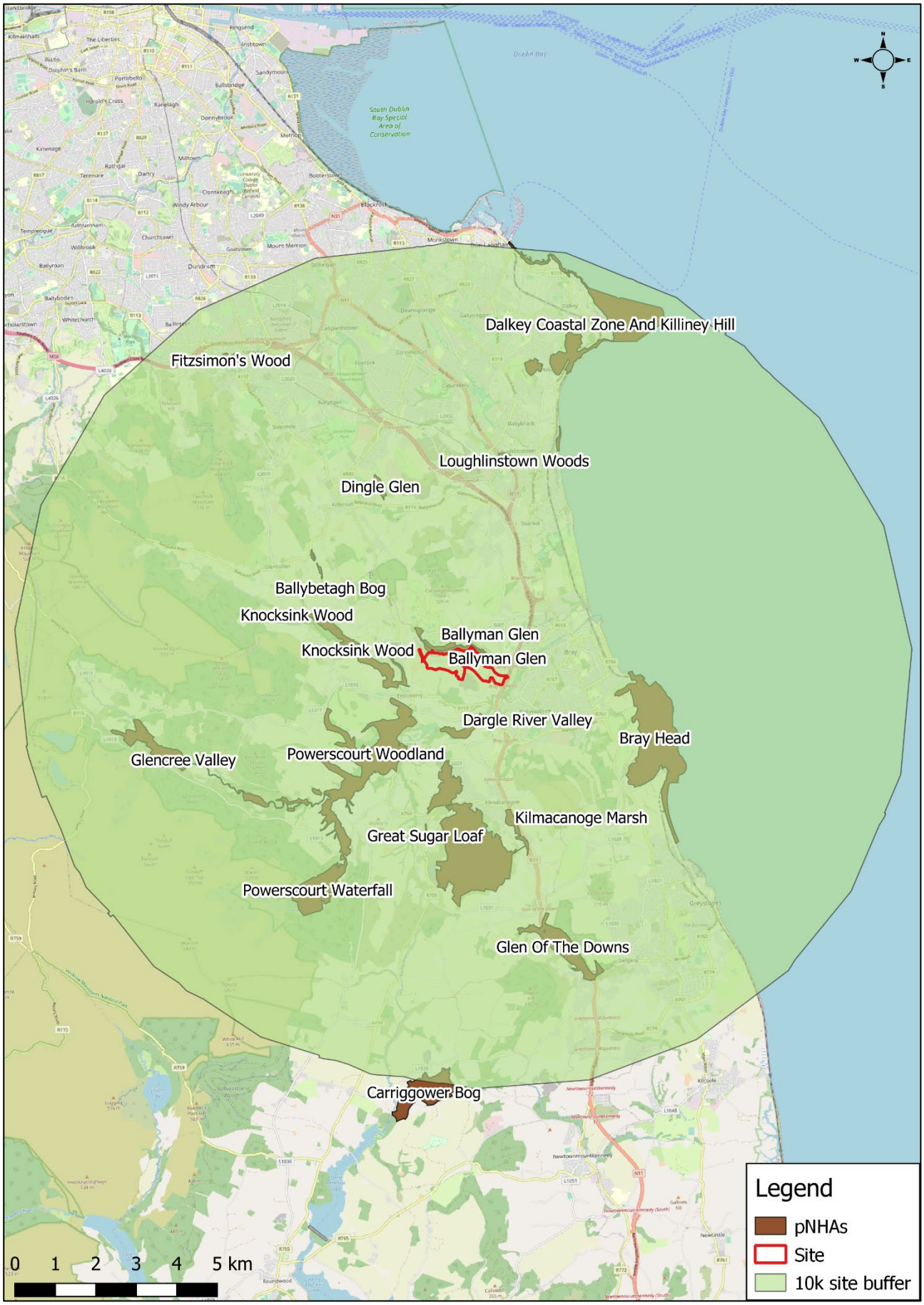


Figure 5-5: Nationally Designated Sites within 10km of the Proposed Development



5.3.2 Habitats

The habitats recorded within the proposed site in June 2021 are described below and illustrated in **Figure 5-6**. The Annex I habitats within Ballyman Glen SAC are described below and are illustrated in **Figure 5-7**.

5.3.2.1 Terrestrial

The proposed site predominantly comprises fields of arable and agriculturally improved grassland bound by hedgerows and treelines.

Improved Grassland (GA1)

A large field of agriculturally improved grassland is situated to the north of the site. The sward recorded here was species poor and dominated by Perennial Rye-grass (*Lolium perenne*). There are also two fields of less intensively managed improved grassland to the south of the site. In addition to Perennial Rye-grass, the sward in these fields also contained the grasses Yorkshire Fog (*Holcus lanatus*), Rough Meadow-grass (*Poa trivialis*), Cock's-foot (*Dactylis glomerata*) and False Oat-grass (*Arrhenatherum elatius*). Herbs present here included Creeping Buttercup (*Ranunculus repens*), White Clover (*Trifolium repens*), Red Clover (*T. pratense*), Dandelion (*Taraxacum agg.*) and Ribwort Plantain (*Plantago lanceolata*); and several noxious weeds including Broad-leaved Dock (*Rumex obtusifolius*), Creeping Thistle (*Cirsium arvense*) Ragwort (*Senecio jacobea*) and Hogweed (*Heracleum sphondylium*).

Amenity Grassland (GA2)

This habitat is represented within sports pitches and domestic gardens within the proposed site. The sward in these areas was of low botanical interest and was dominated by Perennial Rye-grass.

Dry Calcareous and Neutral Grassland (GS1)

A field to the east of the site has not been improved in recent years and is grazed by ponies. The sward comprised grasses including Perennial Rye-grass, Crested Dog's-tail (*Cynosurus cristatus*) and Common Bent (*Agrostis cappilaris*) and herbs including Lesser Hawkbit (*Leontodon saxatilis*), Common Bird's-foot-trefoil (*Lotus corniculatus*), Ox-eye Daisy (*Leucanthemum vulgaris*), Red Clover (*Trifolium pratense*), Wild Carrot (*Daucus carota*), Teasel (*Dipsacus fullonum*), Yellow-wort (*Blackstonia perfoliata*), Common Centaury (*Centaurium erythraea*), Selfheal (*Prunella vulgaris*) and Dandelion (*Taraxacum* agg).

This habitat does not correspond to Annex I habitat *semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometea) (*important orchid sites)* (6210).

Dry meadows and grassy verges (GS2)

This habitat is present within an abandoned sports pitch and historical landfill areas 3A and 3C. Species in the sward included Sweet Vernal-grass (*Anthoxanthum odoratum*), Yorkshire Fog, Common Bent, False Oat-grass and Cock's-foot. Herbs present included Yarrow (*Achillea millefolium*), Dandelion, Ribwort Plantain, Common Sorrel (*Rumex acetosa*), Daisy (*Bellis perennis*), and Creeping Cinquefoil (*Potentilla reptans*). Marsh Orchid (*Dactylorhiza purpurella*) was also recorded in historic landfill area 3A.

Arable (BC1)

There are several fields of arable crops across the study area.

Tilled land (BC3)

One field that had recently been tilled was present to the west of the proposed site.

Buildings and artificial surfaces (BL3)

This habitat is represented by the existing road network and buildings within the proposed site.

Spoil and bare ground (ED2)

An existing unvegetated track present within Ballyman Glen.

Hedgerows (WL1)

Fields across the study area were bound by good quality hedgerows comprised of native species including Ash (*Fraxinus excelsior*), Sycamore (*Acer* pseudoplatanus), Willow (*Salix spp.*), Hawthorn (*Crataegus*

monogyna), Elder (*Sambucus nigra*), Crab Apple (*Malus sylvestris*), Blackthorn (*Prunus spinosa*) and Holly (*Ilex aquifolim*).

Treelines (WL2)

Berryfield Road was lined with tree and shrub species including Ash, Sycamore, Hawthorn and Blackthorn.

Scrub (WS1)

Areas of mixed scrub adjoined parts of the southern edge of the woodland in Ballyman Glen and included Gorse (*Ulex europaeus*), Elder, Blackthorn, Hawthorn, Bramble (*Rubus fruticosus* agg) and Butterfly Bush (*Buddleja davidii*).

Immature Woodland (WS2)

Relatively immature planting of mixed species adjacent to the road network at the east of the site. Species here include Sycamore, Field Maple (Acer campestre), Cherry Laurel (*Prunus laurocerasus*), Rowan (*Sorbus aucuparia*), Scot's Pine (*Pinus sylvestris*), Silver Birch (*Betula pendula*) and Ash.

Mixed Conifer Woodland (WD3)

Small area of mixed conifer woodland adjacent to a domestic dwelling at the west of the proposed site. Species present include Leyland Cypress (*Cupressus leylandii*) and Scot's Pine.

Woodland within Ballyman Glen

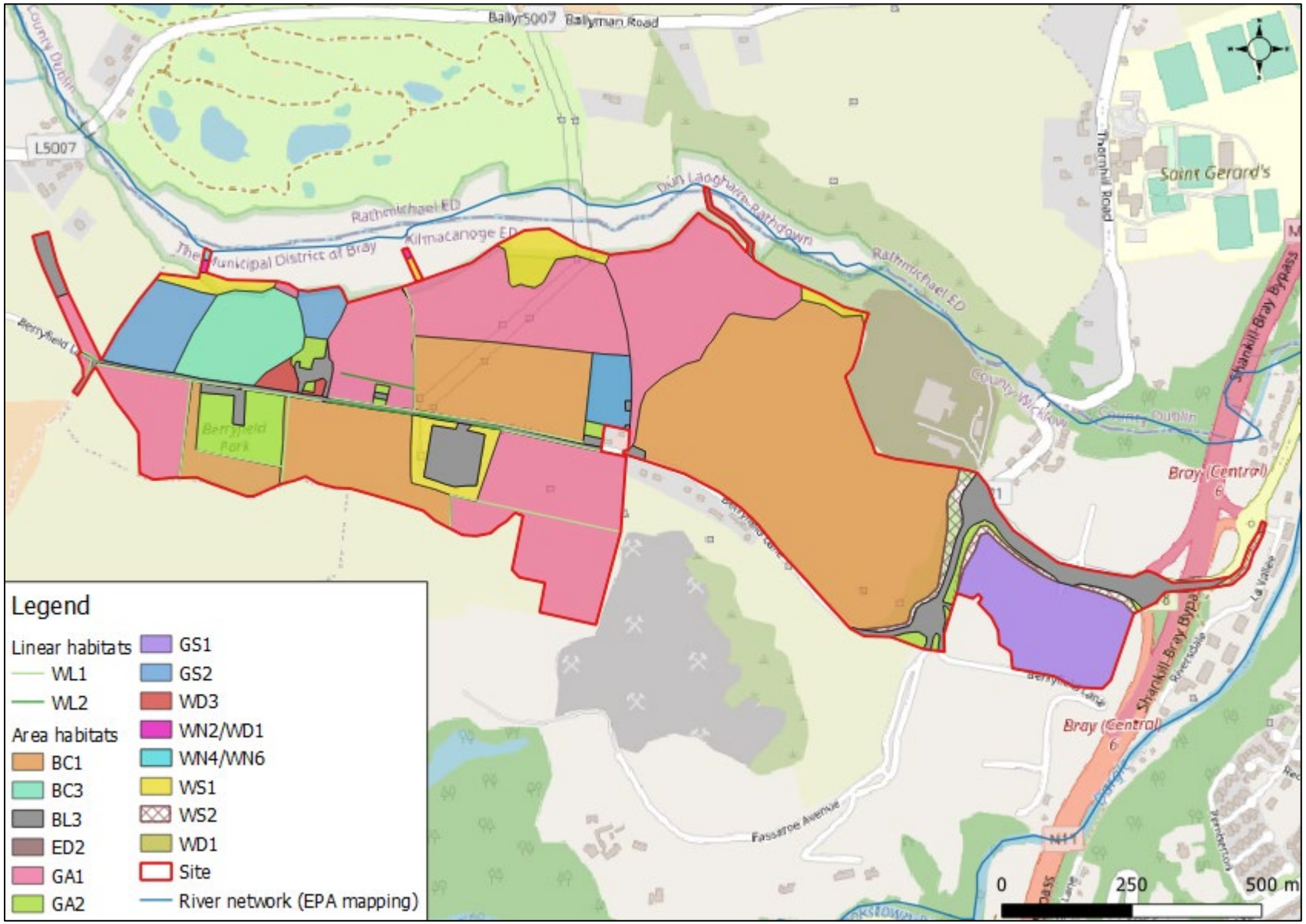
To the north-west of the site, within Ballyman Glen SAC, the river valley supports a wet woodland habitat (WN4/ WN6). Plant species composition here included abundant canopy species such as Ash (*Fraxinus excelsior*) and Alder (*Alnus glutinosa*) with a shrub layer of Grey Willow (*Salix cinerea*) and occasional Hazel (*Corylus avellana*); Holly (*Ilex aquifolium*) is a rare component of the canopy. Further west, and west of the proposed development boundary, Downy Birch (*Betula pubescens*) occurs locally within wet woodland areas.

The ground layer of this woodland area was flushed, wet underfoot and slightly waterlogged in parts. Plant species composition was diverse and included Remote Sedge (*Carex remota*), Great Willowherb (*Epilobium hirsutum*), Creeping Buttercup (*Ranunculus repens*), Water Mint (*Mentha aquatica*), Cleavers (*Galium aparine*), Wavy Bitter-cress (*Cardamine flexuousa*), Nettle (*Urtica dioica*), Herb Robert (*Geranium robertianum*), Meadowsweet (*Filipendula ulmaria*), Bugle (*Ajuga reptans*), Primrose (*Primula vulgaris*), Sanicle (*Sanicula europaea*), Yellow Pimpernell (*Lysimachia nemorum*), Marsh Hawk's-beard (*Crepis paludosa*) Violet (*Viola* spp.), Great Horsetail (*Equisetum telmateia*), Broad Buckler fern (*Dryopteris dilatata*), Male Fern (*Dryopteris filix-mas*) and Lady Fern (*Athyrium filix- femina*). Bryophytes present in these areas include *Mnium hornum, Thuidium tamarascinum* and *Thamnobryum alopecurum*. Yellow Iris (*Iris pseudacrous*), and Reed Canary-grass (*Phalaris arundinacea*) are found in localised areas of marsh located near the river main channel. The species recorded within the woodland and ground layer does not support the list of positive indicator species and criteria for classification as Annex I Habitat '91E0 *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (6410), in accordance with the National Survey of Native Woodland (NSNW) (2003-2008).

Parts of the woodlands fringe; i.e. the southern bounds of Ballyman Glen SAC are drier and correspond to habitats WD1 and WN2. WD1 areas comprise Sycamore (*Acer pseudoplatanus*) and Ash. Drier areas corresponding to WN2 include abundant Ash with Hazel frequent in the understorey. Plant species composition within understorey of drier woodland areas notes the replacement of Great Horsetail with Bramble (*Rubus fruticosus* agg.). Species recorded here include Germander Speedwell (*Veronica chamedrys*), Herb Robert, Sanicle, Ivy, Lords and Ladies (*Arum maculatum*), Hart's-tongue fern (*Asplenium scolopendrium*), Wood Sedge (*Carex sylvatica*) and Spindle (*Euonymus europaeus*).

The habitats within the proposed site are illustrated in **Figure 5-6.**

Figure 5-6: Habitat Map of Fassaroe Phase I SHD Development Lands (Survey June 2021)



Petrifying Springs with Tufa Formation [7220]

Desktop Study

Petrifying Springs with Tufa Formation are defined as springs and seepages where tufa is actively deposited and where characteristic species of bryophytes are dominant or abundant.

'Petrifying springs with tufa formation (Cratoneurion) 7220' are a priority habitat in Annex I of the Habitats Directive. They form where lime-rich spring water deposits tufa (calcium carbonate) on the ground surface. Tufa-depositing waters are characterised by having a high pH, high levels of dissolved calcium and bicarbonate ions and by being oligotrophic (low in nitrogen and phosphorus).

Petrifying springs fall into three physiognomic categories:

(i) clearly defined spring heads with consolidated tufa,

(ii) spring heads with associated tuffaceous flushes, and

(iii) tufa-forming seepage areas on level ground.

They contain Cratoneurion vegetation, typically dominated by bryophytes, and characterised by the presence of *Palustriella commutata* (formerly *Cratoneuron commutatum*) along with *Pellia endiviifolia, Cratoneuron filicinum, Eucladium verticillatum, Bryum pseudotriquetrum, Palustriella falcata* and *Didymodon tophaceus*. Frequently occurring vascular plants are *Festuca rubra, Carex lepidocarpa, C. panicea*, and *Equisetum telmateia*.

Three subtypes of petrifying spring vegetation can be distinguished depending on the setting of the spring: Woodland springs; Coastal springs; and Springs of inland, open habitats. Springs occurring on the Ben Bulben Range constitute a distinct group of high conservation value.

The ecological significance of petrifying springs is seldom confined to a point source; rather, there is often a continuum of intergrading hydrological conditions from the spring head, through a flushed slope and into small streams. Spring heads may be distinct point locations giving rise to small streams immediately below the point of emergence, or water may seep to the surface in a more diffuse pattern over a larger area.

The above description of the habitat is from Lyons and Kelly (2013). A more detailed review of the habitat and associated plant communities is provided in Lyons and Kelly (2013), Lyons (2015), and Lyons and Kelly (2016).

There are eight distinct plant communities associated with Irish petrifying springs, as described by Lyons and Kelly (2016).

Key features used in assessing correspondence with EU Annex I Habitat are as follows:

- Presence of tufa
- Fed by base rich oligotrophic water
- Generally dominated by bryophytes
- Presence of characteristic species of the Cratoneurion
- Wooded or un-wooded
- May occur as discrete spring location with local influence or extend as seepage zones over larger areas

Petrifying spring habitat was recorded frequently throughout the western and northern sections of the study area during survey of Ballyman Glen undertaken by Wetland Surveys Ireland (WSI) in 2019 and also during survey work by WSI in the same area in December 2016. Two additional petrifying springs and associated seepage zones were recorded south of the County Brook River during the 2019 survey.

Survey Results

Springs and associated seepage zones were recorded throughout the lower slopes of the Glen on both the northern and southern sides of the County Brook River. In all, springs were recorded at 29 locations within the glen (see **Figure 5-7**).

The type, distribution, extent and quality of petrifying spring habitat recorded within the survey area are described in the following sections.

In areas where the extent of tufa extended beyond a local area of ca 100 m^2 (10 X 10m), these are mapped as 'seepage zones' in the habitat map (**Figure 5-7**). Elsewhere, where the influence of tufa is more localised these are mapped as point locations.

There are seven seepage zones mapped during the current survey, four of which occur to the north of the County Brook River and three of which occur to the south (see **Figure 5-7**).

In summary, there were six seepage zones that were mapped as polygons as follows:

- Zone I (ca 303 m2 in extent) located to north of river in the western end of study area.
- Zone II (ca 1492 m2 in extent) located north of river, extends in west-east direction parallel to the river.
- Zone III (ca 1882 m2 in extent) located to north of river in the central part of study area.
- Zone IV (ca 431 m2 in extent) located to north of river in the eastern part of study area.
- Zone V (ca 2923 m² in extent) located to the south of the river in the western part of the study area.
- Zone VI (ca 2017 m² in extent) located circa 20m to the east of Zone V on the southern slopes.
- Zone VII (ca 1928 m² in extent) located circa 20m to the east of Zone VI on the southern slopes.

The petrifying springs at Ballyman Glen occur on moderate wooded slopes within the glen and also along the banks of the County Brook River. The seepage zones extend up to 40m upslope from the river bank.

They mostly occur as seepage areas with a dominance of paludal tufa, although oncoids/ooids (plant fragments coated in tufa deposits) are also occasional. Massive tufa cascades are mostly restricted to river banks, although less dramatic example of this tufa formation also occur on moderate slopes removed from the river where there is a constant trickle of water. Tufa fused stones and boulders (cemented rudites) were recorded within the riverbed in some areas often in close proximity or just down-steam of tufa cascades on the stream bank, with stream crust tufa (sheet like deposits of tufa) also noted.

The two main types of tufa springs noted during the survey are described in the following paragraph.

Seepage areas vegetation description: The plant communities of the seepage areas mostly correspond with the *Palustriella commutata-Geranium robertianum* springheads as described by Lyons and Kelly (2016). Bryophyte cover is mostly patchy on the sloped paludal tufa sites and is interspersed with a high cover of leaf litter. The dominant species is *Palustriella commutata* at all sites. Other bryophytes that are common in the ground layer include; *Pelia endiviifolia, Cratoneuron filicinum, Eucladium verticillatum,* and *Calliergonella cuspidata*. The field layer is mostly sparse with *Equisetum telmateia, Carex remota, Chrysosplenium oppositifolium, Adjuga reptans* occurring most frequently with *Eupatorium cannabinum* and occasional ferns. A low cover of *Rubus fruticosus* agg. is usually present.

Canopy cover is moderate to high and consists of a mix of *Salix cinerea, Alnus glutinosa, Fraxinus excelsior, Betula pubescens, Corylus avellana*, and associated *Hedera helix*.

Ground surface is typically damp and relatively firm although may be extremely soft and almost quaking in places where the slope is reduced. Where trickling water is present there is often the presence of oncoids / ooids or low firm consolidated tufa ridges.

Massive consolidated tufa vegetation description: Along the river bank massive consolidated tufa often occurs (see spring assessment B3 below). In these examples bryophytes have an almost complete cover with *Palustriella commutata, Pellia endiviifolia, Aneura pinguis*, and *Conocephalum conicum* most frequent.

Higher plants are sparse and mostly occur around the margins of the solid tufa, and include species such as *Ajuga reptans, Chrysosplenium oppositifolium, Geranium robertianum, Oxalis acetosella, Galium odoratum* and *Ranunculus repens*, and occasional ferns. The canopy is complete and dominated by *Corylus avellana* and *Salix cinerea*, with *Hedera helix* and *Rubus fruticosus* frequently present.

An assessment of conservation status of five representative springs at Ballyman Glen using the methodology outlined in Lyons and Kelly (2016) was undertaken as part of a previous study (Crushell and Foss 2017). Each spring was assessed according to; range and area, structures and functions, and future prospects. The overall condition assessment of four springs was considered unfavourable – inadequate while a single spring was deemed to be in favourable conservation status.

Conservation Status

The main reason that four of the five springs did not attain favourable conservation status was due to the high levels of deer grazing and associated trampling effects on the surface of springs. Most of the springs within the Glen are likely to conform to this in that as deer grazing is occurring at a similar intensity throughout the wooded slopes of the glen. The exception being those springs along the river bank where trampling by deer is less evident.

A further assessment of conservation importance was undertaken using a scoring system proposed by Lyons and Kelly (2016). This confirmed that the springs varied from being of moderate to high conservation importance.

Evaluation: There are extensive seepage areas on both slopes of Ballyman Glen which are associated with calcareous springs. These springs and seepage areas correspond with the EU Annex I habitat Petrifying springs with tufa formation (Cratoneurion) [7220] and are therefore deemed to be of international conservation significance.

Alkaline fen [7230]

Desktop Study

Alkaline fens are typically calcareous basin or flush fen systems with extensive areas of species-rich small sedge communities. These fen systems are often a complex mosaic of habitats, often occurring in association with tall sedge swamp, reedbeds, wet grasslands, springs, and open-water. Alkaline fen is characterised by a broad range of small to medium *Carex* spp., carpets of brown mosses and high species diversity including black bog-rush (*Schoenus nigricans*), blunt-flowered rush (*Juncus subnodulous*), devil's bit scabious (*Succisa pratensis*), hemp agrimony (*Eupatorium cannabinum*) and purple moor-grass (*Molinia caerulea*).

The habitat requires a high water table, a calcareous, low nutrient water supply and minimal water level fluctuation. Low intensity mowing and/or grazing are often important for maintaining species richness. In Ireland, the most extensive areas of alkaline fens are thought to occur in lowland basins underlain by limestone groundwater bodies with a karstic or poorly productive flow regime. Alkaline fens within upland and lowland flushes, along the fringes of calcareous lakes (e.g. Lough Corrib) and within turloughs, dune slacks and machair are thought to be more limited in local extent but more widespread.

Key features used in assessing correspondence with EU Annex I Habitat

- Presence of a range of small sedge species
- Presence of brown moss layer
- Occurring in natural habitat (e.g. lake edge; flush; infilling hollow, fen areas at the edge of reed swamp)
- Waterlogged peat soils
- Base rich conditions

An area of alkaline fen has previously been reported from the southern part of Ballyman Glen (Curtis 1976, NPWS site synopsis). The fen at this location occurs on moderately sloping lands and is fed by a continuous supply of calcareous groundwater from a series of tufa forming springs emerging on the upper slopes. The fen is dominated by a field layer of Purple moor-grass (*Molinia caerulea*), with abundant Blunt-flowered Rush (*Juncus subnodulosus*), and long-stalked Yellow-sedge (*Carex lepidocarpa*). Notable species from the fen area include Narrow-leaved Marsh-orchid (*Dactylorhiza traunsteineri*), and Broad-leaved Cottongrass (*Eriophorum latifolium*). Moss species occurring in the ground layer include: *Palustriella commutata, Calliergonella cuspidata, Ctenidium molluscum*, and *Campylium stellatum*.

This area of fen was confirmed as being present during the survey undertaken by WSI in 2019, however scrub encroachment was noted as a threat to the habitat. The results of the survey undertaken by WSI are detailed below and illustrated in **Figure 5-7**.

Survey Results

A single area of Alkaline fen was recorded on a north-facing un-wooded slope to the south of the County Brook River (see Figure 4-1). The fen habitat is fed by continuous supply of calcareous rich water which has formed extensive tufa substrate. The fen is associated with an extensive seepage area that extends through the woodland to the north to the County Brook River, where strongly consolidated massive tufa formation occurs on the southern river bank.

The fen habitat is surrounded by scrub and woodland and, based on a review of aerial photography and personal observations by WSI surveyors, is being encroached by scrub vegetation, predominantly downy birch (*Betula pubescens*). The extent of open fen is currently estimated to cover 0.18ha compared to ca 0.5ha in the year 2000.

The fen vegetation is dominated by Purple Moor-grass (*Molinia caerulea*) with abundant Great Horsetail (*Equisetum telmateia*), and Black Bog Rush (*Schoenus nigricans*). Locally the ground layer has an almost complete cover of brown mosses with *Calliergonella cuspidata, Cratoneuron filicinum, Palustriella communata*, and *Ctenidium molluscum* all present.

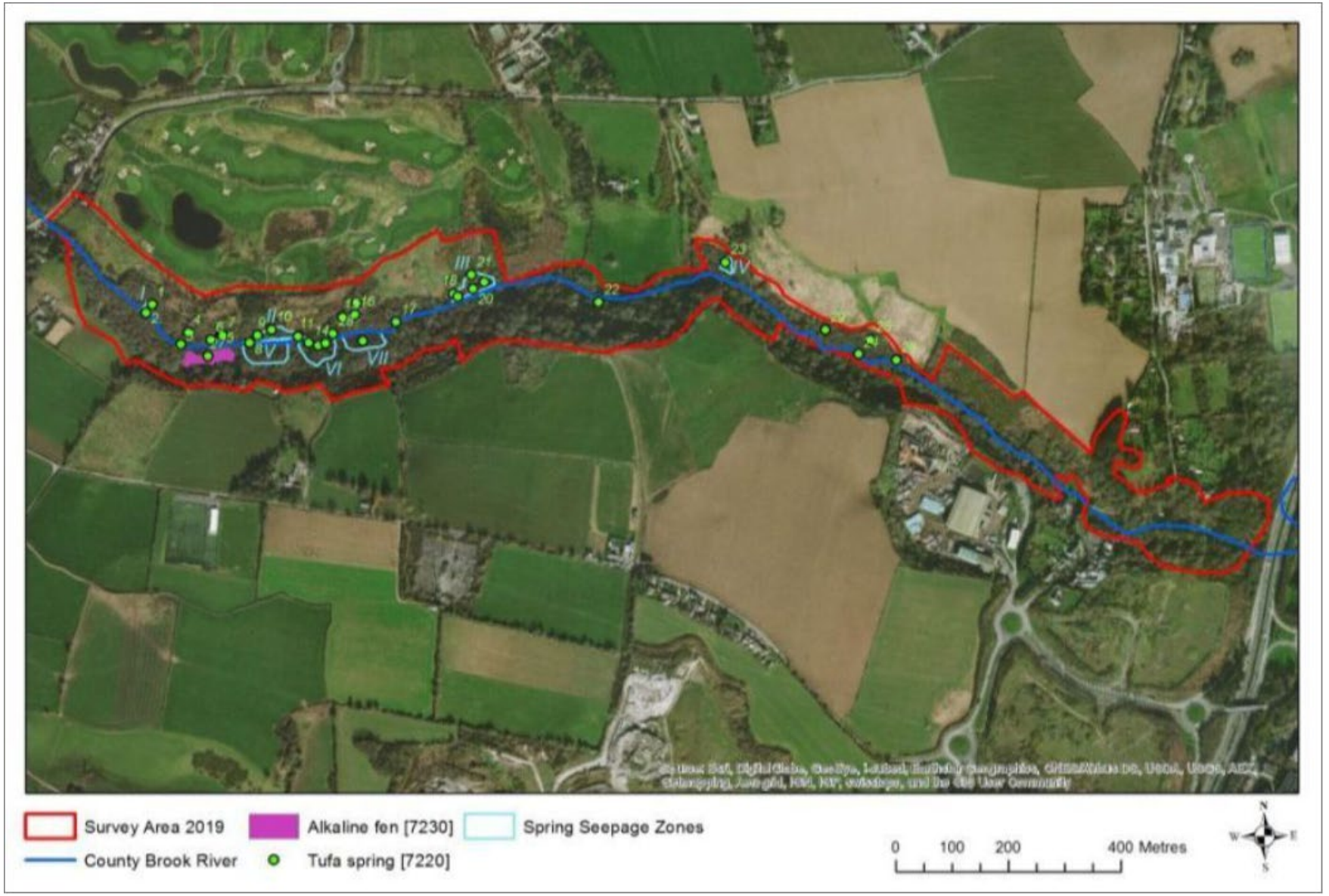
The timing of the survey (November 2019) did not allow a comprehensive assessment of the fen flora. The vegetation of the area is described in the NPWS Site synopsis for the site as follows:

"The vegetation of the main part of the fen is dominated by Greater Tussock-sedge (*Carex paniculata*), Tall Fescue (*Festuca arundinacea*), butterworts (*Pinguicula vulgaris* and *P. lusitanica*), Black Bog-rush (*Schoenus nigricans*) and Broad-leaved Cottongrass (*Eriophorum latifolium*). The site is particularly notable for its orchids, with species including Early Marsh-orchid (*Dactylorhiza incarnata*), Narrow-leaved Marsh-orchid (*D. traunsteineri*) and Marsh Helleborine (*Epipactis palustris*) occurring. In addition, twenty species of sedge have been recorded in the area, including the scarce Long-stalked Yellow-sedge (*Carex lepidocarpa*)."

Evaluation: The habitat is of high ecological interest, corresponding with Annex I Alkaline Fen. The fen is known to support two notable higher plant species; *Dactylorhiza traunsteineri* and *Eriophorum latifolium*. The habitat is somewhat degraded and threatened due to encroachment of scrub and woodland from the edges. However, as the habitat corresponds with an EU Annex I habitat and is a qualifying feature of the SAC, it is deemed to be of international conservation significance.

Plant species identified within this general area included Long-stalked yellow Sedge (*Carex lepidocarpa*), Small-fruited Yellow Sedge (*Carex viridula subsp. viridula*), Carnation Sedge (*Carex panacea*), Jointed Rush (*Juncus articulatus*), Broad-leaved Cottongrass (*Eriophorum latifolium*), Purple Moor-grass, Marsh Arrowgrass (*Triglochin palustris*), Bogbean (*Menyanthes trifoliata*), Devil's-bit Scabious (*Succisa pratensis*), Hemp-agrimony (*Eupatorium cannabinum*), Greater Bird's-foot-trefoil (*Lotus uliginosus*), Marsh Hawk's-beard (*Crepis paludosa*), Angelica (*Angelica sylvestris*), Slender St John's-wort (*Hypericum pulchrum*), *Dactylorhiza* spp., and the mosses *Calliergonella cuspidata, Pseudoscleropodium purum* and *Rhytidiadelphus loreus.*

Figure 5-7: Petrifying Spring and Alkaline Feb Habitats Recorded within Ballyman Glen SAC



5.3.3 Aquatic Ecology

This section of the report examines the aquatic environment in the vicinity of the proposed development area.

The nearest surface water receptor to the proposed development area is the County Brook (Fassaroe Stream) which flows through Ballyman Glen SAC, (referred to as the County Brook stream by the EPA). The County Brook is located approximately 40m north of the landfill remediation and public park proposed works at the nearest point (the proposed three surface water outfalls extend to the stream). It is noted that the County Brook (Fassaroe Stream) is not included as a qualifying interest of the Ballyman Glen SAC designation.

The County Brook (Fassaroe Stream) is not a salmonid river but drains to the River Dargle, a designated salmonid river under S.I. No. 293/1988 - European Communities (Quality of Salmonid Waters) Regulations. The County Brook (Fassaroe Stream) joins the Dargle approximately 1km downstream of the proposed development area and ultimately flows into the Irish Sea at Bray, a further 2km downstream.

The Dargle River and its tributaries support resident brown trout, a nationally significant population of sea trout (both *Salmo trutta*) in addition to a significant and biologically valuable population of Atlantic salmon (*Salmo salar*, listed under Annex II and V of the EU Habitats Directive). Fishery habitat and water quality are regarded as good to excellent for all salmonid life stages throughout the Dargle system and must be protected at all times.

The Cookstown River, a tributary of the Glencullen River is located approximately 200m south of the proposed development area at the nearest point. This river ultimately flows in a north-easterly direction to the River Dargle.

There does not appear to be any direct hydrological connectivity from the proposed development area to the County Brook (Fassaroe Stream) or the Cookstown River. However, both watercourses are downgradient of the proposed area and are vulnerable to overland flow runoff during the construction and operation phases of the proposed development (**Section 5-4**: Potential Impacts).

5.3.3.1 Surface Water Quality

Table 5-7 provides a list of all surface watercourses or aquatic receptors within or downstream of the proposed development area.

Table 5-7: Aquatic Receptors in the Vicinity of the Proposed Development Area

Aquatic Receptors	Location Relative to the Proposed Development Area	River	Outflow
County Brook (Fassaroe Stream)	50m to the North (downstream)	Dargle	Bray Pier
Dargle	1km to the Northeast (downstream)		
Cookstown River	200m South and Southeast (downstream)	Tributary of Glencullen flowing to the Dargle	Bray Pier

Water Framework Directive Risk Assessment

A Pressures and Impacts assessment of human activity on surface waters (and groundwater) was conducted under Article V of the WFD to identify those water bodies that may be at risk of failing to meet the Directive's environmental objectives by 2015. The risk categories employed in the recent third cycle characterisation reported in the draft River Basin Management Plan 2021-2027 in Ireland are outlined in **Table 5-8**.

Table 5-8: WFD Risk Categories

Risk Category	WFD Classification
Not at Risk	Water bodies are meeting their environmental objectives of good or high status
At Risk	Water bodies are not meeting their environmental objectives of good or high status due to significant identified pressures
Review	Measures are not yet showing any or not enough improvements or there is inadequate evidence to determine it is not at risk

Surface water body (river, lakes, transitional and coastal waters) monitoring is conducted by the EPA as part of WFD national surface water quality monitoring programme. Water bodies are classified, in accordance with the WFD, on the basis of a combination of ecological status (a combination of biological elements) and chemical status, and hydromorphological condition in the case of high status. The overall status of a water body is classified into one of five classes, as per Schedule 3 of the Surface Water Regulations 2009 (S.I. No. 272). Recent Q-value results from the EPA website http://gis.epa.ie/Envision and EPA (2021) are presented in **Table 5-9** together with the WFD waterbody status for the period 2013-2018. These are the most recent available data that fed into the draft River Basin Management Plan 2022-2027.

Table 5-9: EPA Q-Rating (2020), equivalent WFD Water Quality Status Classes 2013-2018 and WFD Risk Assessment 3rd cycle

Aquatic Receptors	EPA Waterbody Code	Q-Value (location/year)	EPA Quality Status	Q-value status	WFD Status	River Waterbody Score
Dargle	DARGLE_030	4 (1km u/s Bray Bridge/2020)	Unpolluted	Good	Moderate	Review
Cookstown	GLENCULLEN_010	4 (just upstream confluence with the Dargle/2020)	Unpolluted	Good	Good	Not at Risk

(Source: EPA (2021))3rd Cycle Draft Ovoca-Vartry catchment Report. Catchment Science & Management Unit, Environmental Protections Agency.)

There is no active EPA monitoring site on the County Brook. The monitoring sites on the Cookstown River to the south and southeast of the proposed development area merited the same Q-value result as the Dargle River site, but the Dargle 030 waterbody has an overall moderate status rating.

5.3.3.2 Fisheries Value of Aquatic Receptors

The County Brook (Fassaroe Stream) is not a designated salmonid river and there are little published or recorded results available on the water quality and none on the fishery value of this watercourse. Similarly, there are little recorded results available for the Cookstown River, located to the southeast of the proposed development area, but it is known to support brown trout. As previously stated, both watercourses drain to the Dargle River which is a designated salmonid river and of 'Good' Q-value status but 'Moderate' WFD Status as shown in Table 5.9. Salmon spawn within the Dargle River annually and it supports a resident population of brown trout and migratory populations of sea trout (Salmo trutta) and Atlantic Salmon (Salmo salar), the latter listed under Annex II and V of the EU Habitats Directive. Thus, it is important to note that salmonid waters constraints apply to any development in this area.

Table 5.10 presents the most recent Inland Fisheries Ireland (IFI) stock assessment results of the Dargle River downstream of the proposed development area, undertaken in 2009 at the WFD monitoring point. The survey site was located approximately 1.5km upstream of Bray Pier and 1km downstream of the proposed development area. Three electrofishing passes were conducted using two bank-based electrofishing units and one backpack unit on the 6th of August 2009 along a 37m length of channel. The 2009 IFI fish stock results indicate considerable numbers of salmon fry with records of trout, flounder and European eel in the River Dargle. The salmonid species recorded require a clean, unpolluted system. EPA & WFD water quality results (**Table 5.9**) recorded for the Dargle River indicate these clean conditions as a Q4 - 'Good' status was merited.

No survey work has taken place at this site since then because of ongoing drainage/channel works. The closest upstream site at Newtown Road (ITM: 722260, 716184) was electrofished by IFI in 2017 (55x brown trout (ten-min method converted to single pass)), 2019 (26x Brown trout and 1x stone loach (single pass fishing).) and 2020. (55x brown trout (ten-min method converted to single pass)).

The Cookstown River at Knocksink Woods (ITM: 721699, 717955) has been electrofished by IFI in the following years; 2019: 131 brown trout and 1 eel (ten-min method converted to single pass), 2018: 53 brown trout, 3 eels and 8 salmon (ten-min method converted to single pass), 2017: 127 brown trout (ten-min method converted to single pass).

Table 5-10: 2009 IFI stock survey results for Dargle River (Lower) in a 37m length of channel

Common Name	Scientific Name	Numbers
Brown Trout (Fry)	*Salmo trutta*	19
Sea trout	*Salmo trutta*	2
Salmon (Fry)	*Salmo salar*	361
Flounder	*Platichthys flesus*	20
European Eel	*Anguilla anguilla*	35

Biological Water Quality and Fishery Habitat Assessments

Biological Water Quality and Fishery Habitat Assessments were carried out in September 2021 as detailed in **Section 5.2.3.4** (macroinvertebrates) and **Section 5.2.3.5** (fish habitat) **Table 5-11** presents the Q-Value rating and Fishery Habitat results for each site sampled.

Table 5-11: Aquatic Ecology Assessment Results along the County Brook (Fassaroe Stream)

Site No	GPS Location (ITM)	Instream Habitat (%)				Benthic Substrates (%)			Q-Value/WFD Status	Fishery Habitat
		Riffle	Run	Glide	Pool	Cobble/ Gravel Boulder		Sand/Silt		
1	52.204515, -6.164453	10	75	-	15	60	30	10	Q3/4 - Slightly Polluted 'Moderate' ecological status	**Poor spawning conditions for salmonid (salmon, trout) and lamprey** based on the following observations: - Slightly turbid stream with excessive silty deposits in places - Lack of clean, coarse gravel -Slow and low flow in places, few oxygenating riffle habitats Low level of sand/silt for lamprey spawning **Fair conditions for salmonid/lamprey nursery** habitat due to: - Deeper, swifter riffles downstream - Undercut banks, overhanging vegetation, woody debris lodged in the channel Higher flows potentially **provide fair conditions for migratory adult salmonids and lamprey**
2	52.203140, -6.148158	10	60	-	30	60	30	10	Q3-4 - Slightly Polluted 'Moderate' ecological status	**Poor spawning /nursery habitat for salmonid and lamprey** based on the following observations: -Stream too shallow for fish passage - Lack of clean coarse gravel, high level of calcium carbonate precipitation leading to concretion of gravels and cobbles. - Excessive wind throw along channel length blocking fish passage - Low abundance of pollution-sensitive macroinvertebrates indicating a polluted system Higher flows potentially provide **fair conditions for migratory adult salmonids and lamprey to move to upper reaches**

Site No	GPS Location (ITM)	Instream Habitat (%)				Benthic Substrates (%)			Q-Value/WFD Status	Fishery Habitat
		Riffle	Run	Glide	Pool	Cobble/ Gravel Boulder		Sand/Silt		
3	58.203288, -6.148158	20	40	20	20	50	40	10	Q3 - Moderately Polluted 'Poor' ecological status	**Poor spawning /nursery habitat for salmonid and lamprey** based on the following observations: -Stream too shallow for fish passage - Lack of clean coarse gravel, high level of calcium carbonate precipitation leading to concretion of gravels and cobbles. - Excessive wind throw along channel length blocking fish passage - Low abundance of pollution-sensitive macroinvertebrates indicating a polluted system Higher flows potentially provide **fair conditions for migratory adult salmonids and lamprey to move to upper reaches**
4	53.199390, -6.137137	10	70	0	20	60	30	10	Q4 - Unpolluted, 'Good' ecological status	**Fair conditions for salmonid spawning and nursery habitat** due to: - Deeper, and swifter run habitat than upper sites - Undercut banks, overhanging vegetation, woody debris lodged in the channel Best water quality based on macroinvertebrate communities **Poor spawning/nursery** habitat for lamprey due to low sand/silt Higher flows potentially **provide fair conditions for migratory adult salmon and lamprey**
5	53.200728, -6.129128	-	30	50	20	40	30	30	Q3-4 - Slightly Polluted 'Moderate' ecological status	**Poor spawning, nursery or migratory habitat for salmonid** based on following observations: -Heavily silted with filamentous algae - Lack of clean gravel mix - Stream too shallow in places for fish passage - Poor assemblage of pollution sensitive macroinvertebrates indicating a polluted system Some patches could potentially provide habitat for lamprey but tends to become checked with

Site No	GPS Location (ITM)	Instream Habitat (%)				Benthic Substrates (%)			Q-Value/WFD Status	Fishery Habitat
		Riffle	Run	Glide	Pool	Cobble/ Gravel Boulder		Sand/Silt		
										Helosciadium nodiflorum during the growing season.

5.3.3.3 Water Chemistry Assessment

Field parameters for the five sampling locations along the County Brook (Fassaroe Stream) were taken by Aquens in 2021 at the biological sampling points 1 - 5 as illustrated in **Figure 5-3**. Results are presented below in **Table 5-12**.

Table 5-12: Water Quality Results (Chemical Characteristics), Aquens 2021

Site No.	Dissolved Oxygen (% Saturation)	Conductivity (µS/cm)	pH	Q-Value
1	94.0	587	7.87	3-4
2	100.6	626	8.29	2-3
3	99.7	625	8.25	3
4	97.8	747	7.73	4
5	100.3	701	7.60	2-3

Note that Site 1 is the most downstream sampling location and Site 5 is the most upstream sampling location along the County Brook (Fassaroe) Stream.

A more analytical water chemistry sampling approach was previously undertaken by RPS hydrogeologists in 2016 to inform the proposed landfill remediation proposals and associated Environmental Risk Assessment Report (ERA)[6]. A summary of same is provided below. Surface water samples along the County Brook (Fassaroe) Stream were analysed for a broad suite of parameters (see the ERA in **Volume 3 Part 3** of this EIAR for details). The analytical suite was selected to be consistent with the parameters analysed in the waste, leachate and groundwater samples to allow comparison across the results. Sampling sites (SW1-SW5) are illustrated in **Figure 5-8** which are roughly comparable to the sampling sites by Aquens in 2021 (**Figure 5.3**).

Surface water samples were compared to Environmental Quality Standards (EQS) protective of Freshwater bodies from the Surface Water Regulations (SI 327 of 2012).

Surface water quality samples showed exceedances above EQS for the parameters listed below **Table 5-13**.

Table 5-13: Chemical Parameters in exceedance of EQS standards along the County Brook (Fassaroe) Stream

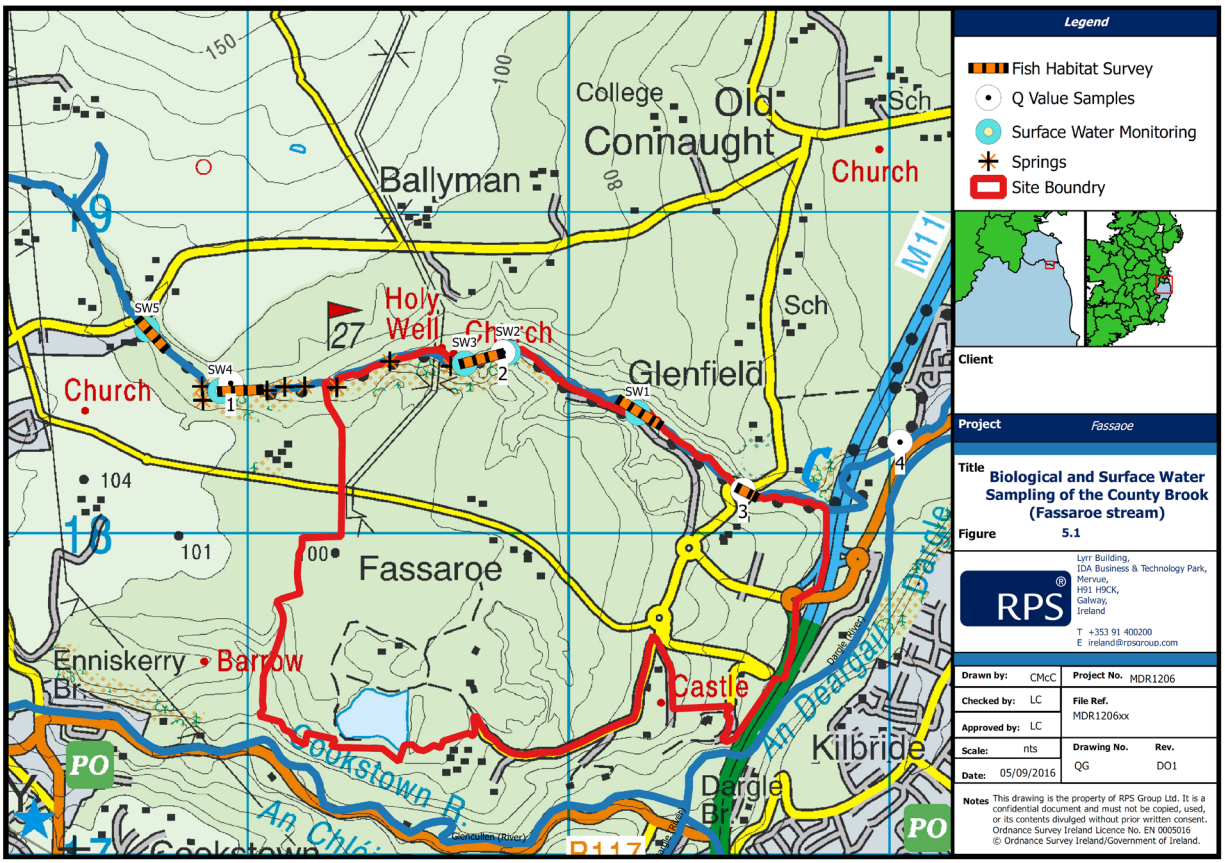
Parameter	Surface Water Sampling Locations (EQS exceedances - Y/N)				
	SW1	SW2	SW3	SW4	SW5
Benzo fluoranthene	Y	Y	Y	Y	Y
Benzo[a]pyrene	Y	Y	Y	Y	Y
Indeno(1,2,3-c,d) Pyrene	Y	Y	Y	Y	Y
Benzo [g,h,i] perylene	Y	Y	Y	Y	Y
Ammoniacal Nitrogen	Y	Y	N	Y	Y

The above water quality exceedances correspond primarily to a group of hydrocarbons that slightly exceed the set EQS standards across all five sampling locations.

Ammoniacal Nitrogen exceedances, albeit slight, were observed across all sampling locations except SW3 which is located between landfill location Site 1 and Site 2.

[6] Fassaroe Historic Landfill Environmental Risk Assessment Report, RPS, 2018

Figure 5-8: Location of Surface Water Sampling Undertaken for ERA in 2016



5.3.3.4 Aquatic and Fisheries Habitat Classification of Study Area (Fossitt)

Aquatic habitats near the proposed development area were classified according to the Guidelines set out in *'A Guide to Habitats in Ireland'* (Fossitt, 2000). The aquatic habitats found within the proposed study area, their corresponding habitat codes (in accordance with Fossitt Level 3) and their ecological value is detailed in **Table 5-14**.

Table 5-14: Aquatic Habitat Types near the Proposed Development Area

Habitat Type	Fossitt Code	Ecological Interest	Rationale
Depositing/ lowland rivers	FW2	National Importance	Rivers, or sections of these, which deposit fine sediments on the river bed, are classified as 'Lowland Depositing Rivers' (FW2). These watercourses are generally found in lowland areas with low gradients where water flow is sluggish. The County Brook (Fassaroe Stream), Cookstown River and the Dargle River, located north, southeast and northeast (respectively) of the proposed development boundary, can both be assigned this category. The Dargle River is an important salmonid system holding significant populations of Atlantic salmon, (Annex II and V of the Habitats Directive) Sea trout, Brown trout, Lamprey and Crayfish (both Annex II species).

5.3.3.5 Aquatic Ecology Results Discussion

The site conditions are detailed in **Appendix 5A**. The County Brook stream was generally less than 2.5m wide for most of its length assessed with depths averaging 12 cm (Site 1) to 20 cm (Site 4 and 5) at the time of sampling. Run (fast, rippled flow) habitat interspersed with pool predominated at most sites except Site 5

which had mainly relatively fast-flowing glide habitat. The benthic substrates were dominated by gravel and cobbles at all sites. These were heavily embedded at Sites 2 and 3 due to calcium carbonate concretion and were consequently difficult to dislodge during kick sampling. Site 5 was sandy in places, with moderate to heavy fine sediment deposition and a high cover of filamentous algae. There were some small patches (<5% cover) of filamentous algae at Site 3 but no evidence of sediment problems at this or the other sites, apart from the aforementioned cattle access which is bringing bankside soil into the reach c. 10m downstream of Site 3.

The study sites were located in reaches which had circa 40% (Sites 1, 2 and 3) and 80% (Site 4) cover of overhanging vegetation. Site 5 was not shaded. The tree cover was predominantly willow (*Salix* sp.) and hazel (*Corylus* sp.) with some ash (*Fraxinus* sp.) and sycamore (*Acer pseudoplatanus*) and dense understorey of brambles and some ferns at Site 3. Due to the considerable shading there was little instream vegetation apart from isolated small patches of mosses attached to cobbles and *Helosciadium nodiflorum* (fool's water cress) along the stream margins at Site 1, 4 and 5. Photographs of the sampling sites are included in **Appendix 5A**.

Biological Water Quality

Contrary to the previous survey in 2015 Site 5 recorded the highest tax on richness (23) followed by Site 4 (21). The lowest taxon richness was at Site 2 and this in part may be attributed to heavy concretion of the substrates and little biofilm due to the calcium carbonate precipitation, also a feature of Site 3. At both sites the leaf litter was also covered in calcium carbonate precipitate.

At all but Site 5 *Gammarus duebeni* was the most abundant taxon. The Simuliidae were more abundant at Site 5. The mayflies (Ephemeroptera) were mainly represented by the relatively tolerant *Baetis rhodani*/*atlanticus* with limited representation of the pollution-sensitive, flat-bodied mayflies. *Rhithrogena semicolorata* was only present at Sites 1 and 4. These were small instars, c. 3mm in length. This species emerges in the summer and following egg hatching can be found in the top substrates of rivers in late September onwards which may account for the small numbers encountered. A single specimen of *Heptagenia sulphurea* was recorded at Site 4 and small numbers of the summer mayfly (*Serratella ignita*) were present at Sites 4 and 5. Stonefly (Plecoptera) were represented by two species which occurred in small numbers at Sites 1 to 4. A high number of *Leuctra* sp. was present in the sample from Site 5. The only caddisfly larva to occur at all sites was *Rhyacophila dorsalis*, the other 7 taxa were variably represented at the five sites. Of note is the 38 specimens of *Sericostoma personatum* at Site 5. It is not uncommon when kick sampling in rivers to hit a patch with large numbers of this species. Beetle (Coleoptera) larvae were predominately riffle beetles and these were most abundant at Site 4. The Diptera (fly larvae) were represented at all sites by Chironomidae (non-biting midge) and Simuliidae (blackfly) in relatively high numbers at most sites particularly Site 5. *Dicranota* also occurred at all sites, but the four other dipteran larvae had a more sporadic occurrence. The snails and worms were equally sporadic in their occurrences.

A checklist of the taxa and their relative abundances at each of the study sites is given in Table 3 of **Appendix 5A**. The values of the various biotic metrics are also included in **Appendix 5A** at Table 4**.**

Water Quality

Sites 1, 3 and 5 were rated Q3-4 based on the dominance of Group C taxa and sparse numbers of Group A (pollution sensitive) indicating moderate pollution **(Appendix 5A).** The absence of Group A taxa at Site 3 resulted in a Q3 score. Ecological water quality at Site 5 was better than a previous survey undertaken by Aquens in 2015 (Q3) to inform an EIS for a previous development proposal at the subject site. Note the representation of Q-value Group B taxa at Site 5 and %EPT abundance are elevated because of the large numbers of one species. Site 4 was rated Q4 due to the presence of three Group A taxa, albeit in low numbers which is probably due to the time of year as all were small nymphs. The EPT richness (11), ASPT score (>6) for this site also indicate good water quality.

Onsite reading of pH indicated alkaline waters, high conductivity, typical of the geology, and well oxygenated conditions at all sites. The high cover of filamentous algae at Site 5 is likely to lead to night-time low oxygen concentrations.

The cause of the moderate pollution in this river is not clear. It is likely that inputs from agricultural fields are a contributing factor but there may be others from domestic sources or impacts related to the aforementioned cattle access. Some recovery in quality occurred at Site 4 but deteriorated further downstream at Site 5 where urban, including road, inputs are likely to be contributing factors.

Chemical Water Quality

Surface water quality assessments produce chemical results reflective of an aquatic environment of good oxygenation, alkaline pH and high ionic content (conductivity).

Table 5.13 present those chemical parameters identified as exceeding Environmental Quality Standards (EQS) at sampling points SW1 - SW5.

A group of four hydrocarbons only slightly exceed the set EQS standards across all five sampling locations. These increased levels could be derived from agricultural transport runoff or influence of oil/fuel spills from vehicles to the historic landfill locations.

Ammoniacal Nitrogen exceedances, albeit slight, were observed across all sampling locations except SW3 which is located between landfill location Site 1 and Site 2. A contributory source to increased levels could be from agricultural activity including ammonia rich fertiliser during transport and livestock waste.

Despite some marginal increases as stated, the overall quality of surface water is particularly good given the nature and location of the sites traversing active agricultural lands and downgradient of historic landfill locations. Heavy metals, Phosphate and Nitrite were all recorded below the EQS levels.

Biological Q-Values, as described above, all range between Q2-3 (Poor WFD status) - Q4 (Good WFD Status). There is no obvious correlation between surface and biological water quality across all five sampling sites. However there were no filamentous algae recorded at any of the sampling sites indicating little nutrient discharge from surrounding land activities.

5.3.4 Species

This section describes species that have been recorded historically within 2km of the proposed site, the potential for the site to support protected species and results of the site surveys. Species records extracted from the NBDC database are included in **Appendix 5C**.

5.3.4.1 Flora

There were no records held on the NBDC database for protected vascular plant species within the vicinity of the site. A total of three protected bryophyte species have been recorded from this grid square, one of which (*Leucabryum glaucum*) is an Annex IV protected species, and the remaining two (*Fissidens rufulus*, *Scleropodium tourettii*) are protected under the Flora Protection Order.

No rare or protected species of vascular plants or bryophytes were recorded during the course of the site surveys.

5.3.4.2 Invasive Species

Four invasive alien plant species categorised as High Impact[7] or that are listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011) have been recorded in the vicinity of the site.

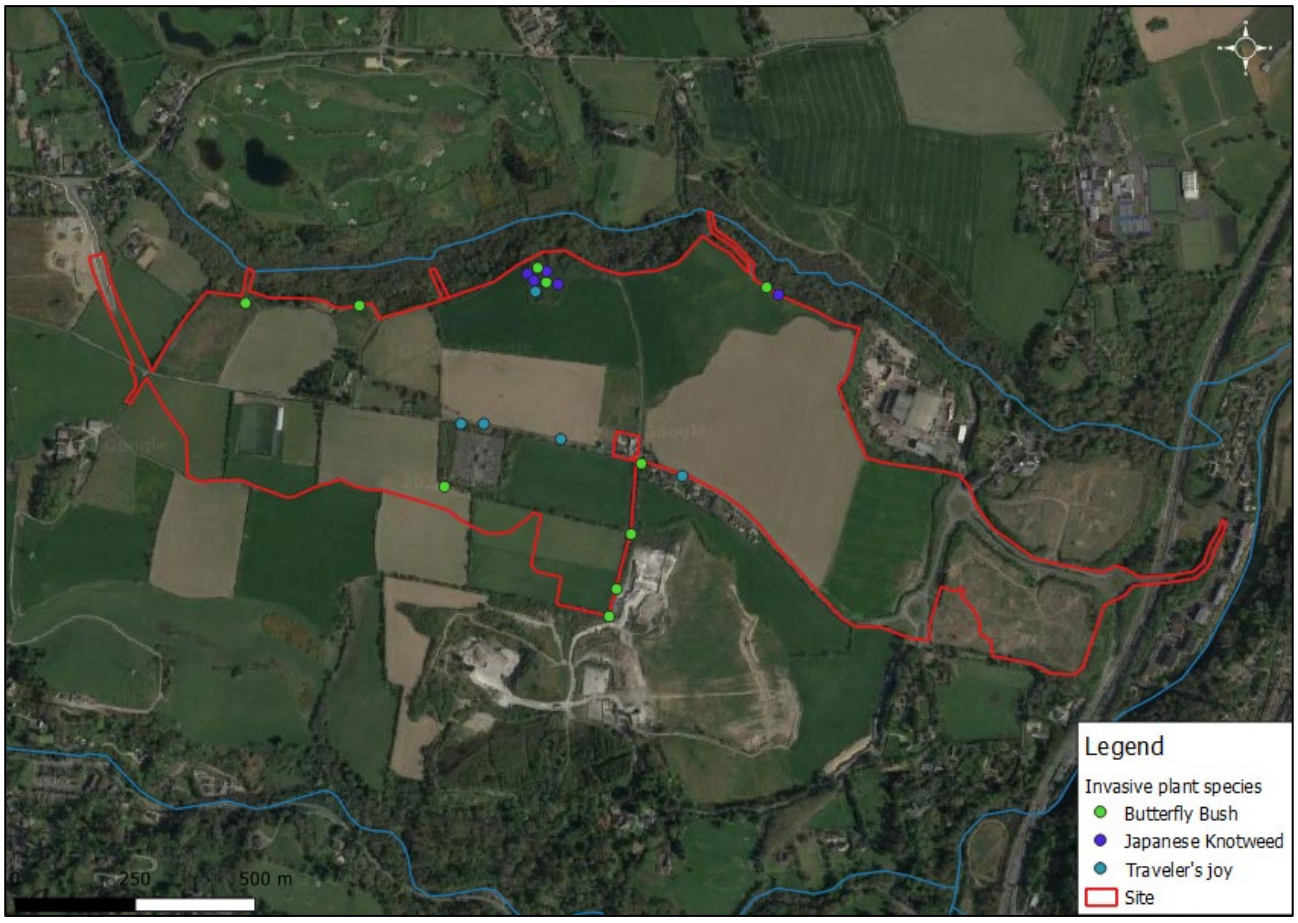
- Japanese Knotweed (*Fallopia japonica*);
- Giant Hogweed (*Heracleum mantegazzianum*);
- Cherry Laurel (*Prunus laurocerasus*); and
- Three-cornered Garlic (*Allium triquetum*).

Japanese Knotweed was recorded in 2013 at Cookstown River approximately 0.5km to the south of the site. Giant Hogweed has been recorded between 1978 and 1987 by the River Dargle at Bray, which is approximately 0.6km to the east of the site. Cherry Laurel was recorded in 2007 from the Dargle Glen, approximately 1.1km to the south of the site, and also in 2005 at Knocksink Woods, approximately 1.6km to the west of the site. Three-cornered Garlic has been recorded at Knocksink, c.0.9km to the south-west of the site.

[7] https://www.biodiversityireland.ie/wordpress/wp-content/uploads/Invasives_taggedlist_HighImpact_2013RA-1.pdf

During the course of the site surveys for the current application in June 2021, four stands of Japanese Knotweed were recorded within the north of the site in an area of scrub; there is also a stand further east within the site at its northern boundary (**Figure 5-9**). Japanese Knotweed is classified as a 'high impact' invasive species. Butterfly Bush is present in field boundaries in the south of the site, scattered throughout the southern edge of woodland in Ballyman Glen, and is also present in the same area as the Japanese Knotweed within the north of the site. Traveller's Joy is also present in the hedgerow adjacent to Berryfield Lane. Butterfly Bush and Traveller's Joy are listed as being of 'Medium Impact' but are not listed in the Third Schedule European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011).

Figure 5-9: Fassaroe Phase I SHD- Invasive Plant Species Map



5.3.4.3 Reptiles and Amphibians

The NBDC hold records of common frog at Enniskerry, c.0.5km to the south-west of the site. There is also a historical record of common lizard at Ballycorus, c.1.8km to the north of the site. No signs of amphibians were observed on site and there is no permanent standing water within the proposed site.

The agricultural land at the proposed site is not suitable to support common lizard. No common lizard were recorded during the course of the site surveys.

5.3.4.4 Avifauna

The proposed site is located c.2.6km to the west of the Irish Sea. As such, a number of protected wetland and waterbirds, including marine bird species have been recorded within the vicinity of the proposed site (see **Appendix 5C**).

Bird species identified during the site walkover surveys reflect the habitat assemblages present in the majority of the study area; i.e., improved pasture and arable fields fringed by hedgerow and treeline habitats. The study area also includes private residential dwellings, gardens and farm holdings, which also influence species composition and abundance. Bird species identified during the course of the site walkover survey

are presented in **Table 5-15.** The conservation status of these birds is also provided according to the BoCCI List (Gilbert *et al*, 2021), on which birds are classified into three separate lists (Red, Amber and Green), based on the conservation status of the bird and hence conservation priority. Red List birds are of high conservation concern, the Amber List birds are of medium conservation concern and the Green List birds are not considered threatened. No Annex I or Red list species were recorded during the site visits.

Table 5-15- Bird Species Observed in the Study Area

Common Name	Species Name	Conservation Status
Blackbird	*Turdus merula*	Green
Blue Tit	*Cyanistes caeruleus*	Green
Buzzard	*Buteo*	Green
Chaffinch	*Fringilla coelebs*	Green
Greenfinch	*Carduelis chloris*	Amber
Hooded Crow	*Corvus cornix*	Green
Swallow	*Hirundo rustica*	Amber
Woodpigeon	*Columba palumbus*	Green
Wren	*Troglodytes*	Green

5.3.4.5 Bats

The review of existing records of bat species in the area of the site indicates that seven of the ten known Irish species of bat have been recorded within a 2km radius of the site. These are Daubenton's Bat (*Myotis daubentonii*), whiskered Bat (*M.mystacinus*), natterer's Bat (*M. nattereri*), Leisler's Bat (*Nyctalus leisleri*), common pipistrelle (*Pipistrellus sensu lato*), soprano pipistrelle (*P. pygmaeus*) and brown long-eared Bat (*Plecotus auritus*). Of these species, soprano pipistrelle have been recorded roosting within 1km of the study area at Ballyboo, Enniskerry.

The bat landscape association model (Lundy et al, 2011) suggests that the proposed site is part of a landscape that is of high suitability for bats including common pipistrelle (*Pipistrellus pipistrellus*), soprano pipistrelle, brown long-eared, Leisler's, Daubenton's, natterer's and whiskered bat. The proposed site and its environs are of low suitability for Nathusius' pipistrelle (Pipistrellus nathusii) and lesser horseshoe bat.

Bat Roost Inspection Survey

Trees

No trees within the study area were being used as roost sites during the course of the surveys undertaken between 2015 and 2021. A total of three trees within the proposed site were categorised as being of moderate suitability for roosting bats (as defined in **Table 5-3**) as they contained one or more potential roost features, but none are suitable for use by larger numbers of bats on a regular basis due to their size and lack of protected, sheltered conditions. A further 6 trees/ groups of trees were categorised as being of low suitability for bats as they supported features that may be used by individual bats opportunistically, however, these potential roost sites do not provide enough appropriate conditions to be used on a regular basis or by larger numbers of bats. The location of the trees with suitability for roosting bats is illustrated in **Figure 5-10** and detailed in **Table 5-16.**

Table 5-16: Fassaroe Phase I SHD: potential tree roosts

PTR Number	Tree Species	BCT Category	PRFs
1	Ash	Moderate	Butt rot
2	Ash	Moderate	Butt rot
3	Ash	Moderate	Lifting bark and broken limbs
4	Beech	Low	4 no. large mature trees of sufficient age to support PRFs
5	Conifers, Scot's Pine	Low	Low potential in lifting bark and knot holes
6	Ash	Low	Heavy Ivy growth
7	Ash	Low	Heavy Ivy growth
8	Ash	Low	Heavy Ivy growth
9	Ash	Low	Heavy Ivy growth

Figure 5-10: Fassaroe Phase I SHD, Location of Potential Tree Roosts at the Site and its Environs

Bat Activity Survey Results

Bat activity was noted throughout the study area during activity transect surveys conducted in 2014, 2019 and 2021. Species recorded include soprano pipistrelle (*Pipistrellus pygmaeus*), common pipistrelle (*P. pipistrellus*), Leisler's bat (*Nyctalus leisleri*), brown long-eared bat (*Plecotus auritus*) and whiskered bat (*Myotis mysticanus*). Most of the activity was of pipistrelles, which were recorded along Berryfield Lane, along hedgerows, in farmyards and around houses.

Leisler's bat was recorded foraging and commuting throughout the study area and it is likely that they roost in an area associated with Rannoch House, approximately 150m south-west of the development footprint. Brown long-eared bats were recorded in a farmyard to the west of the proposed site in 2014, while whiskered bats were recorded in the same area, along Berryfield Road and in the fields to the north of Berryfield Road.

The passive monitors deployed at the site in 2019 and 2021 recorded a total of six species, namely soprano pipistrelle, common pipistrelle, Leisler's bat, brown long-eared bat, whiskered bat and natterer's bat. In 2019, the most frequently recorded bat was Leisler's bat, closely followed by common pipistrelle and soprano pipistrelle. Leisler's bat was recorded in similar numbers during monitoring in 2021 to that in 2019, however, a greater number of common pipistrelle and soprano pipistrelle were recorded in 2021 (**Figure 5-10**). Leisler's bat were recorded c.20 minutes before sunset at Berryfield Lane near Rannoch House, confirming the likely presence of a roost nearby.

Whiskered bat, *Myotis* species (unidentifiable to species level) and natterer's bat were recorded on monitors located in the vicinity of the ESB substation and brown long-eared bat were recorded in low numbers in both 2019 and 2021. A low level of activity was recorded on monitors recording in open areas in the centre of the site.

A map illustrating the location of passive monitors is included in **Figure 5-1** and **Figure 5-2**. The average number of bat passes recorded per night in 2019 is illustrated in **Figure 5-11** and the average number of bat passes recorded per night in 2021 is illustrated in **Figure 5-12**.

Figure 5-11: Average bat passes recorded per night on passive monitors recording at the proposed site in 2019

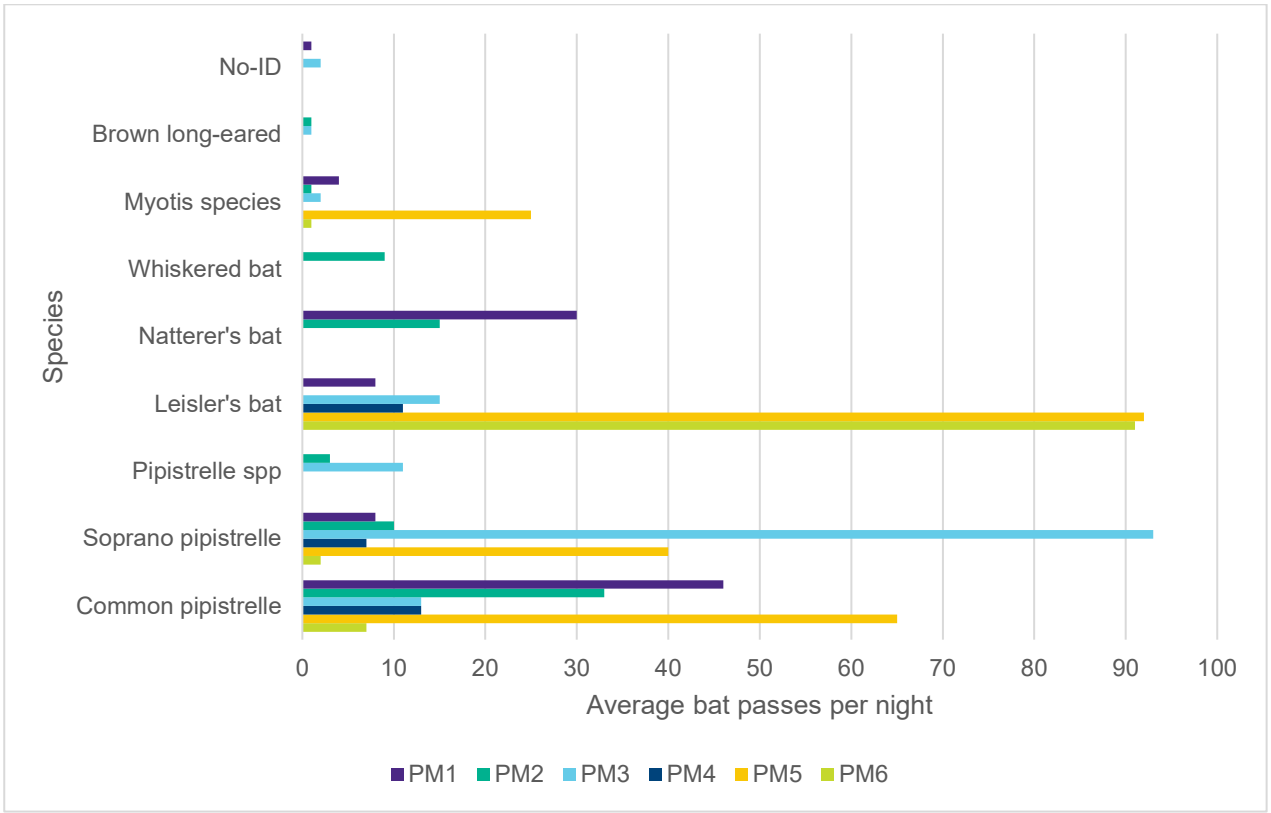
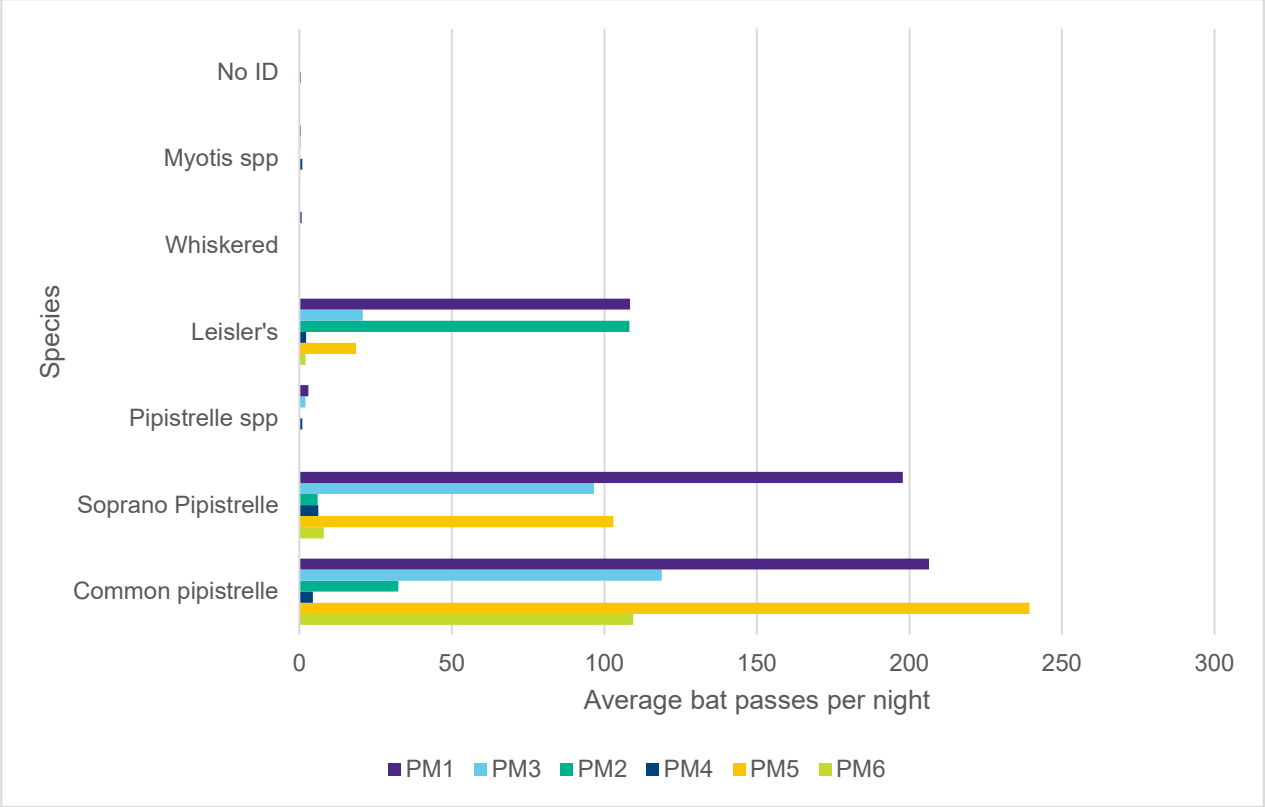


Figure 5-12: Average bat passes recorded per night on passive monitors recording at the proposed site in 2021



5.3.4.6 Badger

The NBDC hold records of badger (*Meles Meles*) from the vicinity of the site, most recently in 2017 in OS Grid Square O21. During the course of the site surveys undertaken between 2015 and 2021, three badger setts were recorded outside of the proposed development area, to the south of the site**.** One of the setts is a main sett, while the other two are annexe setts. Both the main sett and the annexe sett closest to the proposed development showed evidence of activity and were clearly in use at the time of surveys in February 2015, December 2016, August 2019 and August 2021. Mammal paths from the badger setts ran in a westerly direction and also in a southerly direction towards woodland at Enniskerry.

Badger activity was recorded in heavy scrub in Ballyman Glen during the course of the survey undertaken in 2015. No evidence of badger was recorded within Ballyman Glen SAC during the surveys undertaken in 2016, 2019 and 2021, however, one badger dropping was recorded on the boundary of Ballyman Glen at the northern site boundary in 2019.

Badger prints were recorded within field boundaries across the proposed development area during the course of the badger survey undertaken in 2015. A lower level of badger activity signs were recorded during the course of surveys undertaken in 2016, 2019 and 2021, with evidence of activity limited to tracks and badger hair recorded at two hedge banks on the southern site boundary.

Overall, the evidence gathered during the course of the surveys undertaken between 2015 and 2021 suggest that the site forms part of the territory of the local badger population, however the level of badger activity evidence across the site was relatively low.

A map indicating the location of the badger setts has not been included within this EIAR for the protection of this species, however a record of the setts has been provided to the NBDC.

5.3.4.7 Otter

The NBDC hold records of otter (*Lutra Lutra*) from the vicinity of the site, most recently in 2012 at Swan River, c.1.6km to the east of the site, there are also general historical records from Grid Square O21 from the 1960's. No evidence of otter was observed during the site survey undertaken in December 2016. However, there had been heavy rain in the week previous to the survey which may have washed evidence away. One otter spraint was recorded adjacent to a footbridge within Ballyman Glen during the course of surveys undertaken in 2021. Otters forage and commute along the County Brook and there is potential that this species may shelter within areas of scrub/woodland within Ballyman Glen.

5.3.4.8 Other Mammals

The review of existing records from the vicinity of the site indicates that Red Deer (*Cervus elaphus*), Sika Deer (*C. Nippon*), Fallow Deer (*Dama dama*), Pine Marten (*Martes martes*), Red Squirrel (*Sciurus vulgaris*) and Hedgehog (*Erinaceus europaeus*) have been recorded in the vicinity of the site.

Deer

The NBDC hold records of red deer, sika deer and fallow deer from Grid Square O21. There are three general records of red deer from the Grid Square O21, the most recent dated 2008. There are four general records of sika deer from O21, and one record of a road kill from the N11 dated 2011. There is one general record of fallow deer from O21, and one record of a road kill on the N11 dated 2015. Deer prints were observed in Ballyman Glen during the site surveys undertaken in 2016, 2019 and 2021.

Hedgehog

Hedgehogs are found in woodlands, hedgerows, gardens, and meadows. Hedgehogs are mostly nocturnal, but juvenile or sick animals can sometimes be seen during the day. It is quite likely that this species occurs within the study area.

Pine Marten

Pine martens are generally associated with areas of coniferous or broadleaf woodland and scrub, but can also use wider habitat areas such as pasture. There are general records of pine marten from Grid Square O21 dating from 1968 and 1969. No signs of pine marten were observed during the field surveys undertaken in 2016, 2019 and 2021, but it is possible that this species would use Ballyman Glen for foraging and shelter.

Red Squirrel

Red squirrels are most commonly found in large blocks of coniferous woodland, or broadleaf/ mixed woodland where grey squirrels are absent. Red squirrel has been recorded in 2013 approximately 1.3km south east of the wind farm site in mixed broadleaf habitat. No signs of red squirrel were observed during the field surveys undertaken in 2016, 2019 and 2021, but it is possible that this species would use Ballyman Glen for foraging and shelter.

5.3.5 Summary of Ecological Evaluation

Table 5-17 summarises all identified ecological features. Ecological features have been identified as being at risk of potentially significant impacts via a source-pathway-receptor link. Ecological features are valued as being of local ecological importance (higher value) or above as per the criteria set out in **Table 5-5**.

Table 5-17: Ecological Features within the Zone of Influence of the Proposed Development

Site/Habitat/Species	Ecological Value	Ecological Feature (Yes/No)
European sites	International Importance. The application site supports direct connectivity to Ballyman Glen SAC.	Yes
Nationally designated sites	National Importance. Ballyman Glen SAC is also designated as a pNHA.	Yes
Depositing/lowland river (FW2)	National Importance. The County Brook (Fassaroe Stream), Cookstown River and the Dargle River, located north, southeast and northeast (respectively) of the proposed development boundary, can both be assigned this category.	Yes

Site/Habitat/Species	Ecological Value	Ecological Feature (Yes/No)
	The Dargle River is an important salmonid system holding significant populations of Atlantic salmon, (Annex II and V of the Habitats Directive) Sea trout, Brown trout, Lamprey and Crayfish (both Annex II species).	
Improved agricultural grassland (GA1)	Local Importance (lower value). Improved agricultural grassland in the study area is of low botanical importance; however, it does provide a foraging area for some species of fauna.	No
Amenity Grassland (GA2)	Local Importance (lower value). Amenity grassland is of low botanical importance; however, it does provide a foraging area for some species of fauna.	No
Dry calcareous and neutral grassland (GS1)	Local Importance (higher value). The field of pony grazed grassland to the east of the site has not been improved in recent years and supports a higher floral diversity in the context of the highly improved/ arable fields present in the surrounding area.	Yes
Dry meadows and grassy verges (GS2)	Local Importance (higher value). This habitat is present on abandoned grassland has not been improved in recent years. This habitat is not of high botanical importance, however supports a higher floral diversity in the context of the highly improved/ arable fields present in the surrounding area.	Yes
Arable crops (BC1)	Low ecological value. No arable weed species were observed in the margins of arable fields in the study area.	No
Tilled land (BC3)	Low ecological value. One field of tilled land to the west of the site.	No
Hedgerows (WL1)	Local Importance (higher value). The hedgerows in the study area are largely comprised of native species and provide habitat for birds and mammals in addition to providing connectivity in the landscape.	Yes
Treelines (WL2)	Local Importance (higher value). The treelines in the study area provide habitat for birds and mammals in addition to providing connectivity in the landscape.	Yes
Buildings and artificial surfaces (BL3)	Low ecological value. No features of ecological value present.	No
Spoil and bare ground (ED2)	Low ecological value. Track into Ballyman Glen and County Brook.	No
Scrub (WS1)	Local Importance (higher value). Areas of scrub at the southern fringe of the woodland at Ballyman Glen, adjacent to the development footprint, are comprised of native species and offer shelter and foraging to birds and mammals.	Yes
Immature woodland (WS2)	Local Importance (higher value). Land at the periphery of the road network. This habitat does not classify as semi-natural, however it provides supporting habitat for a range of fauna.	Yes
Oak-ash-hazel woodland/Mixed broadleaved woodland (WN2/WD1)	Local Importance (higher value). Woodland habitat in drier areas of Ballyman Glen that includes non-native species such as Sycamore and Butterfly Bush in places. The woodland does however provide shelter and foraging area for protected species.	Yes
Wet Woodland (WN4/WN6)	County Importance. Areas of the semi-natural wet woodland are species rich habitat, but do not correspond with Annex I Habitat 'Alluvial Forests with *Alnus glutinosa* and *Fraxinus excelsior* (91E0)'.	Yes

Site/Habitat/Species	Ecological Value	Ecological Feature (Yes/No)
Mixed conifer woodland (WD3)	Small pockets of conifer woodland adjacent to a domestic dwelling to the west of the site. This habitat is of low botanical importance, however it provides supporting habitat for a range of fauna.	Yes
Petrifying Springs with Tufa Formation (7220)	International Importance. Annex I habitat present within Ballyman Glen.	Yes
Alkaline Fen (7230)	International Importance. Annex I habitat present within Ballyman Glen.	Yes
Reptiles and amphibians	The proposed site is not suitable to support reptiles and amphibians. No evidence of reptiles and amphibians was recorded at the proposed site during the site surveys.	No
Avifauna	Birds, as they occur at the proposed site, are of Local Importance (higher value).	Yes
Bats	No evidence of roosting bats was recorded within the proposed site. However, bats commute to the site to forage. Bats, as they occur at the proposed site, are of Local Importance (higher value).	Yes
Badger	A badger sett is present to the south of the proposed site and badger forage and commute across the site. Badger, as they occur at the proposed site, are of Local Importance (higher value).	Yes
Otter	The footprint of the proposed site is not suitable to support otter. However, evidence of otter has been recorded in County Brook to the north of the site. Otter are of Local Importance (higher value).	Yes
Other mammals	Red Deer, Sika Deer, Fallow Deer, Pine Marten, Red Squirrel and Hedgehog have been recorded in the vicinity of the site and may be present within Ballyman Glen to the north of the site. These species are of Local Importance (higher value).	Yes

5.4 Potential Impacts

This section provides an assessment of potential likely significant effects on ecological features, as listed in **Table 5-17,** in the absence of mitigation. An impact is considered to be significant when it supports or undermines biodiversity conservation objectives for important ecological features. A description of the proposed works is included in **Chapter 2: Description of Works**.

5.4.1 Construction Phase

This section will identify in detail the potential effects of the proposed construction works on ecological features in the receiving environment, in the absence of mitigation.

5.4.1.1 Designated Sites

The proposed development is located adjacent to Ballyman Glen SAC and pNHA (Site Code: 000713). The site is a SAC selected for the Annex I habitats Alkaline Fen [7230] and Petrifying Springs with tufa formation (Cratoneurion) [7220], which is a priority habitat under the Habitats Directive. It should be noted that the County Brook (Fassaroe Stream), which flows through Ballyman Glen is not included as a qualifying interest of the SAC. The SAC also supports semi-natural wet woodland habitat (WN4/ WN6); this habitat is not included as a qualifying interest of Ballyman Glen SAC.

Potential impacts associated with the proposed development on European sites are considered in greater detail in the Natura Impact Statement (NIS) also submitted as part of the current application. The NIS found that the proposed development has the potential to impact on Annex I habitats Alkaline Fen [7230] and Petrifying Springs with tufa formation (Cratoneurion) [7220] as a result of alteration of water quality, alteration of hydrological regime and degradation of habitat. These potential impacts are described in detail within the NIS. The NIS concluded that, with the inclusion of landfill remediation within the proposed works description and the effective implementation of the mitigation measures provided within the NIS, there will be no significant adverse effects on the integrity of Ballyman Glen SAC in view of the sites conservation objectives and that the conservation status of the qualifying Annex I habitats will not be compromised by the proposal either directly, indirectly or cumulatively.

In addition to its designation as a SAC, Ballyman Glen is also a pNHA. Potential impacts to Ballyman Glen pNHA are as described above.

Bray Head pNHA, South Dublin Bay pNHA and Dalkey Coastal Zone and Killiney Hill pNHA all have a remote and indirect connectivity to the proposed works via the County Brook. However, in consideration of the lack of direct hydrological connectivity between the proposed works and County Brook, the characteristics of the proposed works and the characteristics of the qualifying interests of these nationally designated sites, no significant effects on these European sites are anticipated

5.4.1.2 Habitats

5.4.1.2.1 Dry Calcareous and Neutral Grassland

The proposed works to install an attenuation pond at the east of the site (to the west of the N11) will result in the loss of dry calcareous and neutral grassland located at the east of the site. This habitat, as represented at the proposed site, is not of high botanical importance, however it supports grassland of higher diversity in the context of the highly improved agricultural fields in the surrounding area. As such, the loss of habitat is considered to be an adverse effect at the site level, but would represent a moderate, but not significant, adverse effect at the local geographic scale.

5.4.1.2.2 Dry Meadows and Grassy Verges

The proposed remediation works to landfill areas 3A and 3C will result in the loss of dry meadows and grassy verges habitat. This habitat, as represented at the proposed site, is not of high botanical importance, however it supports grassland of a higher diversity in the context of the highly improved agricultural fields in the surrounding area. As such, the loss of habitat is considered to be an adverse effect at the site level, but would represent a moderate, but not significant, adverse effect at the local geographic scale.

5.4.1.2.3 Wet Woodland

The proposed works to install the surface water outfall at the north-west of the site (to serve surface water runoff from the remediated landfills) will result in the direct loss of approximately 0.026ha wet woodland within Ballyman Glen SAC. The total area of wet woodland (WN4/ WN6) recorded within Ballyman Glen is 7.5ha, therefore this represents 0.35% loss of the wet woodland within Ballyman Glen.

The wet woodland is considered to be of county importance due to species rich areas of the woodland along the river valley. However, the loss of woodland that will be required for the proposed development is small scale and is not considered to be significant on a county level, but is significant on a local level.

Potential indirect impacts to wet woodland could include abrasion, root and limb damage and disturbance of adjoining or nearby woodland habitats during the proposed works. Construction of the surface water outfall, landfill capping and associated slope stability works, if unmitigated, could also potentially lead to suspended solids runoff. Excavation and ground disturbance will result in soil disturbance extending overflow runoff impacts. There is potential for this runoff to degrade the wet woodland habitat. This would result in a temporary, reversible adverse effect on a local level.

Japanese Knotweed is present within the Phase 1 application lands adjacent to Ballyman Glen; there is potential for the spread of Japanese Knotweed into wet woodland habitats. Spread of invasive species into the wet woodland and degradation of habitat would be significant on a local level.

5.4.1.2.4 Mixed Broadleaved Woodland and Scrub

The proposed works to the Phase 1 lands will result in the direct loss of approximately 1.78ha scrub and 0.05ha Mixed Broadleaved Woodland.

Potential indirect impacts to woodland habitats could include abrasion, root and limb damage and disturbance of adjoining or nearby treeline habitats during the proposed works.

Japanese Knotweed is present within the proposed Phase 1 lands, there is potential for the spread of Knotweed into scrub and mixed woodland habitats.

These ecological features are considered to be of local importance (higher value) and loss and degradation of these habitats is considered to be significant on a local level.

The potential impacts of woodland removal on fauna are assessed in **Section 5.4.1.3**.

5.4.1.2.5 Immature Woodland

The proposed cycle route connecting with Upper Dargle Road will require the removal of c.0.17ha immature woodland that has been planted adjacent to Junction 6 western roundabout and alongside the R918.

Potential indirect impacts to woodland habitats could include abrasion, root and limb damage and disturbance of adjoining or nearby treeline habitats during the proposed works.

These ecological features are considered to be of local importance (higher value) and loss and degradation of these habitats is considered to be significant on a local level.

5.4.1.2.6 Mixed Conifer Woodland

No works are proposed to mixed conifer woodland, therefore no significant effects on this habitat are expected during the construction phase.

5.4.1.2.7 Hedgerows and Treelines

The proposed works to the Phase 1 lands will result in the direct loss of approximately 1300m hedgerow. The proposed works will not require the removal of any treelines.

Potential indirect impacts to treeline and hedgerow habitats could include abrasion, root and limb damage and disturbance of adjoining or nearby treeline and hedgerow habitats during the proposed works.

These ecological features are considered to be of local importance (higher value) and loss and degradation of these habitats is considered to be significant on a local level.

5.4.1.2.8 Petrifying Springs with Tufa Formation

Alteration of Water Quality

There is potential for a temporary negative impact on groundwater quality during construction works for the proposed landfill remediation. However, these temporary effects are not considered to be significant on an international level, but would be significant on a local level. The construction of the landfill capping system will result in a reduction of leachate generation in the groundwater feeding the petrifying spring habitat. This will lead to a permanent positive effect. A permanent improvement in water quality in groundwater feeding the petrifying springs is significant at the local level, and should an increase in tufa deposition occur, has the potential to increase the habitat area of an internationally important habitat.

Alteration of Hydrological Regime

It is predicted that the capping of the landfills is likely to reduce the current recharge to groundwater up to 7% over the life of the development (see section 5.1.3 of NIS also submitted as part of the current application for more detailed explanation), therefore there is potential for permanent negative impacts on the petrifying springs within Ballyman Glen SAC due to reduced groundwater flow contribution. However, the resulting potential drop of groundwater of 0.3m at the top of the seepage face (section 5.1.3 of NIS submitted with the current application) is located above the level of elevation of the petrifying springs; therefore, negative effects are predicted to be minor.

Degradation of Habitat

Construction works, for the surface water outfall, landfill remediation measures and associated slope stabilisation works, if unmitigated, could potentially lead to suspended solids runoff. Excavation and ground disturbance will result in soil disturbance extending overflow runoff impacts. There is potential for this runoff to degrade the petrifying spring habitat as a result of pollution of surface waters. In the absence of mitigation this would be a temporary negative effect. At their nearest point, the construction works for the surface water outfall are approximately 5m away from petrifying spring habitat, with a vegetated buffer. Therefore, the works are unlikely to cause a significant impact on an international level, but are significant on a local level.

5.4.1.2.9 Alkaline Fen

Alteration of Water Quality

There is potential for a temporary negative impact on groundwater quality during construction works for the proposed landfill remediation. However, these temporary effects are not considered to be significant on an international level, but would be significant on a local level. Construction of the landfill capping system will potentially result in a reduction of leachate generation in the groundwater feeding the alkaline fen habitat. This would have a permanent positive impact.

Alteration of Hydrological Regime

It is predicted that the capping of the landfills is likely to reduce the current recharge to groundwater up to 7% over the life of the development. However, the potential drop of 0.3m at the top of the seepage face is located above the level of elevation of the alkaline fen, therefore it is not anticipated that it will stop the flow of water to the fen. Any impacts that do occur to the fen are predicted to be minor. No reduction in the area of fen is anticipated to arise as a result of the proposals and therefore is not considered to be significant on an international or local level.

Degradation of Habitat

Construction works, for the surface water outfall, landfill remediation measures and associated slope stabilisation works, if unmitigated, could potentially lead to suspended solids runoff. Excavation and ground disturbance will result in soil disturbance extending overflow runoff impacts. There is potential for this runoff to degrade the alkaline fen habitat as a result of pollution of surface waters. In the absence of mitigation this would be a temporary negative effect. At their nearest point, the construction works for the surface water outfall are approximately 10m away from alkaline fen habitat, with a vegetated buffer. Therefore, the works are unlikely to cause a significant impact on an international level, but are significant on a local level.

5.4.1.3 Species

5.4.1.3.1 Avifauna

Bird species are protected under the Wildlife Acts. If the felling of treelines, hedgerows and mature scrub is not timed appropriately, nests containing eggs or young chicks could be destroyed. This will result in a permanent, irreversible, negative effect that is significant at a local level.

Indirect effects on BoCCI Bird Species associated with the proposed scheme may include potential disturbance during the construction works and loss of habitat through hedgerow and treeline removal.

Disturbance of birds during the construction phase is likely to result in a temporary minor adverse effect. Removal of vegetation will lead to loss of habitat for breeding and foraging birds and could potentially disturb any breeding birds if vegetation removal takes place during the breeding season. These impacts are significant on a local level, but not at the national level.

5.4.1.3.2 Bats

Loss of Roosting Habitat

There are roosting opportunities for bats within 6 trees/ groups of trees in the field boundaries that support potential roosting features such as cracks in limbs. No works are proposed to these potential tree roosts, therefore there will be no loss of tree roosting habitat within the site.

While it is likely that a Leisler's bat roost is present in an area associated with Rannoch House, approximately 150m south-west of the development footprint, this will not be impacted by the proposed works.

The proposed development will require the demolition of a single storey dwelling to the north of Berryfield Lane. There is potential for the proposed works during construction to result in the direct loss of potential or actual bat roosts within this building.

Loss of Foraging and Commuting Habitat

The results of the bat activity survey undertaken for the proposed development indicate that the site supports six species of foraging and commuting bat (soprano pipistrelle, common pipistrelle, Leisler's bat, brown long-eared bat, whiskered bat and natterer's bat).

The proposed clearance works will result in the removal of a portion of mixed (broadleaved) woodland, wet woodland, scrub and hedgerow. These habitats provide foraging and commuting habitat for bats. As noted, no trees identified as potential roost sites are to be removed. Loss or fragmentation of foraging habitats (such as hedgerows, treelines and woodlands) that will be cleared during construction may reduce the available insect prey species and also reduce the feeding area for bats in some locations. The alteration and removal of these habitats would have a significant adverse impact to bat species (at a local geographic scale). In the absence of mitigation this project would have a permanent adverse effect on local bat species due to permanent local habitat loss of woodland and hedgerow habitats onsite.

Lighting

Studies have found that Leisler's bat and pipistrelle bats can congregate around white mercury street lights and white metal halide lamps feeding on the insects attracted to the light. However, lighting can cause avoidance of an area for commuting bats and can prevent or reduce foraging for some species, including *Myotis* species[8]. Further, even bat species that have been shown to opportunistically forage in lit conditions have subsequently been recorded being impacted by artificial lighting. In cities, for example, common pipistrelles have been recorded avoiding gaps that are well lit, thereby creating a barrier effect[9]. Temporary lighting required during the construction phase may cause disturbance to bats commuting through or feeding at the proposed site. In the absence of mitigation, disturbance of bats due to construction phase lighting would have a temporary to short-term significant adverse impact at the local geographic scale.

5.4.1.3.3 Badger

Disturbance to setts

No setts have been observed within the footprint of the proposed development; therefore, no sett will be lost as a result of the proposed development. The setts recorded in the wider area are located approximately 275m from the proposed distributer road. No disturbance to setts is anticipated as a result of construction activities.

Interference with commuting badgers/ road death

Badger movement will be constrained by the construction of the housing development and distributer road through the social group's territory. This will fragment and reduce the social group's territory area. Badger road kill was not noted as an issue at the time of the surveys within the study area. However, there is potential for the distributer road to increase road kill rates at its location through agricultural lands at the west of the site. In the absence of mitigation, this would be a permanent significant negative impact to the local population of badgers.

Badgers are active across the study area and clearance for construction will result in increased disturbance and interruption of movement. This would result in a permanent, significant negative impact to the local population of badgers.

[8] Stone E.L. (2013) Bats and Lighting: Overview of current evidence and mitigation.

[9] Bat Conservation Trust and Institute of Lighting Professionals (2018) Guidance Note 08/18: Bats and artificial lighting in the UK. ILP, Rugby

5.4.1.3.4 Otter

There are no watercourses present within the footprint of the proposed development, and no works are proposed to the County Brook (Fassaroe Stream) to the north of the Phase I lands, therefore no direct impacts to otter are anticipated. Degradation of water quality in the County Brook (Fassaroe Stream) may impact on species dependent on the watercourse as a source of prey, such as otter, through degradation of current food chains. In the absence of mitigation, this would result in a temporary, reversible, adverse effect. Otter are listed in Annex II, Annex IV of the Habitats Directive and are protected under the Wildlife Acts, and are therefore considered to be of national importance. However, the potential indirect effects on otter associated with the proposed development would be relatively small scale and temporary, therefore are not significant on a national level, but are considered to be significant on a local level.

5.4.1.3.5 Other Mammals

Deer

No direct effects on deer are anticipated to arise from the proposed development. Deer have been recorded in the area of the proposed development, including Ballyman Glen. The construction of the proposed housing development may result in temporary noise disturbance to deer for the duration of construction. However, in view of the short term nature of the woks and the mobility of deer, impacts are considered to be minor and not significant.

Other non-volant mammals species protected under Schedule 5 Wildlife Act 1976 (as amended): hedgehog, Pine Marten, Red Squirrel

No evidence of hedgehog, pine marten and red squirrel was recorded during the site visits. However, it is possible that these species use Ballyman Glen for shelter and foraging and may experience disturbance during vegetation clearance. Development in the woodland in Ballyman Glen is limited to the construction of surface water outfall and the edge of the landfill capping and slope stability works within the scrub and woodland habitats of the Glen. This would have a slight temporary reversible negative impact on these species.

5.4.1.4 Aquatic Habitats

There is no direct hydrological connectivity between the proposed development area and nearby watercourses, the County Brook (Fassaroe Stream), River Dargle and the Cookstown River and therefore no direct discharges to surface water from the site. Surface water emissions from the proposed development area will comprise of 3 No. surface water discharge points to the County Brook and one to the Cookstown River from the proposed surface water collection system as well as potential overland flow during heavy rainfalls and seepage from groundwater receptors.

Potential impacts, construction and operational (long term) are mainly assessed with respect to indirect impacts. The elements of the proposal that have potential to impact on aquatic habitat are:

- Construction of Residential, Public Parks and Open Spaces, Neighbourhood Centre and Creche: the construction of various developments and open spaces, if unmitigated, could potentially lead to suspended solids and cement and concrete materials in runoff. Excavation and ground disturbance as well as movement of fill material around the site will result in soil disturbance extending overflow runoff impacts to the County Brook (Fassaroe Stream) and Cookstown River and, by extension, the Dargle River downstream. The potential also exists for a range of serious pollutants to enter watercourses during construction works and the transport of materials to and from construction areas.
- Construction of Electricity Infrastructure, services and public utilities: if unmitigated, these elements of the proposal which require excavation and construction works (in places close to Ballyman Glen) have potential to impact the County Brook (Fassaroe Stream) and Dargle River as a result of degradation of surface water quality, which may lead to degradation of water quality of the County Brook (Fassaroe Stream). This may in turn have a detrimental effect on the fish stocks downstream of the Dargle River.
- Construction of a Distributor Road: it is proposed to construct a distributor road from the existing roundabout at the eastern side of the lands at Kilbride Lane to Ballyman Road. The route of this road runs through parts of the site that drain to the County Brook and parts that drain to the Cookstown River, both of which ultimately flow in a northeast direction to confluence with the Dargle River. There does not appear to be any direct hydrological connectivity between the proposed road and either of

these watercourses with considerable scattering of trees serving a buffer effect in between. However, during a heavy rainfall event, potential pollutants and excavated material can become waterborne via overland flow.

- Remediation of Historic Landfill Sites: the County Brook (Fassaroe Stream) is downgradient of the five landfill sites. Some excavations will take place within some of these facilities to accommodate the remediation and capping measures permitted by the EPA. This includes slope stability works, installation of subsurface drains, gas collection and flare system and the proposed access roads etc. The capping works will also require the placement of additional material on top of the sites. These works, if unmitigated, could potentially lead to suspended solids runoff. Excavation and movement of fill material around the site will result in soil disturbance extending overflow runoff impacts to the County Brook (Fassaroe Stream)and Cookstown River and, by extension, the Dargle River downstream. The potential also exists for a range of serious pollutants to enter watercourses during construction works and the transport of materials to and from construction areas.

Suspended Solids Pollution

Soil run-off from construction areas can pose adverse impacts on aquatic life in watercourses near the proposed development area resulting in the following impacts:

- Suspended solids can cause a reduction in visibility in the watercourse, impairing foraging ability for fish as well as damage to gills;
- Settled sediments can smother and displace aquatic organisms such as macroinvertebrates, reducing the amount of food items available to fish;
- High suspended sediment loads can abrade macrophytes and biofilm impacting the food base of grazing aquatic organisms;
- Suspended solids particles can clog or damage the gills of salmonid fish;
- The settlement of suspended solid particles on spawning areas can smother the eggs in the gravel; and
- Higher concentrations of suspended solids may also serve as a sink or carrier for toxins; and water with higher concentration of solids retards photosynthesis.

Pollution with Other Substances Associated with the Construction Process

The potential exists for a range of serious pollutants to enter watercourses during construction works. The following will have harmful effects on fish, plants and invertebrates if allowed to enter watercourses:

- Raw or uncured concrete and grouts;
- Excessive dust emissions from the transport of materials can potentially dissipate to nearby watercourses;
- Wash down water from exposed aggregate surfaces, cast-in-place concrete and from concrete trucks; and
- Fuels, lubricants and hydraulic fluids for equipment used on the development site.

Environmental Incidents and Accidents

The transport of materials to and from construction areas can lead to potential spillages and runoff into watercourses via overland flow particularly during rainfall. This can result in major adverse impacts on downstream watercourses in a worst case scenario. Such materials include; petrol, diesel, top soils, hydrocarbons and chemicals.

An assessment of the significance of potential impacts during construction in the absence of mitigation measures is presented in the following sections.

County Brook (Fassaroe Stream) (County Importance)

There is no direct connectivity between the proposed works and County Brook, therefore there will be no direct adverse effects. The potential exists during construction of elements of the proposal that are proximal to Ballyman Glen for excavated suspended solid material to runoff via downgradient overland flow into County Brook during heavy rainfall. Suspended solids can have negative effects on fish and macroinvertebrate respiratory functions and on their respective habitats.

There is potential for concrete or mortar to enter County Brook channel via downgradient overland flow. Cement is highly alkaline and can give rise to fish kills with similar effects on invertebrates.

Accidental spillages of construction fuels and/or transport materials can indirectly enter County Brook via downgradient overland flow. The main impacts of these materials in the watercourse would be prevention of gaseous exchange at the water surface, leading to reduced dissolved oxygen in the underlying water. The gills of fish can also become contaminated reducing their respiratory capacity.

The County Brook (Fassaroe Stream) is located downgradient of all five landfill areas proposed for remediation works. Excavation, ground disturbance and significant filling / capping works during remediation works will result in intensifying potential overflow runoff impacts to the County Brook (Fassaroe Stream). Due to the extent of groundworks proposed the likelihood of sedimentation of the stream due to runoff is increased. The potential also exists for a range of serious pollutants associated with construction works to enter watercourses during remediation works from the transport of materials to and from construction areas. Due to the large scale construction of the proposed residential and other development, services, utilities, landfill remediation works, public parks and open spaces and electricity infrastructure and their proximity to the County Brook stream, works could potentially result in a **permanent, irreversible adverse effect** on the aquatic ecology of the County Brook (Fassaroe Stream) in the absence of mitigation measures. The proposed works are **unlikely to cause a significant impact on a national level, but are significant on a local level.**

Due to the location of buffered areas and considerable overland flow distance to the County Brook (Fassaroe Stream) it is unlikely the proposed construction of a distributor road will pose a significant impact on this watercourse.

Cookstown River (Local Importance (Higher value))

There is no direct connectivity between the proposed works and Cookstown River, therefore there will be no direct adverse effects. Potential indirect adverse effects on Cookstown River are as for County Brook, as described above. However, as the County Brook (Fassaroe stream) is in closer proximity to the works than the Cookstown River, the potential indirect impacts are slightly reduced in comparison for this watercourse.

The construction of the proposed residential and other development, landfill remediation, public parks and open spaces may result in a **temporary, reversible adverse effect** on the aquatic ecology of the Cookstown River in the absence of mitigation measures. The proposed works are unlikely to cause a **significant impact on a national level, but are significant on a local level.**

Due to the scale of proposed works, location of buffered areas (roads, vegetation buffers) and considerable overland flow distance to the Cookstown River, the construction of electricity infrastructure, services and public utilities may have a **temporary, slight, but not significant, adverse effect on a local level.**

The Cookstown River is the nearest watercourse location to the proposed distributer road, which is located approximately 500m to the north of this watercourse at its closest point. No hydrological conduits between the proposed distributer road and the Cookstown River but potential impacts exist via overland flow. There is potential for **permanent**, **irreversible, adverse effects** on the aquatic ecology of the Cookstown River in the absence of mitigation measures. These effects are **unlikely to be significant on a national level,** but are considered **likely to be significant on a local level.**

Dargle River (International Importance)

There is no direct connectivity between the proposed works and Dargle River, therefore there will be no direct adverse effects. Salmon spawn within the Dargle River annually and it supports a resident population of brown trout and migratory populations of sea trout (*Salmo trutta*) and Atlantic Salmon (*Salmo salar*); the latter listed under Annex II and V of the EU Habitats Directive.

The Dargle is vulnerable to extended indirect impacts via the Cookstown River and County Brook (Fassaroe Stream) during the construction phase of the proposed residential and other development, landfill remediation, public parks and open spaces and electricity infrastructure (See County Brook impact description for description of potential impacts).

There is potential for **permanent, irreversible, adverse effects** on the aquatic ecology of the Dargle River in the absence of mitigation measures. The proposed works are **unlikely to cause a significant impact on an international level, but are significant on a local level.**

The Dargle is vulnerable to extended indirect impacts mainly via the Cookstown River during the construction phase of the proposed distributor road development. There is potential for **permanent, irreversible, adverse effects** on the aquatic ecology of the Dargle River in the absence of mitigation

measures. **The proposed works are unlikely to be significant on an international level,** but are considered **likely to be significant on a local level.**

5.4.2 Operational Phase

This section will identify in detail the potential effects of the operational phase on ecological features in the receiving environment, in the absence of mitigation.

5.4.2.1 Designated Sites

The potential impacts associated with the proposed development on European sites are considered in greater detail in the Natura Impact Statement also submitted with the current application.

The NIS found that the proposed development has the potential to impact on Annex I habitats Alkaline Fen [7230] and Petrifying Springs with tufa formation (Cratoneurion) [7220] as a result of degradation of habitat due to increased human presence, and alteration of hydrological regime. These potential impacts are described in detail within the NIS. The NIS concluded that, with the inclusion of landfill remediation as part of the proposed development and the effective implementation of the mitigation measures provided within the NIS, there will be no significant adverse effects on the integrity of Ballyman Glen SAC in view of the sites conservation objectives and that the conservation status of the qualifying Annex I habitats will not be compromised by the proposal either directly, indirectly or cumulatively.

In addition to its designation as a SAC, Ballyman Glen is also a pNHA. Potential impacts to Ballyman Glen pNHA are as described above.

5.4.2.2 Habitats

5.4.2.2.1 Dry Calcareous and Neutral Grassland

No significant adverse effects on dry calcareous and neutral grassland will occur during the operational phase.

5.4.2.2.2 Dry meadows and grassy verges

No significant adverse effects on dry calcareous and neutral grassland will occur during the operational phase.

5.4.2.2.3 Wet Woodland

Once completed, areas from which vegetation was removed to enable the installation of surface water outfall works will gradually re-vegetate; however, the species composition in these areas may change. It is not anticipated that this would result in a significant adverse effect. No significant effects are anticipated.

5.4.2.2.4 Mixed Broadleaved Woodland and Scrub

No direct impacts to these habitats are anticipated to arise during the operational phase. Once completed, areas from which vegetation was removed to enable the installation of landfill capping, slope stabilisation and surface water outfall works will gradually re-vegetate; however, the species composition in these areas may change. It is not anticipated that this would result in a significant adverse effect. No significant effects are anticipated.

5.4.2.2.5 Immature Woodland

No significant adverse effects on immature woodland are anticipated to arise during the operational phase.

5.4.2.2.6 Mixed Conifer Woodland

No significant adverse effects on mixed conifer woodland are anticipated to arise during the operational phase.

5.4.2.2.7 Hedgerows and Treelines

No significant adverse effects on hedgerows and treelines are anticipated to arise during the operational phase.

5.4.2.2.8 Petrifying Springs with Tufa Formation

Alteration of Water Quality

As described previously, there is an existing movement of leachate from the landfills into the groundwater body feeding the petrifying springs that are a qualifying interest of Ballyman Glen SAC. It is anticipated that the landfill capping system to be installed during the construction phase of the proposed development will continue to reduce leachate generation as a result of rainfall infiltration during the operational phase of the proposed development. This is likely to have a permanent positive impact on the water quality of the groundwater system feeding the petrifying springs within Ballyman Glen.

Alteration of Hydrological Regime

As described previously, it is predicted that the capping of the landfills is likely to reduce the current recharge to groundwater up to 7% over the life of the development. However, the potential drop of 0.3m at the top of the seepage face is located above the level of elevation of the petrifying springs, therefore negative effects on the petrifying springs within Ballyman Glen SAC due to reduced groundwater flow contribution are predicted to be minor. No indirect effects on Petrifying Springs are anticipated to arise during the operational phase. A permanent improvement in water quality in groundwater feeding the petrifying springs is expected to have a positive effect on this habitat, and should an increase in tufa deposition occur, has the potential to increase the habitat area of an internationally important habitat.

5.4.2.2.9 Alkaline Fen

Alteration of Water Quality

As described previously, there is an existing movement of leachate from the landfills into the groundwater body feeding the alkaline fen that is a qualifying interest of Ballyman Glen SAC. It is anticipated that the landfill capping system to be installed during the construction phase of the proposed development will continue to reduce leachate generation as a result of rainfall infiltration during the operational phase of the proposed development. This is likely to have a permanent positive impact on the water quality of the groundwater system feeding the alkaline fen within Ballyman Glen.

Alteration of Hydrological Regime

As described previously, it is predicted that the capping of the landfills is likely to reduce the current recharge to groundwater up to 7% over the life of the development. However, the potential drop of 0.3m at the top of the seepage face is located above the level of elevation of the alkaline fen, therefore negative effects on the alkaline fen within Ballyman Glen SAC due to reduced groundwater flow contribution are predicted to be minor. No indirect effects on Alkaline Fen are anticipated to arise during the operational phase. A permanent improvement in water quality in groundwater feeding the alkaline fen is expected to have a positive effect on this habitat.

5.4.2.3 Species

5.4.2.3.1 Avifauna

No significant adverse effects on birds are anticipated to arise from the operational phase of the proposed development.

5.4.2.3.2 Bats

The operation of the distributer road increases the risk of direct impacts to bats as a result of collision with vehicles. In the absence of mitigation this would have a permanent, significant adverse effect at the local geographic scale.

The street and domestic lighting proposed for the development will increase light levels within the proposed development area. As noted in **Section 5.4.1.3.2**, increased lighting may reduce the availability of feeding sites for bats and would be a long-term significant adverse impact at the local geographic scale.

5.4.2.3.3 Badger

Interference with commuting badgers/ road death

Badger movement will be constrained by the construction and ongoing presence of the housing development and new road through the social group's territory. The development will fragment and reduce the badger territory and has the potential to increase road kill rates where the distributer road passes through agricultural lands at the west of the site. In the absence of mitigation, this would be a permanent significant adverse effect on the local population of badgers.

Disturbance to setts

The operation of the proposed road is likely to result in an ongoing increase in disturbance from traffic noise and potentially from increased access to the lands to the south of the road. This may lead to a greater awareness of and human presence around the sett. The increase in risk of disturbance to badgers would be a permanent but intermittent significant adverse effect on a local level but not on a national level.

5.4.2.3.4 Otter

No significant adverse effects on otter are anticipated to arise from the operational phase of the proposed development.

5.4.2.3.5 Other Mammals

Deer

No direct effects on deer are anticipated to arise from the operational phase of the proposed development.

As noted previously, deer have been recorded in the area of the proposed development, and it is likely that these species use Ballyman Glen for shelter and foraging. The operational phase of the proposed development may result in indirect impacts arising from an increase in disturbance to deer within Ballyman Glen. Ballyman Glen is located on steep slopes and supports dense vegetation growth, as such a substantial rise in human presence within Ballyman Glen is unlikely. In view of the proposals for a large district park with substantial tree planting within the Fassaroe Phase 1 lands, it is considered that impacts from any increase in disturbance to deer within Ballyman Glen will be negligible.

Other non-volant mammals species protected under Schedule 5 Wildlife Act 1976 (as amended): hedgehog, Pine Marten, Red Squirrel.

No direct impacts to these species are anticipated to arise from the operational phase of the proposed development.

The operational phase of the proposed development may result in an increase in noise disturbance to these species within Ballyman Glen. However, as noted above, a substantial rise in human presence within Ballyman Glen is unlikely; further, there is a large district park with substantial tree planting proposed within Fassaroe Phase 1 lands. It is considered that impacts from any increase in disturbance will be negligible. As such, it is considered that impacts from any increase in disturbance to these protected species within Ballyman Glen will be negligible.

5.4.2.4 Aquatic Ecology

This section details operational (long term) impacts from the entire proposed development area (Phase 1 lands) listed above, that could potentially impact the County Brook (Fassaroe Stream), Cookstown River and by extension, the Dargle River.

Hydrology Changes

Changes in hydrological conditions with potential for significant indirect effects on instream flora and fauna are:-

- Surface water at finished ground level (e.g., on grassed areas, pathways etc.) will drain overland or through swales and ponds to the development's surface water drainage system. However, some infiltration of surface water will continue to occur through the soils overlying the capping system and will need to be managed independently in a subsurface drainage system. In addition, a leachate interceptor drain will be constructed on the downstream gradient perimeter of all landfill sites to collect leachate that may seep or build up beneath the capping system. The two of these measures will firstly reduce the amount of water percolating through the waste body and secondly introduce a leachate interceptor drain for below cap level. Combined these should have a net benefit on the quality of SW / groundwater seepage to the County Brook. As the above cap layers will drain to a collection system discharging at set points (rather than filter to groundwater) it could alter the rate / nature of flow of water into the County Brook. These alterations will not be significant alterations as the total volumes will be unchanged – just the location and rate slightly;
- Surface water runoff via overland flow from any hardstanding base areas at the proposed electricity infrastructural sites close to Ballyman Glen;
- Increased erosion from potential failure in landfill slope stability works. Sediment loss can give rise to increased bottom sedimentation, which, in turn, can adversely impact macroinvertebrates and aquatic habitat quality of both the Cookstown River and County Brook (Fassaroe Stream). Elevated suspended solids levels within the water column can damage the gills of salmonid fish and benthic macroinvertebrates and can smother fish spawning areas downstream at the Dargle River when deposited; and
- Potential leakage of the sewer pipework from the proposed residential and commercial development could potentially impact on groundwater quality and by extension exert adverse impacts downgradient to the County Brook (Fassaroe Stream) and Cookstown Rivers.

Hydrocarbons Runoff

Hydrocarbons are generally derived from crankcase oil, lubricating oils and fuels. The potential exists for runoff of these materials from the proposed distributor road and parked vehicles within the proposed residential and recreational areas. Spillage of Hydrocarbons are of major concern because they are responsible for the larger percentage of toxicity to fresh water organisms.

Potential Impacts of hydrocarbons from the proposed development are the following:-

- Prevention of gaseous exchange at the water surface, leading to reduced dissolved oxygen in the underlying water; and
- The gills of fish can become contaminated reducing their respiratory capacity.

A summary of the significance of potential impacts during construction, in the absence of mitigation measures, is presented in the text below.

County Brook (Fassaroe Stream)

There is potential for leakage of sewer pipework from the proposed residential and commercial development to have an adverse effect on groundwater quality and by extension exert adverse effects downgradient to the County Brook (Fassaroe Stream). If impacts persist, excessive algae and sewage fungus would occur on the surface depleting the entire system of oxygen reserves and by extension, reducing oxygen levels for resident fish and macroinvertebrates.

The potential also exists for runoff of hydrocarbons from parked vehicles within the proposed residential and recreational areas. This can result in damage to gills of fish and also compromise oxygen reserves in the water column for fish and macroinvertebrates.

The operation of the proposed residential development, recreational facilities, public parks and open spaces may result in **permanent, irreversible, negative effects** on the aquatic ecology of the County Brook (Fassaroe Stream) in the absence of mitigation measures. These effects are **unlikely to be significant on a national level, but is considered likely to be significant on a local level.**

During significant rainfall, surface water runoff via overland flow from any hardstanding base areas at the proposed electricity infrastructural sites can potentially pose slight toxicity effects to fish and macroinvertebrates within the stream.

Due to the location of buffered areas and considerable overland flow distance to the County Brook (Fassaroe Stream) it is unlikely the operational phase of the proposed distributor road will pose a significant impact on this watercourse. However, there is potential for dissipate runoff of hydrocarbons via overland flow during heavy rainfall from the road surface. Spillage of hydrocarbons are of major concern because they are responsible for the larger percentage of toxicity to fresh water organisms if discharged in excess.

The operation of the electricity infrastructure and distributer road may result in **temporary, reversible, negative effects** on the aquatic ecology of the County Brook (Fassaroe Stream) in the absence of mitigation measures. These effects are **unlikely to be significant on a national level,** but is considered **likely to be significant on a local level.**

In relation to the remediated historic landfill sites, a potential failure in landfill slope stability works could result in increased bottom sedimentation and, in turn, can adversely impact macroinvertebrates and aquatic habitat quality of the County Brook (Fassaroe Stream). Should this occur, the operational phase of remediation works of landfill sites would result in **permanent**, **irreversible, negative** impacts on the aquatic ecology of the County Stream (Fassaroe Stream) in the absence of mitigation measures.

Despite potential impacts in the absence of mitigation as outlined above, the overall aim of the remediation works is to have a positive impact on groundwater quality and, by extension, to the receiving surface waters of the overall catchment area. As such, these effects are **unlikely to be significant on a national level,** but are considered **likely to be moderate on a local level.**

Cookstown River

As the County Brook (Fassaroe stream) is more downgradient, in closer proximity to the proposed development area than the Cookstown River, and drains a larger area of the subject development than the Cookstown River, the potential indirect impacts are reduced for this watercourse.

The specific impacts outlined above for the County Brook (Fassaroe Stream) apply to the Cookstown River but at a much lower level.

The operation of the proposed residential development, electricity infrastructure, recreational facilities, public parks and open spaces may result in a **temporary, reversible negative effect** on the aquatic ecology of the Cookstown River in the absence of mitigation measures. This effect is unlikely to be significant on a national level, but is considered likely to be **moderate on a local level**.

The Cookstown River is the nearest watercourse location to the proposed main access road located approximately 200m to the southeast of the proposed distributor road. Some of the surface water drainage network for the roadway will drain to the attenuation pond which in turn outfalls to the Cookstown River. Thus, the potential for impacts exist via overland flow. Runoff of hydrocarbons from the proposed distributor road to the Cookstown River can potentially prevent gaseous exchange at the water surface, leading to reduced dissolved oxygen in the underlying water. The gills of fish can also become contaminated reducing their respiratory capacity.

The operation of the proposed distributor road may result in **permanent**, **irreversible, negative effects** on the aquatic ecology of the Cookstown River in the absence of mitigation measures. These effects are unlikely to be significant on a national level, but is considered likely to be significant on a local level.

With regards to the remediated historic landfill sites, as the Cookstown River is located at a greater distance to the remediation landfill works than the County Brook (Fassaroe Stream) and not directly downgradient, the potential impacts are therefore more reduced. The operational phase of remediation works of landfill sites may result in **temporary**, **reversible, negative effects** on the aquatic ecology of the Cookstown River in the absence of mitigation measures. **These effects are unlikely to be significant on a national level** but are considered **likely to be moderate on a local level.**

Dargle River

The Dargle is vulnerable to extended indirect impacts via the Cookstown River and County Brook (Fassaroe Stream) during the operational phase of the proposed residential development, recreational facilities, public parks and open spaces.

The specific impacts outlined above for the County Brook (Fassaroe Stream) apply to the Dargle River.

The Dargle is vulnerable to extended indirect impacts mainly via the Cookstown River during the operational phase of the proposed distributor road development. Hydrocarbon runoff (see impacts described previously) can potentially alter oxygen reserves for spawning, nursery and migratory salmon and trout. Direct contamination of toxic substances can also directly affect fish gills and their respiratory functions.

The operation of the proposed residential development and distributer road may result in **permanent, irreversible, negative effects** on the aquatic ecology of the Dargle River in the absence of mitigation measures. These effects are **unlikely to be significant on an international level but is considered likely to be significant on a local level.**

The Dargle and its salmonid habitats are vulnerable to extended indirect impacts via the Cookstown River and County Brook (Fassaroe Stream) during the operational phase of the proposed electrical infrastructural development. The specific impacts outlined above for the County Brook (Fassaroe Stream) apply to the Dargle River. The operation of the electricity infrastructure may result in **temporary, reversible, negative effects** on the aquatic ecology of the Dargle River in the absence of mitigation measures. These effects are u**nlikely to be significant on an international level** but is considered **likely to be significant on a local level.**

The Dargle is vulnerable to extended indirect impacts mainly via the County Brook (Fassaroe Stream) during the operational phase of remediation of landfill works. Elevated suspended solids levels within the water column as a result of bottom sedimentation can damage the gills of salmonid fish and benthic macroinvertebrates and can smother fish spawning areas downstream at the Dargle River when deposited. Organic and inorganic materials derived from leachate material can compromise the integrity of the oxygen reserves in the Dargle River reducing oxygen availability for fish and macroinvertebrates.

The operational phase of remediation works of landfill sites may result in **temporary, reversible, negative effects** on the aquatic ecology of the Cookstown River in the absence of mitigation measures. These effects are unlikely to be significant on an international level but are considered likely to be significant on a local. level

5.4.3 Do Nothing Scenario

If the proposed development were not to proceed, ongoing activities would continue within the proposed area to include arable and pastoral farming and the potential progression of one-off residential and recreational developments. These activities would be likely to result in localised and small scale cumulative impacts to the various ecological receptors within the proposed development area. **The historical landfill sites would continue to contaminate the local groundwater system with leachates, and would continue to pose a threat to the conservation value of the petrifying springs and alkaline fen present within Ballyman Glen.**

5.4.4 'Worst Case' Scenario

The 'worst case' scenario with respect to the proposed development is that there will be impacts on habitats and fauna as a result of the proposed development. Based on the 'worst case' scenario the following potential ecological impacts would be likely as a result of the development:

- Direct loss of 1300m hedgerow and 475m line of trees;
- Disturbance of birds during the construction and operational phase;
- Indirect impacts to aquatic species including salmon as a result of pollutants and sediments entering watercourses;
- Indirect impacts to otter as a result of a reduction in water quality affecting levels of available prey;
- Direct and indirect impacts to badgers during the construction and operational phase;
- Direct and indirect impacts to bats during the construction and operational phase;
- Disturbance to red squirrel, pine marten, hedgehog and deer during the construction and operational phase; and
- Direct impact to petrifying springs and alkaline fen during the construction and operational phase.

5.4.5 Potential Cumulative Impacts

Cumulative effects can result from individually insignificant but collectively significant actions taking place over a period of time or concentrated in a location.[10] The analysis of cumulative effects presented in this report considers Plans, projects and land uses affecting or potentially affecting ecological receptors in the zone of influence of the proposed development and whether the construction and operation of the proposed Phase 1SHD development is likely to add to an overall significant effect upon them.

A search of Wicklow County Council planning enquiry system (http://www.wicklow.ie/online-enquiries) and Dún Laoghaire-Rathdown County Council planning enquiry system (http://planning.dlrcoco.ie) was conducted for developments permitted since 2017 that may have in-combination effects with the proposed development on ecological features in the study area. Plans relevant to the Fassaroe area were searched in order to identify any elements of the plans that may act cumulatively or in-combination with the proposed development.

Table 5-18 lists those Plans, projects and land uses which may potentially contribute to Cumulative or In-Combination Impacts with the proposed development.

[10] CIEEM (2018). Guidelines For Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine

Table 5-18: List of Potential Plans, Projects and Landuse which may Contribute to Cumulative Impacts

Name of Plan orProject	Key Issues Directly Linked to Relevant European Sites	Potential Cumulative or In-Combination Impacts on Relevant European Sites
Bray Municipal District Local Area Plan 2018	Strategies and Objectives within the LAP include the following: *To promote and facilitate the rapid delivery of the maximum number of housing units in the key development areas of Fassaroe and the former Bray golf club.* *For Bray, the key location for new employment development shall be in Fassaroe, where it is the objective to secure the delivery of up to 3,000 new jobs.* *Within the expansion area of Fassaroe, the Planning Authority will facilitate the provision for the development of appropriately scaled retail provision, which provides for the immediate needs of residents and employees of the area but does not undermine the role of Bray town centre as the principal shopping destination in the settlement.* *To promote the linkage of the Luas extension or other mass transit to Bray town centre, Bray train station and Fassaroe; with respect to the major development area of Fassaroe, west of the N11, the development of this area shall make provision for mass transit such as Luas or BRT, including any necessary infrastructure such as stabling;* *All development proposals within the Fassaroe Action Area shall take cognisance of the requirement to maintain the rate, quality and general areas where groundwater recharge occurs in order to maintain or enhance the recharge supplying the groundwater-dependent habitats of Ballyman Glen SAC. This shall be through the review of existing hydrogeological assessment(s) and the carrying out of new hydrogeological assessment to inform the development of an appropriate SuDS system(s) throughout any development site and taking into account the cumulative in-combination impact of other development.* Details on the Action Area Plan for Fassaroe are included in Section 2 of this report.	The proposed line a possible Luas / BRT under the Bray MD LAP crosses the Ballyman Glen SAC. However, the exact nature of such a public transport link is not yet known and will be determined at a future application stage. . Therefore an informed cumulative impact assessment of the potential future link across the glen and the proposed Fassaroe development cannot be undertaken at this time. It is noted that the Wicklow County Development Plan 2016 – 2022 includes objectives NH2, NH3 and NH4 on the protection of European sites, as detailed below. When the link across the Glen is progressed in line with future phases of development at Fassaroe, a full assessment of the potential ecological impactsassociated with the proposals will be required, to include the appropriate research and survey work necessary in order to inform a robust assessment of the potential impacts associated with the proposed works.
Wicklow County Development Plan2016 - 2022	Biodiversity Objectives include the following: **NH1** To ensure that the impact of new developments on biodiversity is minimised and to require measures for the protection and enhancement of biodiversity in all proposals for large developments. **NH2** No projects giving rise to significant cumulative, direct, indirect or secondary impacts on Natura 2000 sites arising from their size or scale, land take, proximity, resource requirements, emissions (disposal to land, water or air), transportation requirements, duration of construction, operation, decommissioning or from any other effects shall be permitted on the basis of this plan (either individually or in	Policies and objectives of the Wicklow County Development Plan 2016 – 2022 to ensure that local planning applications comply with proper planning and sustainability and with the requirements of relevant EU Directives and environmental considerations, there is no potential for adverse in-combination effects on ecological features within the zone of influence of these works.

Name of Plan orProject	Key Issues Directly Linked to Relevant European Sites	Potential Cumulative or In-Combination Impacts on Relevant European Sites
	combination with other plans or projects). NH3 To contribute, as appropriate, towards the protection of designated ecological sites including candidate Special Areas of Conservation (cSACs) and Special Protection Areas (SPAs); Wildlife Sites (including proposed Natural Heritage Areas); Salmonid Waters; Flora Protection Order sites; Wildfowl Sanctuaries (see S.I. 192 of 1979); Freshwater Pearl Mussel catchments; and Tree Preservation Orders (TPOs). To contribute towards compliance with relevant EU Environmental Directives and applicable National Legislation, Policies, Plans and Guidelines, including the following and any updated/superseding documents: • EU Directives, including the Habitats Directive (92/43/EEC, as amended), the Birds Directive (2009/147/EC), the Environmental Liability Directive (2004/35/EC), the Environmental Impact Assessment Directive (85/337/EEC, as amended), the Water Framework Directive (2000/60/EC) and the Strategic Environmental Assessment Directive (2001/42/EC). • National legislation, including the Wildlife Act 197610, the European Communities (Environmental Impact Assessment) Regulations 1989 (SI No. 349 of 1989) (as amended), the Wildlife (Amendment) Act 2000, the European Union (Water Policy) Regulations 2003 (as amended), the Planning and Development Act 2000 (as amended), the European Communities (Birds and Natural • Habitats) Regulations 2011 (SI No. 477 of 2011) and the European Communities (Environmental Liability) Regulations 2008. • National policy guidelines (including any clarifying Circulars or superseding versions of same), including the Landscape and Landscape Assessment Draft Guidelines 2000, the Environmental Impact Assessment Sub-Threshold Development Guidelines 2003, Strategic Environmental Assessment Guidelines 2004 and the Appropriate Assessment Guidance 2010. • Catchment and water resource management Plans, including Eastern and South Eastern River Basin Management Plan 2009-2015 (including any superseding versions of same). • Biodiversity Plans and guidelines, including Actions for Biodiversity 2011-2016: Ireland's 2nd National Biodiversity Plan (including any superseding version of same). • Ireland's Environment 2014 (EPA, 2014, including any superseding versions of same), and to make provision where appropriate to address the report's goals and challenges. **NH4** All projects and plans arising from this plan (including any associated improvement works or associated infrastructure) will be screened for the need to undertake Appropriate Assessment under Article 6 of the Habitats Directive. A plan or project will only be authorised after the competent authority has ascertained,	

Name of Plan orProject	Key Issues Directly Linked to Relevant European Sites	Potential Cumulative or In-Combination Impacts on Relevant European Sites
	based on scientific evidence, Screening for Appropriate Assessment, and a Stage 2 Appropriate Assessment where necessary, that: 1) The Plan or project will not give rise to significant adverse direct, indirect or secondary effects on the integrity of any European site (either individually or in combination with other plans or projects); or 2) The Plan or project will have significant adverse effects on the integrity of any European site (that does not host a priority natural habitat type and / or a priority species) but there are no alternative solutions and the plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature. In this case, it will be a requirement to follow procedures set out in legislation and agree and undertake all compensatory measures necessary to ensure the protection of the overall coherence of Natura 2000; or 3) 3) The Plan or project will have a significant adverse effect on the integrity of any European site (that hosts a natural habitat type and/or a priority species) but there are no alternative solutions and the plan or project must nevertheless be carried out for imperative reasons for overriding public interest, restricted to reasons of human health or public safety, to beneficial consequences of primary importance for the environment or, further to an opinion from the Commission, to other imperative reasons of overriding public interest. In this case, it will be a requirement to follow procedures set out in legislation and agree and undertake all compensatory measures necessary to ensure the protection of the overall coherence of Natura 2000.	
Dún Laoghaire Rathdown CDP 2016- 2022	It is a policy of the Council to prepare a Local Area Plan for Old Conna once existing infrastructural constraints in the water supply have been overcome. Any developments with potential impacts to Ballyman Glen SAC will be bound by the following policies set out in the draft County Development Plan:- **Policy LHB17**: Protection of Natural Heritage and the Environment is an overall policyfor the protection of the natural heritage:- "*It is Council policy to protect and conserve the environment including, in particular, the natural heritage of the County and to conserve and manage Nationally and Internationally important and EU designated sites - such as Special Protection Areas, candidate Special Areas of Conservation, proposedNatural Heritage Areas and Ramsar sites - as well as non-designated areas ofhigh nature conservation value which serve as 'Stepping Stones' for the purposes of Article 10 of the Habitats Directive*". **Policy E14** - Groundwater Protection & Appropriate Assessment which states that: '*It is Council policy to ensure the protection of the groundwater resourcesin and around*	Associated developments included within the Old Conna LAP area could potentially pose impacts on Ballyman Glen SAC. However, any developments with potential impacts to Ballyman Glen will be bound by the overarching Policy LHB17 and Policy E14, LHB22 and E123. With the inclusion of these protective policies within the Dún Laoghaire Rathdown CDP 2016-2022, no adverse cumulative impacts with the proposed Phase I development at Fassaroe on ecological features within Ballyman Glen SAC are anticipated.

Name of Plan orProject	Key Issues Directly Linked to Relevant European Sites	Potential Cumulative or In-Combination Impacts on Relevant European Sites
	the County and associated habitats and species in accordance with the Groundwater Directive 2006/118/EC and the European Communities Environmental Objectives (groundwater) Regulations, 2010'; and **Policy LHB22 -** Rivers and Waterways which states 'It is Council policy to maintain and protect the natural character and ecological value of the river and stream corridors in the County and where possible to enhance existing channels and to encourage diversity of habitat. It is also policy (subject to the sensitivity ofthe riverside habitat) to provide public access to riparian corridors to promote improved passive recreational activities'. **Policy EI23** is also noted: Rathmichael Ground and Surface Water Protection stated – "*It is Council policy to refuse planning permission for any new developments which include an on-site wastewater treatment facility within the Rathmichael area until the groundwater issues in the area are resolved or ameliorated*"	
River Basin Management Plan 2018-2021	The project should comply with the environmental objectives of the Irish RBMP which are to be achieved generally by 2021. • Ensure full compliance with relevant EU legislation • Prevent deterioration • Meeting the objectives for designated protected areas • Protect high status waters • Implement targeted actions and pilot schemes in focus sub-catchments aimed at: targeting water bodies close to meeting their objective and addressing more complex issues which will build knowledge for the third cycle.	The implementation and compliance with key environmental policies, issues and objectives of this management plan will result in positive in-combination effects to European sites. The implementation of this plan will have a positive impact for the biodiversity. It will not contribute to in-combination or cumulative impacts with the proposed development.

Name of Plan orProject	Key Issues Directly Linked to Relevant European Sites	Potential Cumulative or In-Combination Impacts on Relevant European Sites
Inland Fisheries Ireland Corporate Plan 2021 -2025 The Inland Fisheries Act 2010.	To place the inland fisheries resource in the best sustainable position possible for the benefit of future generations. To protect, manage and conserve Ireland's inland fisheries and sea angling resources and to maximise their sustainability and natural biodiversity. • To sustainably develop and improve fish habitats. • To protect, maintain and enhance Ireland's wild fish populations. • To actively engage with stakeholders in the continued stewardship of our shared resource. • To play a leadership role in achieving our climate action and biodiversity goals. • To value our people and support their development and performance. • To foster a culture of value for money and evaluation of performance in a measurable, transparent and accountable manner. • Harness the power of innovation to continue to deliver a modern fisheries service.	The implementation and compliance with key environmental issues and objectives of this corporate plan will result in positive in-combination effects to European sites. The implementation of this corporate plan will have a positive impact for biodiversity of inland fisheries and ecosystems. It will not contribute to in-combination or cumulative impacts with the proposed works.
Fassaroe Masterplan	The zoning and development of the lands are subject to a Masterplan. A masterplan prepared by LOCI was adopted by Wicklow County Council in 2010. The Fassaroe Masterplan is described in **Section 2.2** and illustrated in Figure 2-5 of this report. The masterplan includes the development framework with identified development areas to guide all development in the area including the current proposed development and future phases of development within the Masterplan lands	The detailed design for the future phases of development at Fassaroe is not currently known, consequently there has been no Appropriate Assessment or Ecological Impact Assessment of the aforementioned proposals to date. Therefore an informed cumulative impact assessment of the provision of the future development at Fassaroe development or the lands at Enniskerry cannot be undertaken at this time. It is noted that the Wicklow County Development Plan 2016 – 2022 includes objectives NH2, NH3 and NH4 on the protection of Natura 2000 sites, as detailed above. Should either Phase II of the Fassaroe development or development of the lands at Enniskerry be progressed, a full assessment of the potential ecological impacts associated with the proposals will be required, to include the appropriate research and survey work necessary in order to inform a robust assessment of the potential impacts associated with the proposed works on ecological features within the Zone of Influence of the works.
Old Connaught Woodbrook WaterSupply Scheme (WSS)	The Old Connaught-Woodbrook WSS is a major scheme being undertaken by Irish Water to provide storage and distribution capacity for the area (including Woodbrook, Old Conna, Ballyman, Rathmichael and Fassaroe (County Wicklow)). TheWSS will consist of new watermains and associated supporting infrastructure such as reservoirs and pumping stations.	The WSS project is permitted and expected to be implemented shortly, though no exact dates are confirmed. The NIS undertaken for the development found that no significant residual effects are anticipated on the Qualifying Interests of Ballyman Glen SAC. The conclusion of the NIS

Name of Plan orProject	Key Issues Directly Linked to Relevant European Sites	Potential Cumulative or In-Combination Impacts on Relevant European Sites
		was that there will be no potential for cumulative impacts arising in combination with any other plans or proposals, with the implementation of best practice and the recommended mitigation measures. It is considered that the proposed development will not adversely affect the integrity of Ballyman Glen SAC. The EclA undertaken for the development concluded that, with the implementation of the mitigation measures outlined in the report, it is considered unlikely that there will be any residual impacts as a result of the proposed development. Adherence to the overarching policies and objectives of the Dún Laoghaire Rathdown County Development Plan 2016-2022 will ensure that local planning applications and subsequent grant of planning will comply with the core strategy of proper planning and sustainability, including consideration of the requirements of relevant environmental Directives. In view of the above, no in-combination effects on biodiversity will occur with the proposed development. .
Other permitted development projects	None of relevance found on the Wicklow or Dún Laoghaire-Rathdown planning enquiry systems	n/a
Agriculture	The study area is set in a predominantly agricultural landscape, with land immediately adjacent to the study area mainly comprised of improved agricultural grassland and arable fields, bound by hedgerows. The main potential impacts of agriculture would be in terms of potential increase in nutrient levels of local watercourses.	As previously noted, there are no streams or formal drains directly connecting the proposed development to any major water body. In the absence of mitigation, there is potential for temporary negative impacts to aquatic ecology (see **Section 5.4**). However, taking into consideration the measures included in the construction methods (see **Section 5.5** below), it is not anticipated that the proposed Phase I SHD development will contribute to a cumulative impact with farming activities on water quality within the catchment area.

5.5 Mitigation Measures

5.5.1 Construction Phase

Mitigation measures are proposed to address the potential adverse effects on the ecological features identified within the zone of influence of the works. These measures will allow any potential impacts affecting the ecological status of the ecological features to be minimised and avoided where possible.

The Construction Environment Management Plan – Fassaroe SHD Planning Application (Atkins, 2022) has been reviewed as part of this Ecological Impact Assessment. The Construction Environment Management Plan (CEMP) is included as a standalone document with this planning application.

The Contractor will be required to comply with and implement the requirements and mitigation measures as set out in the EIAR and any conditions imposed as part of the granted planning approval.

5.5.2 Construction Environmental Management Plan

The Contractor will be required to comply with and implement the requirements and mitigation measures as set out in the EIAR and any conditions imposed as part of the granted planning approval.

The works will be undertaken in compliance with following documents supplemented by specific additional measures proposed below:-

- DOMNR (1998). Fishery guidelines for Local Authority works. Department of the Marine and Natural Resources, Dublin;
- Environment Agency (2013) *The Knotweed Code of Practice. Managing Japanese knotweed on development sites* (Version 3);
- NRA (2010) Guidelines for the Management of Noxious Weeds and Non- Native Invasive Plant Species on National Roads. National Roads Authority, Dublin;
- H. Masters-Williams et al (2001) Control of water pollution from construction sites. Guidance for consultants and contractors (C532). CIRIA;
- IFI (2016) *Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters*. Inland Fisheries Ireland, Dublin;
- Irish Water (2016). *Information and Guidance Document on Japanese knotweed Asset Strategy and Sustainability*;
- Murnane *et al* (2002) Control of Water Pollution from Construction Sites- Guide to Good Practice. SP156; and
- Murphy, D. (2004) *Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites*. Eastern Regional Fisheries Board, Dublin.

5.5.3 Construction Phase Mitigation

As with any development, all measures necessary should be taken to ensure comprehensive protection of local ecological features, in the first place by complete impact avoidance and as a secondary approach through mitigation by reduction and remedy.

Fisheries-specific constraints which will apply to this works programme are listed in the guideline document "*Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites*". This document should be consulted by the authority and associated contractors when planning to undertake these works. The maintenance of aquatic habitat integrity (both in-stream and riparian) is essential in safeguarding the ecological value of these important systems. The measures below shall be adhered to.

The Contractor shall apply the mitigation measures detailed in **Table 5-19** below for each of the potential construction impacts identified. These measures shall be incorporated in their entirety into the construction contract documentation.

Table 5-19: Mitigation Measures for Potential Construction Phase Impacts

Potential Impact	Mitigation Measures
Petrifying Springs	The following measures will be implemented for the storage and use of hydrocarbons on site:- • Diesel tanks, used to store fuel for the various items of machinery, will be self-contained and double-walled. • Refuelling will be carried out from these tanks or from delivery vehicles and will not be left unattended. • Fuels, lubricants and hydraulic fluids for equipment used on the construction site will be carefully handled to avoid spillage, properly secured against unauthorised access or vandalism, and provided with spill containment according to best codes of practice - (Enterprise Ireland BPGCS005). • Any spillage of fuels, lubricants or hydraulic oils will be immediately contained and the contaminated soil removed from the site and properly disposed of. • Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for disposal or recycling. • Appropriate spill control equipment, such as oil soakage pads, will be kept within the construction site to deal with any accidental spillage. It is possible that waste will be encountered during construction for the installation of utility infrastructure and the leachate could be mobilised (either vertically or horizontally). To minimise or prevent lateral migration of groundwater/leachate along utility trenches, clay plugs will be used.
Scrub, Mixed Broadleaved Woodland, Immature woodland, Hedgerows and Treelines	Woodland habitats adjacent to working areas shall be demarcated to indicate clearly that no access is permitted. Where construction activity takes place in habitats categorised as ecological features (i.e., valuable habitats, including woodland) it is important that activity is limited to the footprint of the infrastructure and immediate surrounds. Again, areas where access is restricted should be demarcated. Where possible, treelines, scrub, woodland and mature trees shall be avoided and retained intact. Any existing mature trees adjacent to the works or construction sites to be retained will be protected from any accidental damage during construction through use of measures such as fencing. Protective fencing barriers will be installed as outlined in Section 6.2, Barriers and Ground Protection, of BS 5837. Measures will be taken to ensure that trees and hedges being retained are incorporated into the development without being impacted upon. Protective fencing will be provided around trees and hedge vegetation being retained and this will enclose their Root Protection Areas (RPAs). The fencing will be at least 2.3m.. No soil, spoil, constructional materials or rubbish will be stored or tipped and no construction plant or vehicles will be parked within the spread of existing trees, shrubs or hedges.
Wet woodland	Works to wet woodland are limited to the installation of a surface water outfall at the north-west of the site. Woodland habitats adjacent to working areas shall be demarcated to indicate clearly that no access is permitted. Where construction activity takes place in habitats categorised as ecological features (i.e., valuable habitats) it is important that activity is limited to the footprint of the infrastructure and immediate surrounds. Again, areas where access is restricted should be demarcated. Any existing mature trees adjacent to the works or construction sites to be retained will be protected from any accidental damage during construction through use of measures such as fencing. Protective fencing barriers will be installed as outlined in Section 6.2, Barriers and Ground Protection, of BS 5837. Measures will be taken to ensure that trees and hedges being retained are incorporated into the development without being impacted upon. Protective fencing will be provided around trees and hedge vegetation being retained and this will enclose their Root Protection Areas (RPAs). The fencing will be at least 2.3m. **Invasive Species** Mitigation measures to prevent the spread of invasive non-native species are provided below. **Degradation of habitat** As detailed in the suspended solids section of this table, rigorous sediment, erosion and pollution control measures have been provided for the proposed works. Good practice measures for the prevention of pollution will be employed at all times during the construction and operational period of the development.
pNHA/NHA	See mitigation relevant to Ballyman Glen SAC
Deer	No specific mitigation measures are required.

Potential Impact	Mitigation Measures
Otter	The measures outlined for the protection of water quality below will ensure that a sufficient level of mitigation is also afforded to otter.
Badger	**Badger proof fencing**: The distributer road shall be flanked to each side by badger-proof fencing from the south of the Enniskerry FC football pitch to the western end of the road. Fences should be constructed using plastic-coated chain link fencing. The wire should be stapled to timber fencing or to concrete posts for stability. The fence must be a minimum of 1000mm in height and must also be buried to a depth of 200mm and with a return towards the direction of approach (away from the road) of 300mm. The mesh diameter must not exceed 50mm as badger may climb the standard mesh of approximately 63mm diameter. The fence must be bent outward from the road to the base to lessen the likelihood that badgers will dig under it. A means of retaining this bend is desirable (in the form of pegging). **Badger underpass and access to each side of the route:** The potential interruption to the movement of badgers across their territory created by the routing of the road and the fencing necessary to prevent badger access at the western end of the distributer road can be alleviated by the provision of a badger underpass under the road to the west of Enniskerry FC grounds, near the junction with Berryfield Lane. All field gates close to the underpass locations must prevent badgers from exiting by way of mesh on and under the gate. The underpass should be constructed of concrete pipes (or steel and heavy duty plastic) of a diameter less than 600mm in diameter up to 1000mm. Pipes should be laid end-to-end to span the width of the road (at its widest base). For the remainder of the road, there must be badger-proof fencing on each side of this tunnel (travelling in each direction on both sides of the road). Where there is a drainage ditch running alongside the road, a further length of pipe or planking must be installed to allow badgers access to the underpass. A concrete slab base and a concrete slab surround prevent any badgers digging under the pipe. As well as this, fencing is more secure when attached to a totally vertical surface than if simply connected to the pipe. The badger underpass should connect the hedgerow or drainage ditches on each side of the road to cover on the other to encourage uptake of new underpasses. It is essential that the direction of bend of the wire is in the direction from which the badger is approaching, as to place it in the opposite direction will lead to a failure of mitigation. Badger fence design approval must be sought from a qualified ecologist to ensure that the design and make of the fencing and other measures will be effective in preventing badger access to the route. Specifications for badger proof fences and badger gates are as recommended in the NRA document Guidelines for the Treatment of Badgers on National Roads. Further technical details are covered in this document or by the DMRB Volume 10. Badger –proof fencing must be properly attached and buried and posts must not create conditions conducive to badgers climbing the fence. The buried return fence must point away from the land take of the road to work properly. Given that mammals continue to enter onto new roads, all fencing shall be examined upon completion by an ecologist to ensure that there are no obvious gaps or opportunities for mammals to enter unto the route.
Other non-volant mammals species protected under Schedule 5 Wildlife Act 1976 (as amended): hedgehog, Pine Marten, Red Squirrel.	Trees shall be checked for potential red squirrel nests or dreys and use by pine marten prior to clear felling by a suitably qualified ecologist.
Bat species	Where possible, treelines, woodland and mature trees shall be avoided and retained intact. Any existing mature trees adjacent to the works or construction sites to be retained will be protected from any accidental damage during construction through use of measures such as fencing. Protective fencing barriers will be installed as outlined in Section 6.2, Barriers and Ground Protection, of BS 5837. Measures will be taken to ensure that trees and hedges being retained are incorporated into the development without being impacted upon. Protective fencing will be provided around trees and

Potential Impact	Mitigation Measures
	hedge vegetation being retained and this will enclose their Root Protection Areas (RPAs). The fencing will be at least 2.3m. **Examination of trees for bats prior to felling:** The land-take of the proposed road shall be further examined to determine the potential for tree roosts prior to felling, to ensure any altered circumstances are identified prior to construction. If any trees are deemed to have high potential, these trees will be examined further either by a bat detector survey or by examination from a hoist, teleporter, tree access procedure. All bat roosts are protected and can only be removed once a licence to derogate is acquired from the National Parks and Wildlife Service by a bat specialist. Felling should only be undertaken following acknowledgement by a bat specialist that there are no bats within the trees for removal. Trees should ideally be felled in the period late August to late October, or early November, in order to avoid disturbance of any roosting bats as per *National Roads Authority* guidelines (NRA 2006) and also to avoid the bird breeding seasons. Tree felling should be completed by Mid-November at the latest as bats roosting in trees are very vulnerable to disturbance during their hibernation period (November – April). Trees with Ivy (*Hedera helix*) cover, once felled, should be left intact onsite for 24 hours prior to disposal to allow any bats beneath foliage to escape overnight. **Buildings** Pre-construction bat surveys of the dwelling scheduled for demolition at the proposed site shall be undertaken by a suitably qualified ecologist prior to the commencement of construction to determine the presence or absence of bats. In the event that no evidence of bat usage is found during the inspection, development can commence. Should bats be found, development will be delayed and a derogation license will be required from NPWS wildlife licencing section. **Landscaping** Loss of commuting and foraging habitat at the site will be mitigated by the landscaping proposals, which include retention of hedgerows and wooded areas within and immediately adjacent to the site, which will be protected from any accidental damage during construction through use of measures such as fencing. Protective fencing barriers will be installed as outlined in Section 6.2, Barriers and Ground Protection, of BS 5837. Measures will be taken to ensure that trees and hedges being retained are incorporated into the development without being impacted upon. Protective fencing will be provided around trees and hedge vegetation being retained and this will enclose their Root Protection Areas (RPAs). The fencing will be at least 2.3m. To mitigate for the loss of hedgerow and partial removal of woodland, substantial native tree planting will be established on the site. Large areas of open space will be maintained on the site, along with areas of wildflower meadow. The planting schemes shall ensure connectivity to linear/ woodland habitats in the wider landscape. Trees that are being retained at the site shall be protected during clearance and construction works in line with current guidelines e.g. British Standard 5837:2012 and National Roads Authority 2006a. **Provision of bat boxes** A number of bat boxes are proposed for erection in proposed woodland areas to be located adjacent to Ballyman Glen at the north of the site. The following bat boxes are proposed: 9x 1FF Schwegler Bat Box or Rocket Bat Boxes (which are pole mounted). ; Bat boxes should be erected on trees at a height no less than 3m from the ground and with no clutter below them. It is proposed that all boxes should be in a shaded area where temperatures do not fluctuate greatly. No bat boxes shall be illuminated intentionally or unintentionally. **Control of light pollution** Lighting within the proposed development site shall be installed with sensitivity for local wildlife while still providing the necessary lighting for human usage. This is particularly important for bat foraging/commuting habitat at the edge retained hedgerows, treelines and woodland habitats at the site. The following general principles, which accord with the relevant verified measures set out in the BCT Lighting Guidelines (BCT, 2018), shall be implemented: - • Lighting design shall fully consider the presence of protected species. Therefore, appropriate lighting shall be used within the proposed development and adjacent areas, with more sensitive lighting regimes deployed in wildlife sensitive areas (e.g. woodland edge and hedgerows).

Potential Impact	Mitigation Measures
	• Dark buffer zones shall be used to separate habitats or features from lighting by forming a dark perimeter around them. This shall be used for habitat features noted as foraging areas for bats (Berryfield Lane, woodland edge habitats). • Buffer zones will be used to protect dark buffer zones and shall ensure that light levels (levels of illuminance measured in lux) within a certain distance of a feature do not exceed certain defined limits. For key bat habitat, such as treelines along Berryfield Lane and planted woodland areas at the edge of Ballyman Glen SAC), there shall be an absence of artificial illumination. The buffer zone can be further subdivided into zones of increasing illuminance limit radiating away from the feature or habitat that requires to be protected. Luminaire design is extremely important to achieve an appropriate lighting regime. In order to mitigate any potential impacts on bats from lighting, the following verified mitigation measures will be implemented, as set out in the most recent BCT Lighting Guidelines (BCT, 2018). • All luminaires used will lack UV/IR elements to reduce impact. • LED luminaires will be used due to the fact that they are highly directional, lower intensity, good colour rendition and dimming capability. • A warm white spectrum (<2700 Kelvins is recommended to reduce the blue light component of the LED spectrum). • Luminaires shall feature peak wavelengths higher than 550nm to avoid the component of light most disturbing to bats. • The use of specialist bollard or low-level downward directional luminaires shall be implemented in bat sensitive areas to retain darkness above. • Column heights shall minimise light spill. The shortest column height allowed shall be used where practicable. • Only luminaires with an upward light ratio of 0% and with good optical control will be used. • Luminaires will always be mounted on the horizontal, i.e. no upward tilt. • Any external security lighting will be set on motion-sensors and short (1min) timers. • As a last resort, accessories such as baffles, hoods or louvres will be used to reduce light spill and direct light only to where it is needed.
Birds	No scrub clearance, tree felling or other removal of vegetation will occur during the bird breeding season from 1st March to 31st August
Spread of Invasive Species	The presence of invasive species has the potential to lead to an offence under the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011). Regulation 49 of the 2011 Regulations prohibits (unless under licence) the breeding, release, or allowing or causing the dispersal from confinement of any animal listed in the Third Schedule of the Regulations; or the planting, allowing or causing dispersal, and spreading of any plant listed in the Third Schedule. Japanese Knotweed is a plant listed in the Third Schedule. It is an offence to plant or encourage the spread of Japanese Knotweed by moving contaminated soil from one place to another, or incorrectly handling and transporting contaminated material or plant cuttings. Persons must therefore take all reasonable steps and exercise due diligence to avoid committing an offence under the 2011 Regulations. • Japanese Knotweed is present within the proposed Phase 1 lands at Fassaroe (Refer to **Figure 5.8** for specific locations). An Invasive Plant Species Management Plan has been prepared to accompany this planning application. • The contractor and Cosgrave Property Group Representative must ensure that the source locations for materials which are introduced to the site during the construction phase of the project are free from non-native invasive species.
Suspended Solids Pollution	The following guidelines for erosion and sediment control are largely based on Goldman et al (1986) and are particularly important to apply in sites immediately upstream of significant salmonid habitat. They shall be applied at the subject site as follows: • Sediment traps or settlement measures should be provided for on all watercourses during construction (See section 7.5.1.2 of Chapter 7 – Water Services, Hydrology and Drainage). • Top soil stripping in proximity to any watercourses should be undertaken as much as feasible in dry weather conditions and all stockpiles will be located greater than 100m from the watercourse. Stockpiles within 200m of the watercourses will be covered. • Re-vegetate stripped areas, particularly cut and fill slopes and disturbed slopes as soon as possible. Use mulches or other organic stabilisers to minimise erosion until vegetation is established on sensitive soils. • Installation of silt fences along the contour at the base of a disturbed area. This will be particularly important along the lower works extent line at the northern side of the site adjacent

Potential Impact	Mitigation Measures
	to Ballyman Glen. Regular inspection of silt accumulation at the base and remove as appropriate. • The length and steepness of slopes should be minimised where practicable. • Sediment basins and traps should be installed before any major site development, remediation and grading takes place. Additional sediment traps and silt fences should be installed as such works take place to keep sediment contained on site at appropriate locations. • Runoff-control measures should be located in conjunction with sediment traps to divert water from planned undisturbed areas away from the traps and sediment-laden water into the traps. • Guidelines for minimising impacts on water quality and fisheries in relation to Construction will be implemented including, but not limited to, CIRIA C532 "Control of water pollution from construction sites - Guidance for consultants and contractors", Inland Fisheries Ireland guidelines and TII guidelines. • It is recommended that the "Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites" (http://www.fishingireland.net/environment/constructionanddevelopment.htm) be consulted when planning to undertake works on this site. The maintenance of habitat integrity (both in-stream and riparian) is essential in safeguarding the ecological value of this important urban natural resource. The specific details of any works directly affecting watercourses or riparian habitats in the area, must first be submitted to IFI for assessment
Pollution With Other Substances	• Tools and equipment are not to be cleaned in County Brook (Fassaroe Stream) or Cookstown River. Water used for cleaning should not be disposed of in the County Brook or any other watercourse. • Chemicals/fuels used should be stored in sealed containers in the site lockup prior to use. • Chemicals shall be applied in such a way as to avoid any spillage or leakage. • Fuelling should take place in designated areas of hardstanding and not be conducted within 50m of the County Brook (Fassaroe Stream) or Cookstown River. • Spill kits should be made available close to the river and all staff will be properly trained on correct use. • To minimise any impact on the underlying subsurface strata from material spillages, all oils, solvents and paints used during construction will be stored within temporary bunded areas. Oil and fuel storage tanks will be stored in designated areas, and these areas will be bunded to a volume of 110% of the capacity of the largest tank/ container within the bunded area(s) (plus an allowance of 30 mm for rainwater ingress). Drainage from the bunded area(s) will be diverted for collection and safe disposal. • Machinery used on site should be regularly inspected to ensure there is no leakage from them and to ensure the machinery will not cause contamination of watercourses. All machinery operating in these locations should be steam-cleaned in advance of works and routinely checked to ensure no leakage of oils or lubricants occurs. • Raw or uncured waste concrete should be disposed of by removal from the site. • Wash down water from exposed aggregate surfaces, cast-in-place concrete and from concrete trucks should be trapped on-site to allow sediment to settle out and reach neutral pH before clarified water is released to the stream or drain system or allowed to percolate into the ground. • Waste oils and hydraulic fluids should be collected in suitable leak-proof containers and transported from the site and off-site areas for disposal or recycling. • Where required, fuel should be transported in a mobile, double skinned tank and a spill tray will be used when refueling (if taking place outside a compound area). • All areas of land that are to be used for site compounds and storage depots should be fenced off at a minimum distance of 50 metres from the watercourse.
Environmental Incidents and Accidents	• An emergency-operating plan should be established to deal with incidents or accidents during construction that may give rise to pollution within any watercourse. This shall include means of containment in the event of accidental spillage of hydrocarbons or other pollutants (including oil booms, soakage pads, etc. • Oil booms and oil soakage pads should be kept on site to deal with any accidental spillage.

5.5.4 Operational Phase

The following details the mitigation measures required to offset potential impacts of the proposed development during the operation phase.

The mitigation measures for each of the operational impacts detailed below shall be incorporated in their entirety into the construction contract documentation.

Table 5-20: Mitigation Measures for Potential Operational Phase Impacts

Potential Impact	Mitigation Measures
Petrifying Springs	Mitigation measures are as for the construction phase, detailed in **Table 5-19**.
Scrub, Woodland, Hedgerows and Treelines	No further specific mitigation measures are required.
Deer	No specific mitigation measures are required.
Otter	The measures outlined for the protection of water quality below and in **Table 5-19** will ensure that a sufficient level of mitigation is also afforded to otter.
Badger	Mitigation measures are as for the construction phase, detailed in **Table 5-19**.
Other non-volant mammals species protected under Schedule 5 Wildlife Act 1976 (as amended): hedgehog, Pine Marten, Red Squirrel.	No further specific mitigation measures are required.
Bat species	Mitigation measures are as for the construction phase, detailed in **Table 5-19**.
Birds	No further specific mitigation measures are required.
Spread of Invasive Species	No further specific mitigation measures are required.
Hydrology Changes	• When working on existing drainage systems, run-off shall be prevented from entering open drains or gullies or indeed open water sources. Temporary measures can be put in place at the outfall (or intersection with other drainage) to remove sediments and oil, such as a catch pit, sump or a geotextile screen, or the pipe/culvert can be temporarily blocked or diverted. • Slope gradients and earthen areas of the landfill facilities should be maintained and monitored regularly to ensure compaction of materials and reduce silt mobilisation towards the County Brook (Fassaroe Stream). • At the five historic landfill sites, surface water at finished ground level (e.g., on grassed areas, pathways etc.) will drain overland or through swales to the development's surface water drainage system. However, some infiltration of surface water will continue to occur through the soils overlying the capping system and will be managed independently in a subsurface drainage system. A leachate interceptor drain should be constructed on the downstream gradient perimeter of all sites to collect leachate that may seep or build up beneath the capping system. This is already provided for in the design proposals.
Hydrocarbons Runoff	• Run-off from the proposed distributor road during operation shall be channelled through the collection system and hydrocarbon interceptor by design. • A sustainable drainage system should be installed on the proposed new road which will prevent significant pollution to surface receiving waters.

5.6 Predicted Residual Impacts

5.6.1 Construction Phase Terrestrial Ecology

5.6.1.1 Ballyman Glen SAC and pNHA

Petrifying Springs and Alkaline Fen

The result of the recharge assessment conducted for the Environmental Risk Assessment (RPS, 2016) has highlighted that the capping of landfills is likely to reduce the current recharge to groundwater by up to 7% over the life of the development. The development may therefore have a minor negative impact on the springs and seepages supporting the tufa deposits identified within Ballyman Glen SAC due to reduced groundwater flow contribution. The reduced recharge is expected to result in a local drop in groundwater levels of approximately 0.3m. As a result, the potential drop in the top of the seepage face supporting the springs may drop by 0.3m; however, the tufa springs are not located at the top of the seepage face. Therefore, while the flow discharging from the springs may reduce by 7%, it is expected that they will continue to flow.

An assessment of the water quality has shown that the capping of the landfills will have a beneficial impact on the groundwater quality and could potentially lead to an increase in tufa deposition rates as the groundwater quality at existing springs improves. While there may be a reduction in flow from the springs, the improvement in water quality could lead to an increase in the tufa deposition rate and also an increase in the number of tufa deposits. The net potential impact on the springs is therefore considered to be a positive impact as a result of the reduced leachate seepage rate. Likewise, the areas of alkaline fen are not located at the top of the seepage face, therefore no loss of alkaline fen area or distribution is anticipated as a result of the proposed development. It is likely that there has been a negative impact to the quality of the groundwater feeding the area of alkaline fen as a result of historic landfill area 3A. As detailed previously, it is expected that the landfill remediation included in the project design of this proposal will have a positive impact on groundwater quality. Overall, no significant adverse residual impact on alkaline fen is anticipated as part of this proposal; the net potential impact on the alkaline fen is considered to be a positive impact as a result of the reduced leachate seepage rate.

Wet Woodland

The removal of wet woodland for the installation of the surface water outfall will be limited to an area of 0.026ha. It is anticipated that the canopy of the cleared area of wet woodland will close over naturally with time. In view of these factors, no significant residual impacts to wet woodland are anticipated.

5.6.1.2 Mixed Broadleaved Woodland and scrub

It is anticipated that the scrub and woodland cleared for the installation of the surface water outfall, edge of the capping and slope stabilisation works will regenerate naturally with time. Further, it is recognised that extensive planting of native tree species is proposed for the district park area of the proposed development, to comprise the planting of approximately 2,600 trees. The woodland planting areas comprise a total of 1.5ha Therefore, no residual impacts to mixed broadleaved woodland and scrub are anticipated.

5.6.1.3 Immature Woodland

The proposed cycle route connecting with Upper Dargle Road will require the removal of c.0.17ha immature woodland that has been planted adjacent to the western roundabout of Junction 6 and along the R918. In view of the extensive planting of native tree species that is proposed for the district park area of the proposed development, no significant residual impacts to immature woodland are anticipated. As noted previously, it is proposed to plant approximately 2,600 trees, with a total area of woodland planting of 1.5ha.

5.6.1.4 Hedgerows and Treelines

The proposed development will require the removal of c.1300m hedgerow and no tree lines.

The proposed landscaping plan includes for the following:

- Planting of 1,400 linear metres of hedgerow comprising native species

With the effective implementation of the proposed landscaping plan there will be a net gain of 100m hedgerow. There are no significant residual impacts on hedgerows and treelines.

5.6.1.5 Deer

There are no significant residual impacts on deer.

5.6.1.6 Otter

There are no significant residual impacts on otter.

5.6.1.7 Badger

The evidence gathered during the course of the surveys undertaken between 2015 and 2021 suggests that the site forms part of the territory of the local badger population, however the level of badger activity evidence across the site was relatively low. Nonetheless, there will be a long-term/ permanent disruption to movement across the line of the new distributer road to the west of the site, except where a crossing point has been provided. Badgers will also have a permanent reduction in foraging area as a result of the construction of the mixed housing development on Phase 1 lands. With the inclusion of road crossing point and the provision of the district park adjacent to Ballyman Glen, there will still be some permeability to badgers within the study area, but the construction of the development will result in a reduction in badger territory. Interaction between neighbouring badger territories may also be affected due to alterations in badger movements within the lands intersected.

5.6.1.8 Other Non-Volant Mammals

There are no significant residual impacts on other non-volant mammals.

5.6.1.9 Bats

With the effective implementation of mitigation measures there are no significant residual impacts on bats.

5.6.1.10 Birds

With the effective implementation of mitigation measures there are no significant residual impacts on birds.

5.6.2 Construction Stage -Aquatic Ecology

Following the full implementation of the mitigation measures described in **Section 5.5** it is anticipated that there will be no significant residual impacts on the aquatic ecology of the aquatic receptors near the proposed development area as a result of construction works.

5.6.3 Operational Phase- Terrestrial Ecology

5.6.3.1 Ballyman Glen SAC and pNHA

Petrifying Springs and Alkaline Fen

The residual impacts of the operational phase on petrifying springs and alkaline fen are as detailed for the construction phase in **Section 5.6.1.1**.

Wet Woodland

There are no significant residual impacts on wet woodland.

5.6.3.2 Mixed Broadleaved Woodland and Scrub

There are no significant residual impacts on woodland and scrub.

5.6.3.3 Immature Woodland

There are no significant residual impacts on immature woodland.

5.6.3.4 Hedgerows and treelines

There are no significant residual impacts on hedgerows and treelines.

5.6.3.5 Deer

There are no significant residual impacts on deer.

5.6.3.6 Otter

There are no significant residual impacts on otter.

5.6.3.7 Badger

The residual impacts of the operational phase are as provided for the construction phase in **Section 5.6.1.6**.

5.6.3.8 Other Non-Volant Mammals

There are no significant residual impacts on other non-volant mammals.

5.6.3.9 Bats

There will be a reduction in the dark areas of Fassaroe as a result of the development. This will reduce the feeding potential for species such as Whiskered bat and Brown Long-eared bat. While planting creates some compensation, it cannot address the overall alteration of light levels in the area.

5.6.3.10 Birds

There are no significant residual impacts on birds.

5.6.4 Operational Phase – Aquatic Ecology

It is not anticipated that the proposed development will involve any significant negative impacts to the aquatic receptors near the proposed development area (once recommended mitigation measures are followed) and therefore by extension there will be no significant residual impacts as a result of the proposed development.

5.7 Monitoring and Reinstatement Measures

It is essential to monitor bat boxes for their acceptance of use by bats and those boxes that remain unused two years after the date of erection should be relocated. Seasonal inspection of bat boxes should be undertaken (excluding mid-June to mid-August, the lactation period of females, where any disturbance at this time can be detrimental to survival of young) to monitor bat usage and in wintertime for general wear and tear and to remove droppings following use the previous summer. This should be undertaken by a licensed bat-handler.[11]

[11] National Roads Authority (2005): Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes. National Roads Authority, Dublin.

6 SOILS, GEOLOGY AND HYDROGEOLOGY

6.1 Introduction

This chapter describes the type of soils and geology and hydrogeology likely to be encountered beneath and in the general area of the proposed development. It also addresses the potential impact of the proposed development on soils, geology and hydrogeology together with the mitigation measures that will be employed to eliminate or reduce any potential impacts.

The site is currently used for agricultural purposes with residential housing located in the surrounding areas. This proposed development comprises the construction of 650 no. housing units on a ca. 80.16 ha Site at Fassaroe, Bray, Co. Wicklow in addition to the remediation of 5 no. historic landfills. A detailed description of the proposed development is presented in Chapter 2 - Project Description.

6.2 Methodology

The following section outlines the legislation and guidelines considered, and the methodology for preparing this chapter.

6.2.1 Study Area

The study area comprises of the red line boundary shown on the MCORM Architects planning application drawing PL03 lodged as part of the planning application.

6.2.2 Relevant Legislation and Guidance

This assessment has been completed in accordance with the EIAR guidance and the relevant best practice guidance from the following:

- Institute of Geologists of Ireland, '*Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements*' (IGI, 2013); The IGI guidance document is an updated version of the 2002 guidelines, '*Geology in Environmental Impact Statements, A Guide'* (IGI, 2002), which was revised to take account of legislative changes, and the operational experience developed by geoscientists in the production of relevant environmental assessments;
- '*Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes'* by the Transport Infrastructure Ireland (TII) formerly National Roads Authority (NRA) (TII, 2009)
- Environmental Protection Agency (EPA) (2015) '*Revised Guidelines on the Information to be contained in Environmental Impact Statements'*;
- Environmental Protection Agency (EPA) (2015) *'Advice Notes on Current Practice (in the Preparation of Environmental Impact Statements)*';
- Environmental Protection Agency (EPA) (2017) *'Guidelines on the Information to be contained in Environmental Impact Assessment Reports – Draft*';
- European Commission (2017) Environmental Impact Assessment of Projects; Guidance on the preparation of the Environmental Impact Assessment Report; and,
- Department of Housing, Planning and Local Government (DHPLG) (2018) Guidelines for Planning Authorities and an Bord Pleanála on carrying out Environmental Impact Assessment.

6.2.3 Scope of Works

The following scope of works were undertaken by Atkins (Land, Soils & Geology Sections) & AWN Consulting Limited (Hydrogeology Sections) in order to complete the land, soils, geology and hydrogeology assessment presented in this chapter:

- Desk-based study including review of available historical information. This desktop study was carried out prior to the site walkover in order to determine the baseline conditions of the study area to obtain relevant background information. The desk-based study involved reviewing information from the following sources:
  - GSI Datasets Public Viewer and Groundwater webmapping (consulted 23rd August 2021, 08th September 2021);
  - EPA Public Viewer and webmapping (consulted 08th September 2021, 31st March 2022);
  - Ordnance Survey webmapping to assess the surface topography and landforms (consulted 13th March 2022, 31st March 2022);
  - Directory of Active Quarries, Pits, and Mines in Ireland, GSI 2014; and,
  - Memoir of Localities of Minerals of Economic Importance and Metalliferous Mines in Ireland, The Mining Heritage Society of Ireland, 1998;
- Site Walkover Survey by an experienced Geo-environmental Scientist in September 2021;
- Reviewing and obtaining the relevant information from the previous completed Ground Investigation Reports. A number of ground investigations have been completed in the vicinity and surrounding area of the proposed site and are included in the sources of information and reports used in the preparation of this chapter of the EIAR, as listed below and included in Appendices and / or the application documentation:
  - Bray Western Environs Soil Infiltration Test Report, Geoenvironmental Environmental Consultants, March 2015 (Appendix 6C);
  - Warehouses & Ancillary Offices Geotechnical Interpretative Report, Atkins, October 2002 (Appendix 6D);
  - Proposed Development at La Vallee, Fassaroe Geotechnical Investigation, Glover Site Investigations Ltd, September 2001 (Appendix 6E);
  - M11 Fassaroe Interchange Preliminary Geotechnical Investigation, Glover Site Investigations Ltd, May 2000;
  - Fassaroe Development – Geotechnical Interpretative Report Proposed Overbridge at M11 Interchange, Atkins McCarthy, 21 June 2001 (Appendix 6F);
  - Fassaroe Historic Landfill Environmental Risk Assessment, RPS 2018 (EIAR Volume 3 Part 3);
  - Fassaroe Historic Landfill Gas Management Strategy, RPS, August 2021 (application documentation) ;and
  - Fassaroe Historic Landfill Remediation Strategy Report, RPS, March 2022 (application documentation).
- The following sources of information were also used:
  - Soil Infiltration Test Report, Geoenvironmental Environmental Consultants, March 2015;
  - Cosgrave Property Development Fassaroe Historic Landfill – Environmental Risk Assessment, Atkins, 15 June 2010;
  - Fassaroe Historic Landfill Environmental Risk Assessment, RPS, 03 June 2016;
  - Fassaroe Historic Landfill Gas Management Strategy, RPS, August 2016;
  - Fassaroe Historic Landfill Remediation Report, RPS, August 2016; and,
  - Engineering Report – Fassaroe Phase 1 Development, Atkins, July 2016.

6.2.4 Assessment Criteria

This chapter evaluates the effects, if any, which the proposed development will have on Land, Soils, Geology and Hydrogeology as defined in the Environmental Protection Agency (EPA) '*Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports'* (EPA, 2017) as well as in line with Article 94 and Schedule 6 of the Planning and Development Regulations 2001 (as amended) and Article 5 and Annex IV of the EIA Directive (2011/92/EU, as amended). The Draft EPA document entitled '*Advice Notes for Preparing Environmental Impact Statements'* (EPA, 2015) is also followed in this geological and hydrogeological assessment and classification of environmental effects. Due consideration is also given to the guidelines provided by the Institute of Geologists of Ireland (IGI) in the document entitled '*Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements'* (IGI 2013). Finally, the document entitled 'Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes' by the Transport Infrastructure Ireland (TII) formerly National Roads Authority (NRA) (TII, 2009) is referenced where the methodology for assessment of impact is appropriate.

The impact assessment has been undertaken in accordance with EPA guidance on the preparation of an EIAR and the IGI guidance (IGI, 2013) which outlines the following elements:

- Initial Assessment;
- Direct and Indirect Site Investigation & Studies;
- Rating of the hydrogeological attribute(s) on the proposed development site;
- Mitigation Measures, Residual Impacts and Final Impact Assessment; and,
- Completion of the Soils and Geological Sections of the EIS (now referred to as EIAR).

The TII (2009) criteria for rating the magnitude and significance of impacts on the geological related attributes and the importance of hydrogeological attributes at the site during the EIA stage are also relevant in assessing the impact and are presented in Tables 1-5 in **Appendix 6A**.

6.3 Receiving Environment

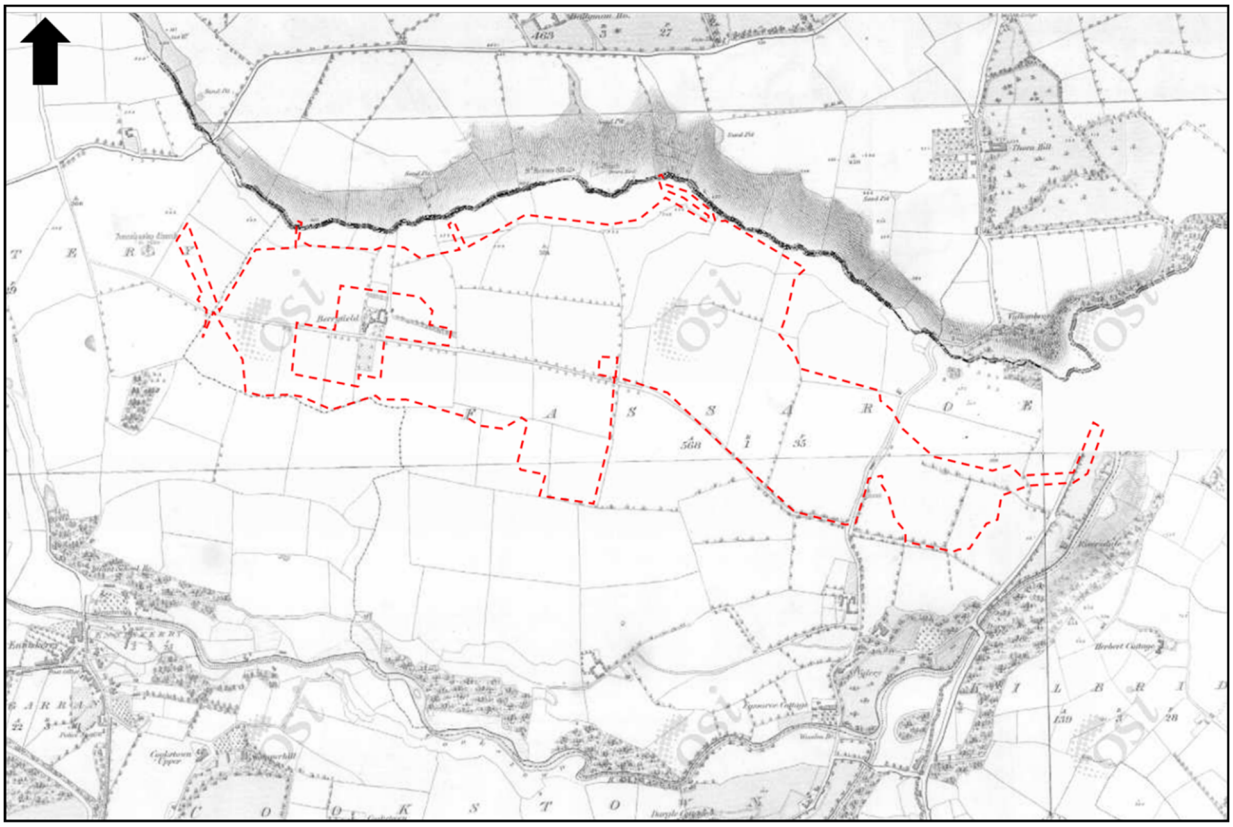
6.3.1 Soils and Geology

This section provides a description of the soils and geology in the general region of the proposed development and also takes account of the current and historic uses of the proposed development (hereafter referred to as the Site).

6.3.1.1 Site Development

A review of historic maps and aerial photographs from the Ordnance Survey of Ireland (OSI, 2021) has been carried out. This consisted of a review of 6 inch and aerial maps from 1837 through to present day. The mapping shows changes in residential, commercial and industrial uses on the surrounding areas in Bray and Enniskerry whilst the current land use of the proposed development site is largely agricultural, arable farming and grazing, and there is largely a rural aspect to the site.

Figure 6-1: Ordnance Survey 1837-1842 (OSI, 2022))

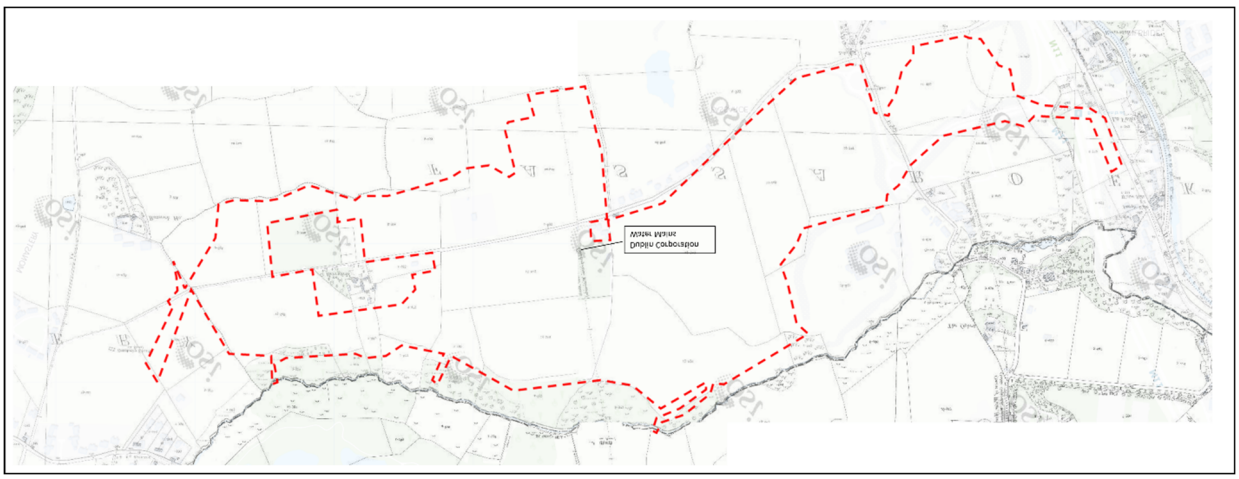


1837-1842 (OSI, 2022))

The area is comprised predominately of agriculture fields. Annabasky Church (in ruins) is identified to the west of the proposed development and Berryfield house is shown in the middle of the proposed development. The County Brook stream flows north, the Dargle River flows to the east and the Glencullen River flow to the south of the site. Further north of the County Brook stream there are 5 sand/gravel pits. St Kevin's Well, a church and graveyard are also noted to the north of the stream.

The general surrounding area is agricultural.

Figure 6-2: Ordnance Survey 1888-1913 (OSI, 2022))

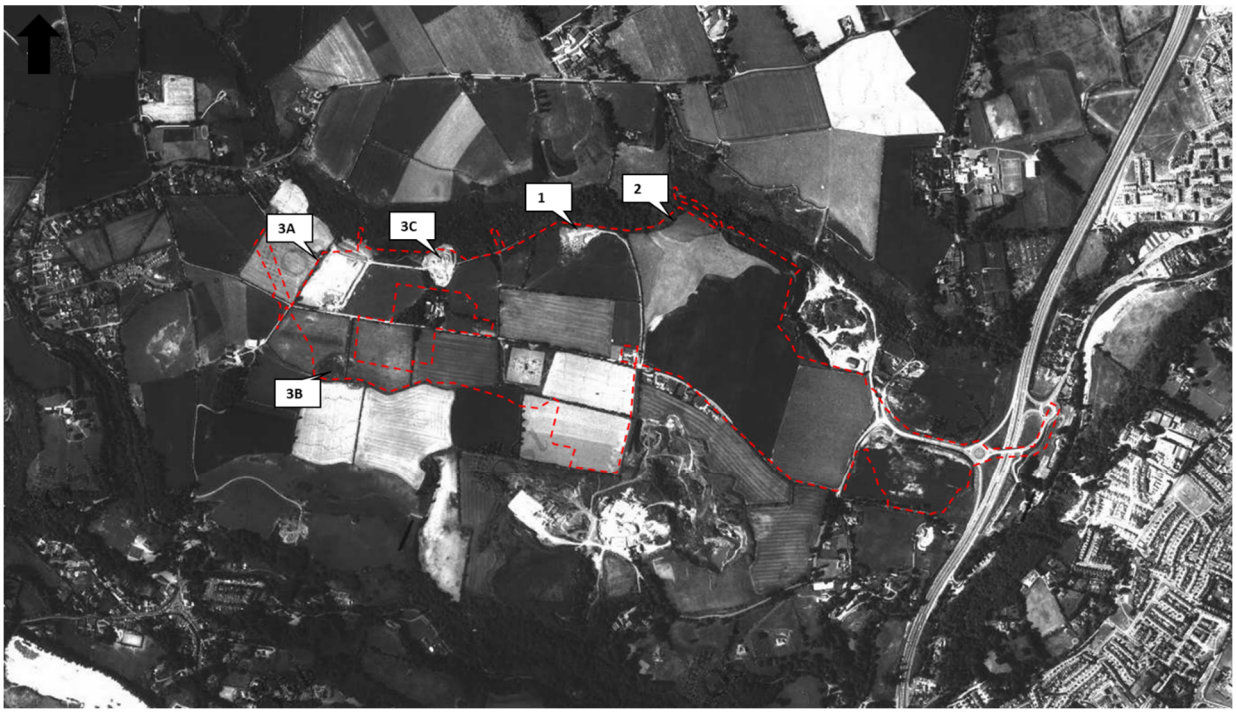


1888-1913 (OSI, 2022))

The land is predominately agricultural with a development of a forest north of the proposed development. There are a number of agricultural buildings still shown beyond the east of the Site surrounded by a forested area.

A Dublin Corporation watermains is shown to run on a north south axis through the centre of the site.

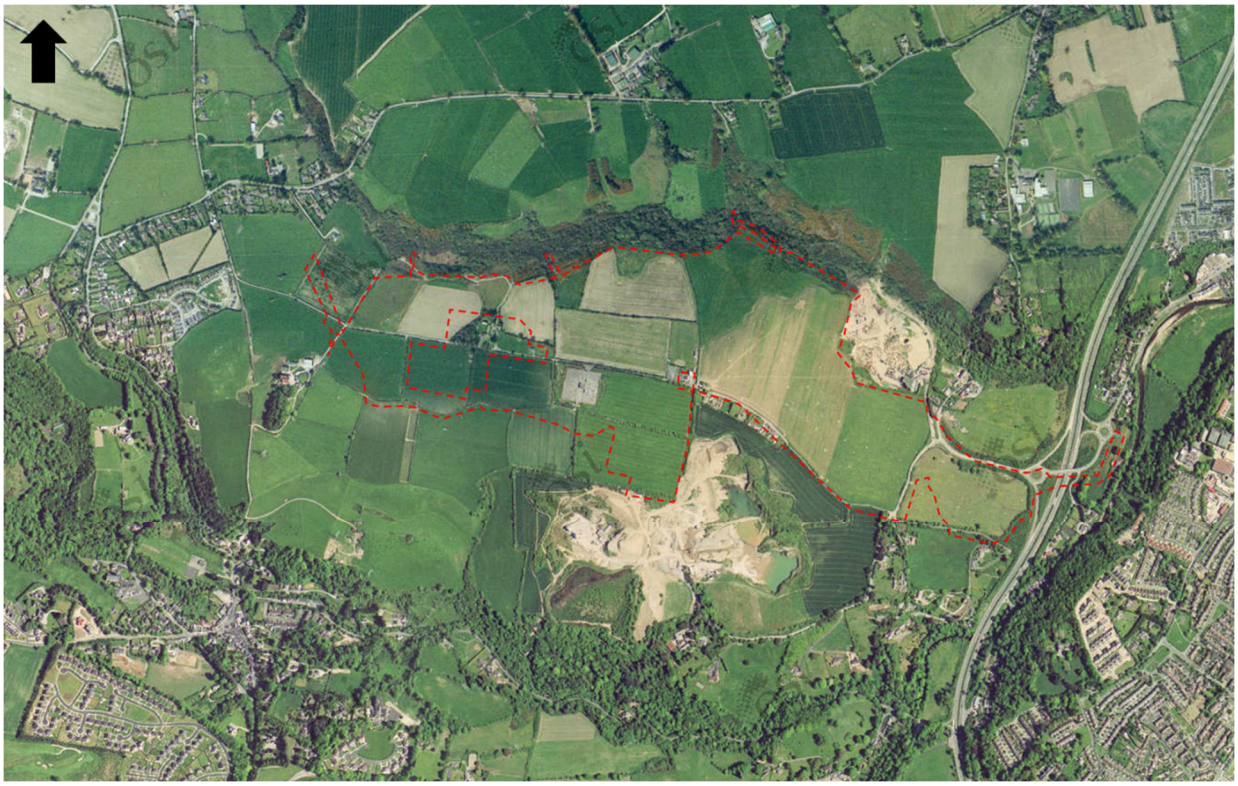
Figure 6-3: Various Aerial Photos 1995 – 2022 (OSI,2022, Google Maps, 2022)



1995 (OSI, 2022))

The 1995 aerial maps show residential housing along the Berryfield Lane and Ballyman Road in addition to an ESB substation. The N11/M11 Motorway runs adjacent to the eastern extent of the overall development site. There is a quarry to the south of Berryfield lane on land operated by Roadstone Limited. There are what appears to be 5 areas of worked ground within the boundary of the proposed site. These areas appear to be the location of what are now known as historic landfill 1, 2, 3A and 3C on the boundary of the Ballyman Glen SAC and pNAH and, historic landfill 3B south of Berryfield lane. Vegetation cover appears to be establishing over historic landfill 2 and 3B. An ESB substation (Fassaroe 110 kV sub-station is present within the middle of the proposed development. To the northeast of the site a gravel pit is present, this facility was closed in 2003 and is now an EPA licensed Integrated Waste Management Facility operated by Greenstar Limited.

The development of Bray town to the east and Enniskerry town to the south of the proposed development is shown.



2000 (OSI, 2022)

Minor changes are noted on the 2000 aerial maps. The historic landfill sites are grassed over.

2005 (OSI, 2022)

The 2005 maps show the development of the Dun Laoghaire Golf Course north of Ballyman Glen. Some quarry remediation works have been carried out by Roadstone to the south of the site.

2012 (OSI, 2022)

Bray and Enniskerry village continue to expand.

Current Aerial Map (Google, 2022)

Bray and Enniskerry village continue to expand. The construction of 2no. roundabouts at the eastern end of the proposed development is visible. Dun Laoghaire Golf Course north of Ballyman Glen is established. Greenstar Integrated Waste Management Facility shows development.

6.3.1.2 Site Topography

A Site walkover survey was carried out on 24th September 2021. Weather conditions were dry and sunny. The land form generally falls from ca. 100mOD in the west to ca. 30mOD to the east of the site. The Site is currently in agricultural use, a combination of arable crops, vegetable crops and grassland. The historic landfill areas were very overgrown with grass and other rough vegetation and no waste was noted on the surface.

6.3.1.3 Soils

The Teagasc soil maps (GSI 2021) indicate that the soil underlying the proposed Site comprises of shallow well drained mineral (mainly basic) soils. Alluvial soils associated with the Ballyman Glen and the County Brook stream to the north of the site as shown on **Figure 6-1** below. The GSI quaternary sediments maps (GSI 2021) indicate that the superficial deposits beneath the site are gravels derived from limestone as shown on **Figure 6-2** below. Alluvium is indicated along the Ballyman Glen to the north of the site. The access road to the east of the site also crosses an area of alluvium.

Figure 6-4: Teagasc Soil Maps (GSI 2021)

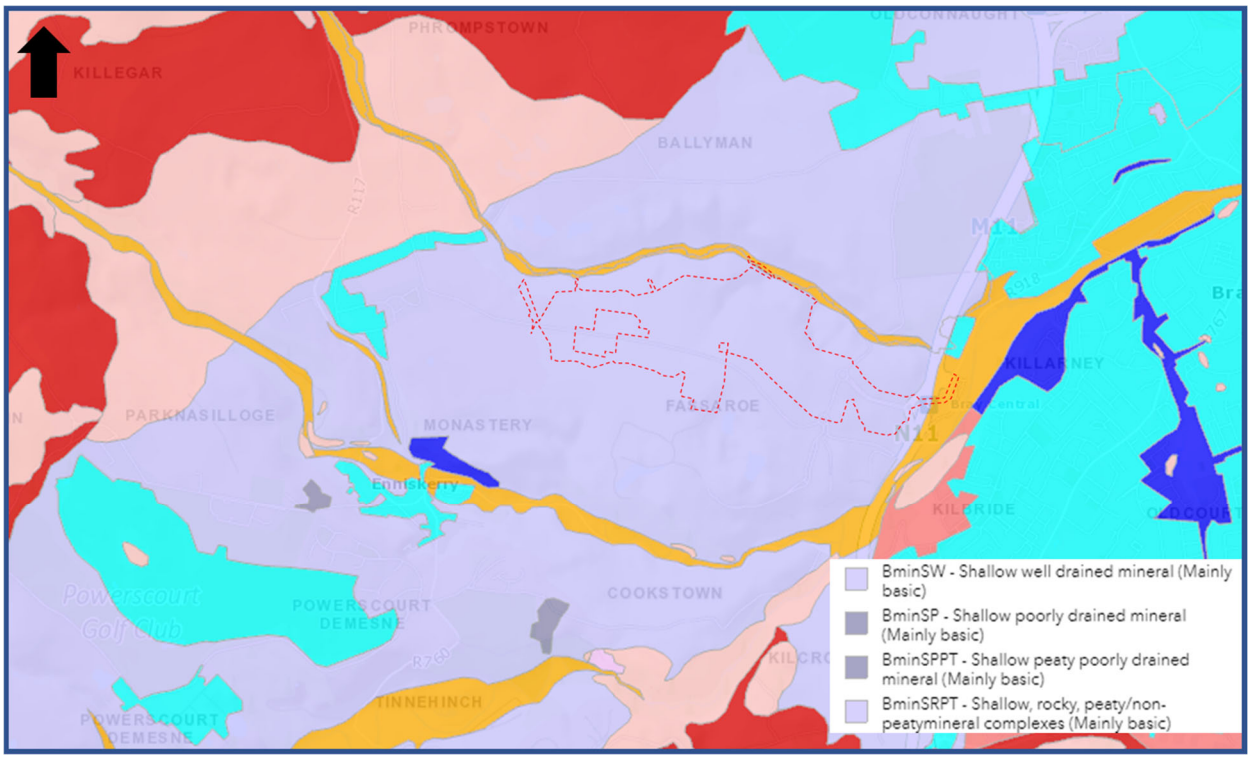
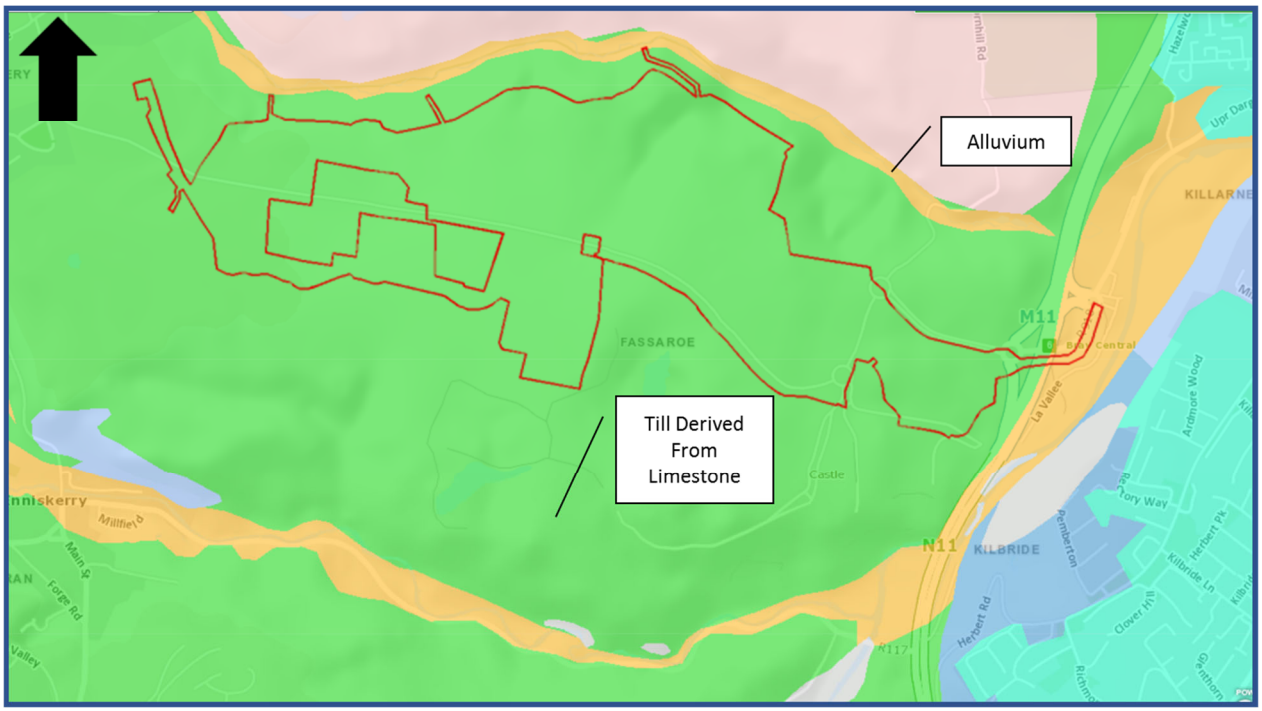


Figure 6-5: Quaternary Sediments (GSI 2021)



A number of site investigations were conducted at and near the proposed development site over the last 20 years. Based on the data from these site investigations, the thickness of overburden across the site extends to >25m bgl, but becomes shallow to the east near the N11/M11 where bedrock is encountered at 5.6m.

Ground Investigations were carried out in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:2015. The drawing in **Appendix 6B** shows the combined locations of the ground investigation data points (boreholes and trial holes). A brief overview of the ground investigations (for which reports are available) is provided below along with a summary of the key findings.

Bray Western Environs (Refer to Appendix 6C)

Site investigations were carried out in March 2015 for the Bray Western Environs across the proposed development for a proposed roadway. This comprised of 14no. trial pits (TP01-TP14) excavated to a depth of between 1.5 – 2m deep.

M11 Interchange SI (Refer to Appendix 6F)

In May 2000, Glover Site Investigations Ltd carried out a site investigation on behalf of Atkins McCarthy for a proposed interchange to access the Fassaroe development lands – '*Fassaroe Development, Geotechnical Interpretative Report Proposed Overbridge at M11 Interchange*', Atkins McCarthy, 21 June 2001 and '*N11 Fassaroe Interchange Preliminary Geotechnical Investigation*', Glover Site Investigations Ltd, May 2000. The site investigation (S.I.) consisted of:

- Three percussive boreholes – BH101, BH102 and BH103. BH101 was drilled to 9m; BH102 to 6.5m; and BH103 to 7.8m but extended to 13.8m using rotary coring drilling techniques;
- Eleven trial pits – TP101 to TP111. These were excavated to a maximum depth of 3.2m;
- Installation of piezometers into each of three boreholes; and,
- Soil testing using in-situ techniques and laboratory analyses.

The findings from the SI indicated:

- Made ground (fill) consisting of clayey gravel and cobbles and ranging in thickness up to 2.5m;
- Alluvium deposits underlie the made ground. It consists of firm clay with silt and layers of gravel. The thickness increases towards the Dargle River from 0.5m to 4.1m;
- Glacial sand and gravel underlie the alluvium. These deposits consist of medium dense slightly gravelly sand and medium dense of dense gravel with cobbles. Thickness varies, as a result of river erosion, up to 4m;
- Bedrock, consisting of sandstone and slate, was encountered at depths of between 5.6m and 7.0m. The bedrock was recorded as weak to moderately weak to the depths drilled; and,
- Groundwater levels, as recorded in piezometers, lie at/near the interface of the glacial gravels and bedrock.

Warehouses & Ancillary Offices SI (Refer to Appendix 6D)

In November/December 2001, IGSL carried out a site investigation (SI) on behalf of Atkins for a development proposed at the time of warehouses and offices at the Fassaroe development lands – '*Warehouses & Ancillary Offices Geotechnical Interpretative Report'*, Atkins, October 2002. The SI consisted of:

- Fifteen (15) percussive boreholes – BH401 to BH415, drilled to depths of between 4.1m (BH403) and 19.4m (BH415). Two boreholes were re-drilled using rotary drilling techniques to depths of 17m and 30.1m;
- Forty-one (41) trial pits – TP401 to TP441. These were excavated to a maximum depth of 5.6m;
- A total of 5no. groundwater monitoring standpipes were installed in boreholes BH402, BH408, BH410, BH414 and BH415;
- Installation of piezometers into five boreholes; and,
- Soil testing using in-situ techniques and laboratory analyses.

The findings from the SI indicated:

- Made ground (fill) consisting of clayey gravel and cobbles and ranging in thickness up to 2.5m;
- Fluvial silts, sands and gravel in a variable and complex sequence;
- Grey boulder clay (lodgement till) was found to underlie the entire site; and,
- Bedrock was found at depths of between 20m and 40m across the site and consists of shale (tentatively proven in only one borehole).

July-August 2001 La Vallee SI (Refer to Appendix 6E)

In July/August 2001, Glover Site Investigations Ltd carried out an SI on behalf of Atkins McCarthy along the western banks of the Dargle River at the Fassaroe development lands – '*Proposed Development at La Vallee, Fassaroe Geotechnical Investigation – Report 4184'*, September 2001. The SI consisted of:

- Two (2) rotary boreholes – BH41 and BH43, drilled to depths of 8.1m and 5.45m, respectively;
- Fourteen (14) trial pits – TP40 to TP42 and TP44 to TP54. These were excavated to a maximum depth of 3.2m;
- Installation of piezometers into each of the two boreholes; and,
- Soil testing using in-situ techniques and laboratory analyses.

The findings from the SI indicated:

- Medium dense to dense silty sandy gravel and boulders to depths of up to 5.1m;
- Stiff brown sandy gravely clay with cobbles (lodgement till) to depths of 8.1m; and,
- Bedrock was not recorded.

January-March 2016 Historic Landfills SI (See Environmental Risk Assessment Report (RPS 2018 - EIAR Volume 3 Part 3)

In January-March 2016, Priority Geotechnical Ltd carried out a SI on behalf of RPS at five historic landfill areas within the Fassaroe development lands – 'Fassaroe Historic Landfills, Site Investigations, Factual Report', 27 May 2016. The SI consisted of:

- Fifty-five (55) rotary boreholes – LG01 to LG16 and LG18 to LG20 (eight of these coincide with cable percussion boreholes); BH01, BH03 to BH11 and BH13; and G01 to G25, drilled to depths of between 6.0m and 35.0m;
- Ten (10) cable percussion boreholes – LG02, LG04, LG07, LG10, LG11, LG14, LG15, LG17, LG19 and LG21, drilled to depths of between 0.5m and 10.7m;
- Twenty-eight (28) trial pits – TP01 to TP28. These were excavated to a maximum depth of 4.5m;
- Installation of piezometers into each of the 57 No boreholes; and,
- The installation of twenty-one (21) combined gas/leachate monitoring boreholes, twenty-five (25) gas monitoring boreholes and eleven (11) groundwater monitoring.

The findings from the SI indicated:

- Domestic-type waste to depths of up to approximately 19m;
- Natural material encountered typically consisted of sand and gravel, with lesser clay;
- Leachate and landfill gas are present at the site in the vicinity of each of the five historic landfill sites identified;
- Bedrock was not recorded; and,
- No significant evidence of contamination was identified outside the identified landfill areas.

The regional geological descriptions were verified by Site-specific ground investigation. Site specific soils records, as observed during the ground investigation, were relatively consistent and are summarised as follows;

- Topsoil was encountered at all locations across the Site and ranged from 0.2 to 0.4 meters below ground level (m bgl) across the Site;
- Till encountered across the Site has been described as firm to very stiff sandy gravelly silty clay with isolated pockets of sand and gravel. Depth of till was generally encountered to depths of 1.8 to 3.6m bgl.;
- Till is generally underlain by sands and gravels encountered up to 25m bgl;
- Bedrock encountered to the east of the site adjacent to the N11 at ca. 6m bgl; and
- There are 5 no. historic landfills within the development site with waste encountered up to 16m bgl.

Site-specific geological cross-sections have been prepared showing the general soil and rock profile for the Site and are presented in **Figure 6-3** and **Figure 6-4** below.

Figure 6-6: Cross Section A-A'

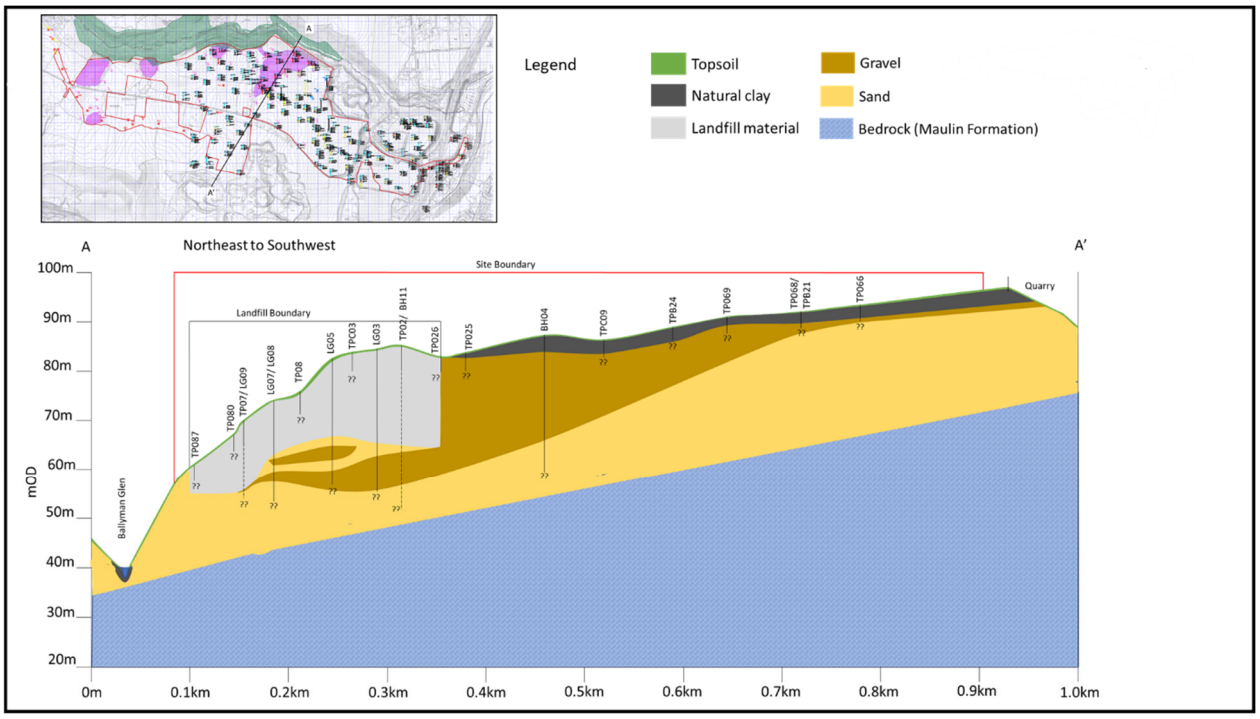
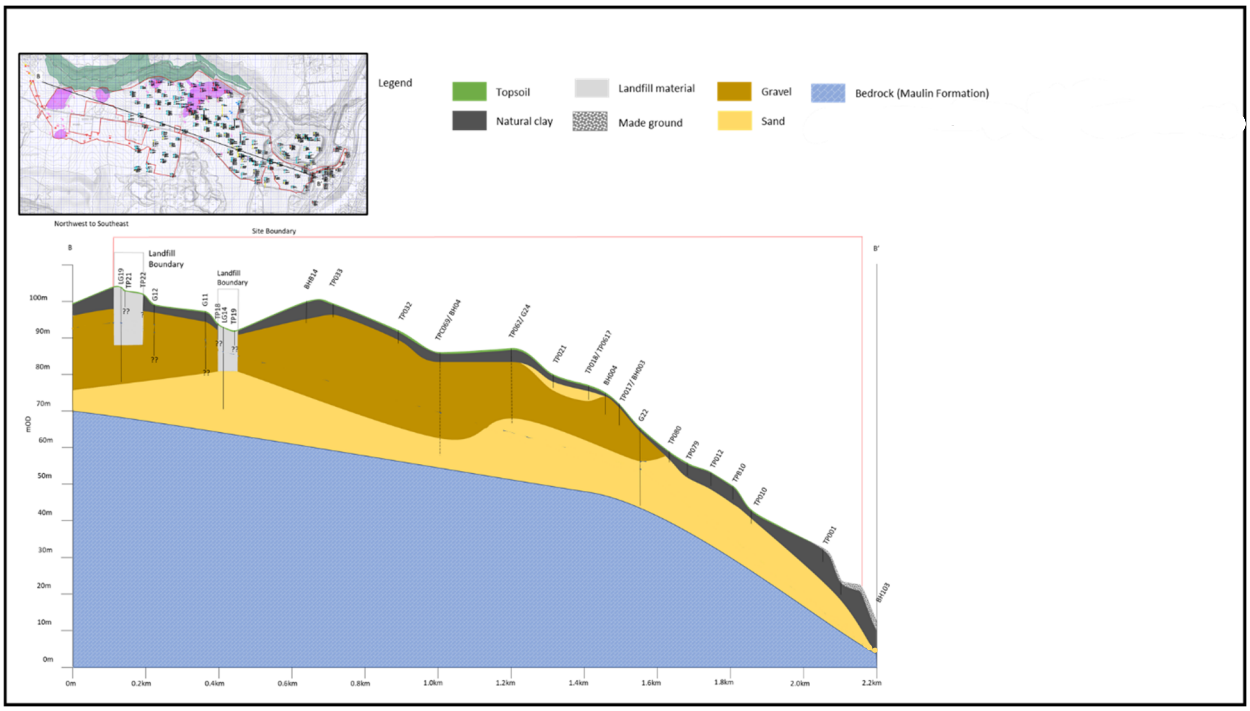


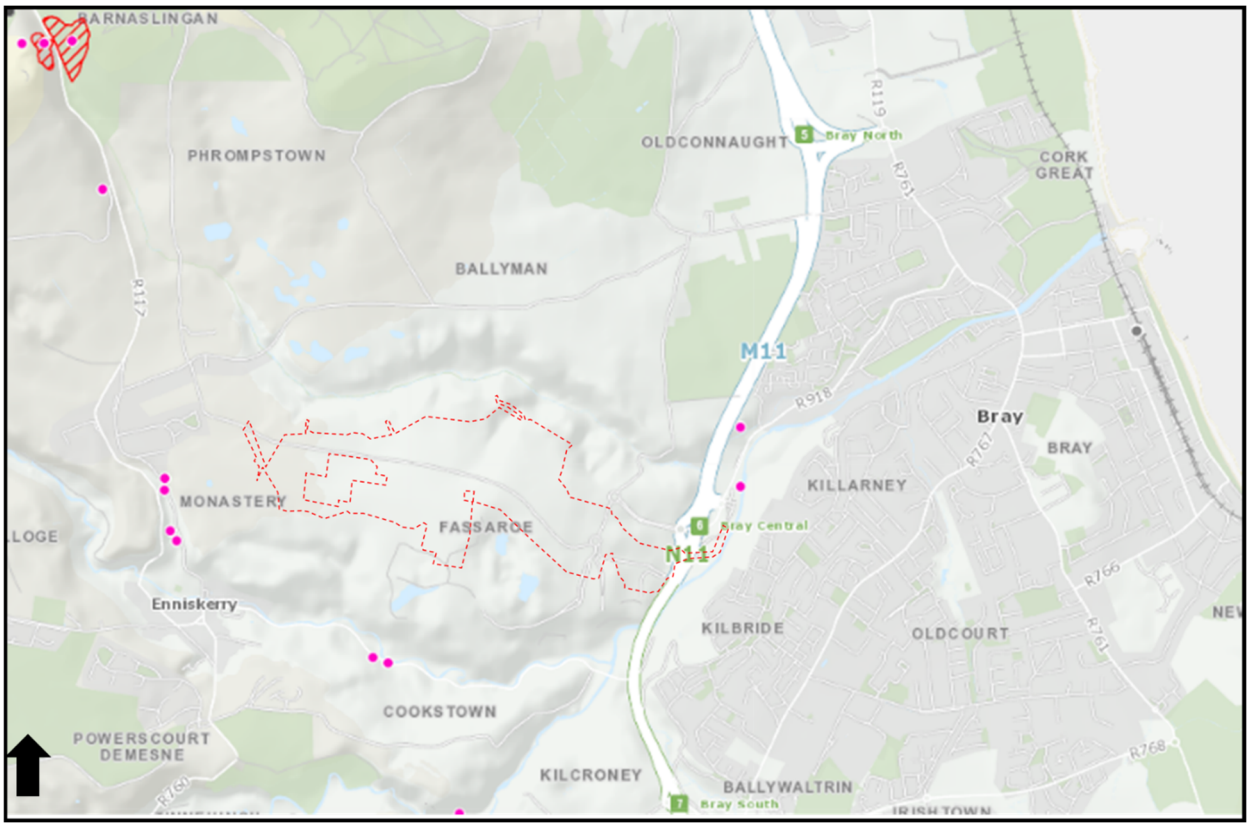
Figure 6-7: Cross Section B-B'



6.3.1.4 Landslide Susceptibility

The published maps do not indicate any occurrences of landslide events within the site. There is one landslide event noted immediately east of the development site as shown on **Figure 6-5** below. This is recorded as an undetermined event adjacent to the River Dargle (GSI 2021) and is outside the site boundary.

Figure 6-8: Landslide Events (GSI 2021)



4 no. areas of landslips and potential future landslips have been identified to the north of landfill site 2. Stabilisation of these areas will be incorporated in the remediation of landfill site 2 which is outlined in Chapter 2 of this report, Volume 3 Parts 3 and 4 of the EIAR and the Historic Landfill Remediation Strategy Report and Gas Management Strategy lodged as part of the current application documentation.

6.3.1.5 Contaminated Land / Soil Quality

Fassaroe Historic Landfills

Historic land uses in parts of the proposed site, including the Phase 1 site, have the potential to cause soil and groundwater contamination. It is known that parts of the site have been used for landfilling domestic waste.

RPS Carried out an Environmental Risk Assessment Report (RPS 2018) (included in **Volume 3 Part 3** of this EIAR. The report states as follows:

> *"From a review of the register compiled in accordance with Section 22 of the Waste Management Act 1996 as amended (the Act) and presented in the Eastern Midlands Region Waste Management Plan 2015 – 2021, Wicklow County Council (WCC) have registered four Historic Unregulated Local Authority Landfills located within lands presently in the ownership of Cosgrave Developments at Fassaroe, Co. Wicklow*
>
> *…An additional historic landfill (Site 1) is also located within Cosgrave Development's ownership… with reference made to such in WCC's report entitled 'Tier 2-3 Environmental Risk Assessment Landfills No. 3A and 3C - Wicklow County Council, December 2012 (amended April 2013)' which states: Between the early-1970s and the mid-1990s, Wicklow County Council operated a number of municipal landfills in the Fassaroe area, to the west of Bray, in north County Wicklow. Four landfills were sited on the northern side of Berryfield Lane with a fifth small landfill located to the south of the road."*

Areas identified as having been used historically for waste disposal are shown on **Figure 6-6** below. These 5 No. historic landfill sites (Site 1, 2, 3A, 3B and 3C) are located generally within the northern part of the site with Site 3B located along the route of the proposed east west road at the western half of the site. 4no. of the landfills are located adjacent to the Ballyman Glen which is a designated Special Area of Conservation (Site Code: 000713).

As part of the 2018 Environmental Risk Assessment, a site inspection was completed on the 12th of October 2015. A series of site investigations were carried out which identified municipal waste to depths of up to 19m, landfill gas and leachate. Sampling confirmed that groundwater quality has been impacted from the landfilling activities, which has in turn impacted the quality of the receiving surface water bodies. The extent of groundwater contamination was found to be limited to within approximately 50m from the waste bodies – i.e., a recovery of groundwater quality is seen at distances of 50m from the waste. The Risk Assessment states;

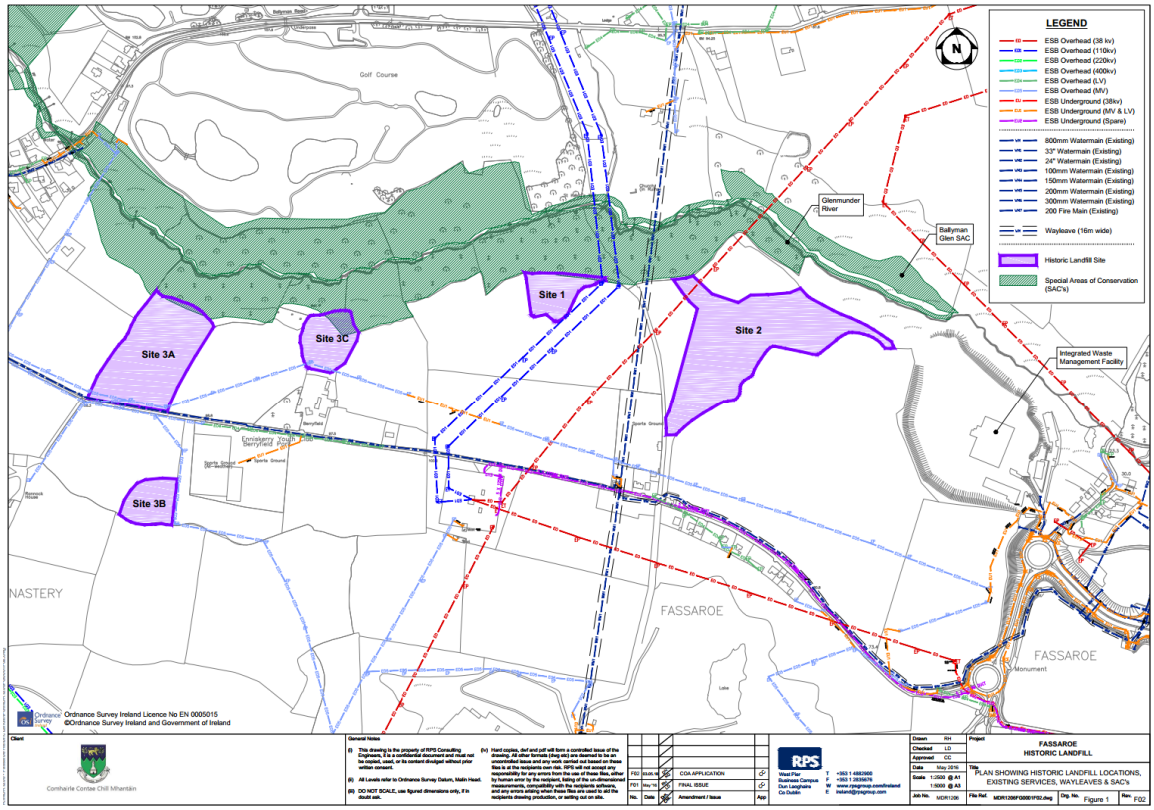
> "*Olfactory evidence of landfill gas was noted at Site 3A and 3C. Vegetative die back was notable in Sites 2 and 3B with Sites 1, 3A and 3C showing notable signs of ground disturbance. Visible evidence of waste was noted in the northern margins of Site 2 where erosion has taken place on the slopes leading to the river valley"* (RPS, 2018).

From the RPS risk assessment the landfills were assigned a risk ranking as follows based on the EPA Code of Practice Environmental Risk Assessment for Unregulated Waste Disposal Sites (EPA 2007):

- Site 1 - Low Risk;
- Site 2 - High Risk;
- Site 3A - High Risk;
- Site 3B - Low Risk; and,
- Site 3C – Moderate Risk.

A landfill Certificate of Authorisation was granted in 2019 (subject to conditions) to Wicklow County Council by the EPA for 4no. of the landfills (2, 3A, 3B and 3C) in accordance with Regulation 7(6) of the Waste Management (Certification of Historic Unlicensed Waste Disposal and Recovery Activity) Regulations, 2008 (See **Volume 3 Part 2** of this **EIAR**). Landfill site 1 is exempt from the within regulations as it was closed before 1977.

Figure 6-9: Historic Unregulated Landfills (RPS, 2018)



EPA and Local Authority Facilities

EPA and local authority waste and industrial licenced and permitted facilities are identified within **Figure 6-7** below.

On a regional scale, there are 2no. Environmental Protection Agency (EPA) licenced facilities adjacent to the proposed development; Fassaroe Waste Recovery Facility (W0269-01) and Integrated Waste Management Facility (W0053-03). Refer to Figure 6.7 (EPA, 2022).

Fassaroe Waste Recovery Facility (W0269-01), a former quarry, operated by Roadstone Limited is located south of the proposed development. This facility is licensed to accept a maximum of 550,000 tonnes per annum of soil and stones which will be used to fill the quarry void and restoration of the landscape to its initial pre-extraction level. It is also licenced to accept 20,000 tonnes per annum of construction and demolition waste to be recycled to produce secondary aggregates, which will be mainly sold for further use off-site. Some of the secondary aggregates will be used on site to construct roads. According to the EPA licence '*the total estimated amount of soil and stone to be backfilled is approximately 750,000 tonnes over an estimated period of 6 years.'* The main EPA licensed activities at the Waste Recovery Facility are as follows:

- *'The principal activity is the recycling or reclamation of inorganic materials'*
- *The restoration of the sand and gravel quarry using soil and stones; and*
- *The operation of a construction and demolition waste recycling operation'* (EPA Licence W269-01).

Integrated Waste Management Facility (Bray Depot) (W0053-03) formerly operated by Greenstar but now operated by Panda Waste is located north east adjacent to the proposed development. This facility is licensed to accept a maximum of 200,000 tonnes per annum comprising of household waste, commercial waste, construction and demolition waste and hazardous waste. The main EPA licensed activities at the Soil Recovery Facility are as follows:

- '*Bulking of municipal solid waste prior to transfer off site for disposal;*
- *Composting, wood shredding, processing/storage of dry recyclables;*

- *Recovery of construction and demolition waste; and,*
- *Acceptance of waste at a civic waste facility to include acceptance of hazardous waste such as bonded asbestos waste, WEEE and chlorofluorocarbons'* (EPA License W0053-03).

There is a very low likelihood of short term negative impact from the adjacent waste facilities.

Surrounding land-use in the vicinity of the Site is described as follows. There are 2 no. Integrated Pollution Control (IPC) licensed EPA facilities, 1no. EPA waste licenced site and 2 no. local authority waste facilities within 5km of the proposed development. There are no Seveso (COMAH) establishments within 15km of the proposed development.

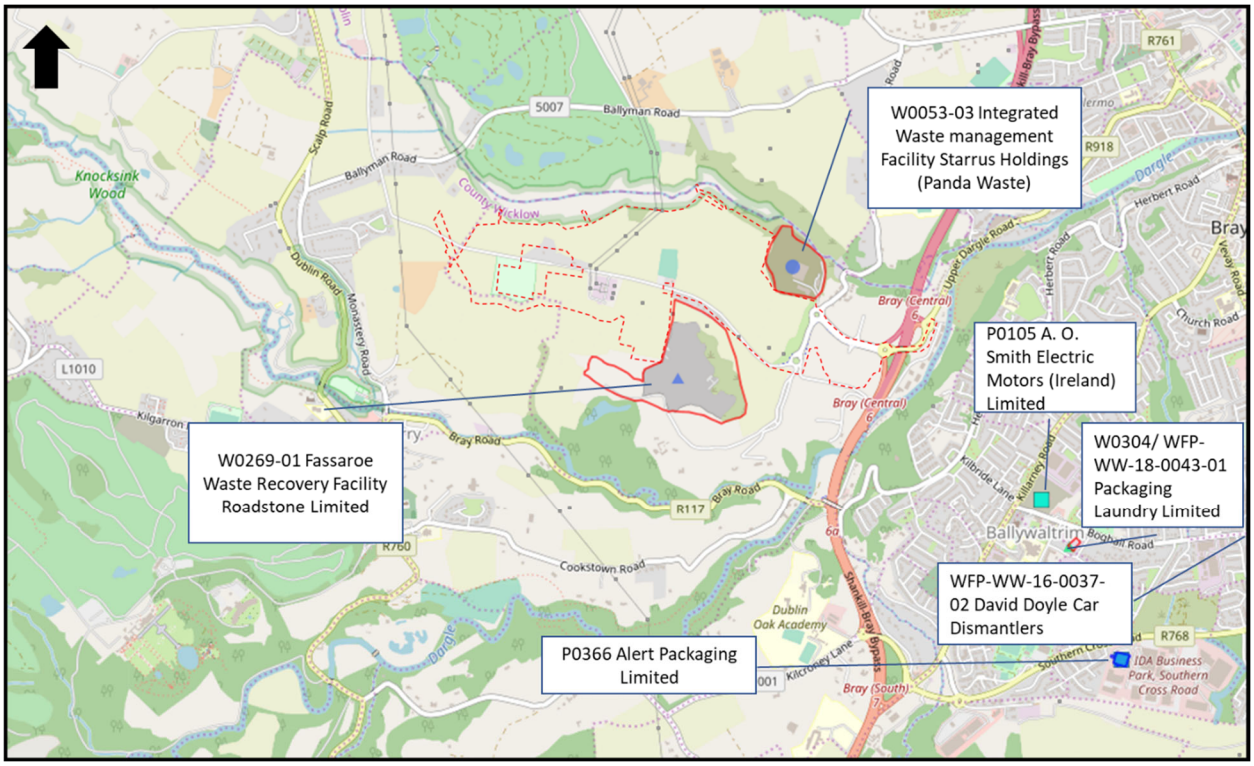
2 no. IPC EPA licensed facilities within 5km of the proposed development include A.O. Smith Electric Motors (Ireland) Limited (P0105-01) located within the Killarney Business Park ca. 1.30 km south east of the proposed development, and Alert Packaging Limited (P0366) within the IDA Business Park located within 2.10km south east of the proposed development in Bray town.

Packaging Laundry Limited facility (EPA Licence No. W0304) is located within the Oldcourt Industrial Estate ca. 1.70 km south east of the proposed development.

David Doyle car dismantlers (WFP-WW-16-0037-01) is located at Boghall Road ca. 2.5km south east of the proposed development.

The surrounding area is a mix of agricultural, residential, commercial and industrial land-use.

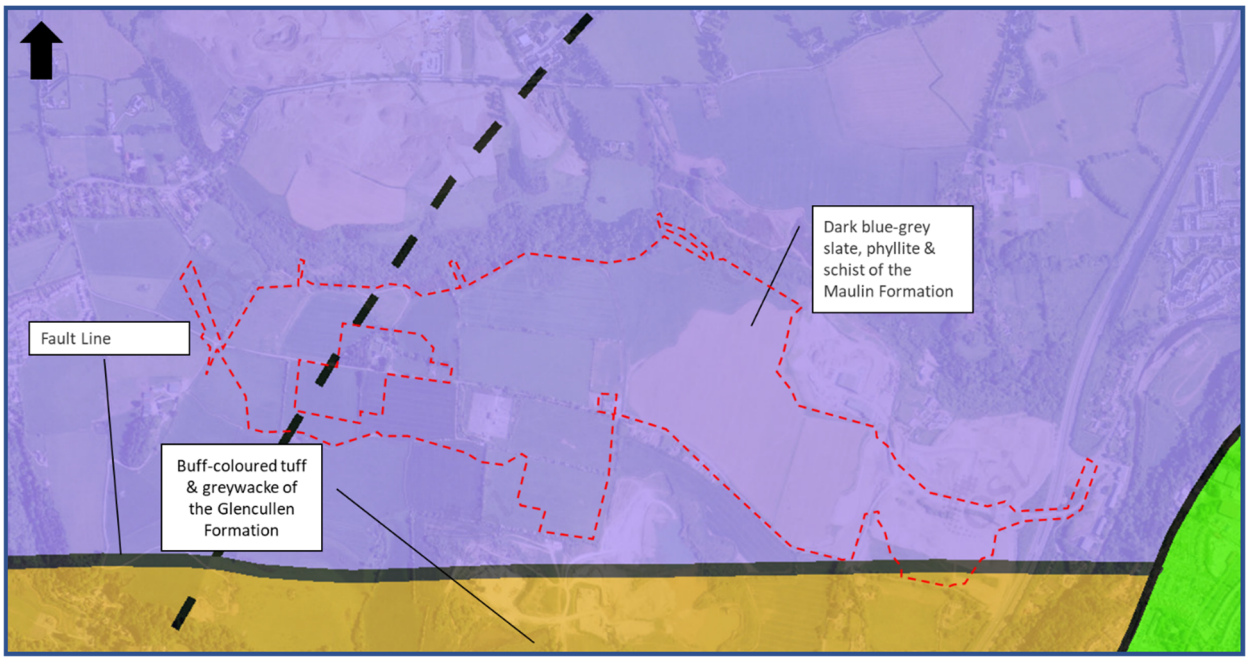
Figure 6-10: EPA Licenced Facilities (EPA 2022)



6.3.1.6 Bedrock Geology

Published geology shows that the proposed Site is underlain by the Maulin formation with a small portion of the proposed Site to the south east adjacent to the N11 underlain by the Glencullen River formation as shown in **Figure 6-8** (GSI, 2021). The Maulin formation is described by GSI as '*dark blue-grey slate, phyllite & schist'* and the Glencullen River formation is described as '*buff-coloured tuff & greywacke'* (GSI, 2021). Both the Maulin and Glencullen River formations are Ordovician in age and belong to the Ribband Group.

Figure 6-11: Bedrock Geology (GSI 2022)



The metasediments of the Maulin and Glencullen River bedrock formations are thrust faulted against Cambrian metasediments (consisting of dominantly greywacke & quartzite rock) to the east and southeast of the site towards Bray. There is a structural feature running from northeast going through the west of the Site which is described by GSI as '*outer limit of metamorphic aureole.'* There is a fault line running south of the proposed Site and intercepts the Site southeast near the M11. The rocks are highly folded and faulted as a result of several phases of deformation. The predominant structures in the region are primarily north east / south west trending normal faults with minor thrust faults and associated folding. These structures influence the overall hydrology and topography of the region in the area with river valleys following the structural features.

In conjunction with the National Parks and Wildlife Service (NPWS), the GSI has been identifying sites of geological interest (geological heritage sites (GHS)) across the Ireland since 1998. The development site is predominantly located within the Enniskerry Delta GHS (IGH Theme 1: IGH7), described by GSI as *'a large accumulation of sands and gravels which has been quarried extensively historically'* which is an *'excellent example of a deglacial, ice marginal, meltwater-deposited feature'* (GSI, 2020). There are 4no. additional designated Geological Heritage Site within a 2m radius of the Site.

In 2014, Wicklow County Council in partnership with the Irish Geological Heritage Programme of the Geological Survey of Ireland (GSI), assessed the geological heritage of Wicklow and identified the most important sites which are worthy of protection as County Geological Sites. The report entitled "The Geological Heritage of Wicklow An audit of County Geological Sites in Wicklow" by Robert Meehan, Matthew Parkes, Vincent Gallagher, Ronan Hennessy and Sarah Gatley (WCC and GSI 2014), designates the Enniskerry Delta as a County Geological Site (CGS). The report states that a

> "*CGS listing here is not a statutory designation and carries no specific implications or responsibilities for landowners. It is primarily a planning tool, designed to record the scientific importance of specific features, and to provide awareness of them in any decision on any proposed development that might affect them. It thus also has an educational role for the wider public in raising awareness of this often undervalued component of our shared natural heritage*."

"*The important thing is that the relevant planning department is aware of the sites and, more generally, that consultation can take place if some development is proposed for a site. In this way, geologists may get the opportunity to learn more about a site or area by recording and sample collection of temporary exposures, or to influence the design so that access to exposures of rock is maintained for the future, or occasionally to prevent a completely inappropriate development through presentation of a strong scientific case."*

The Wicklow County Development Plan 2014-2022 identifies a number of objectives in relation to CGS as follows:

"NH25 Geological and soil mapping where available shall be considered in planning decisions relating to settlement, excavation, flooding, food production value and carbon sequestration, to identify prime agricultural lands (for food production), degraded/contaminated lands (which may have implications for water quality, health, fauna), lands with unstable soils / geology or at risk of landslides, and those which are essential for habitat protection, or have geological significance.

NH26 Protect and enhance 'County Geological Sites' (Schedule 10.10 and Map 10.10 of this plan) from inappropriate development at or in the vicinity of a site, such that would adversely affect their existence, or value.

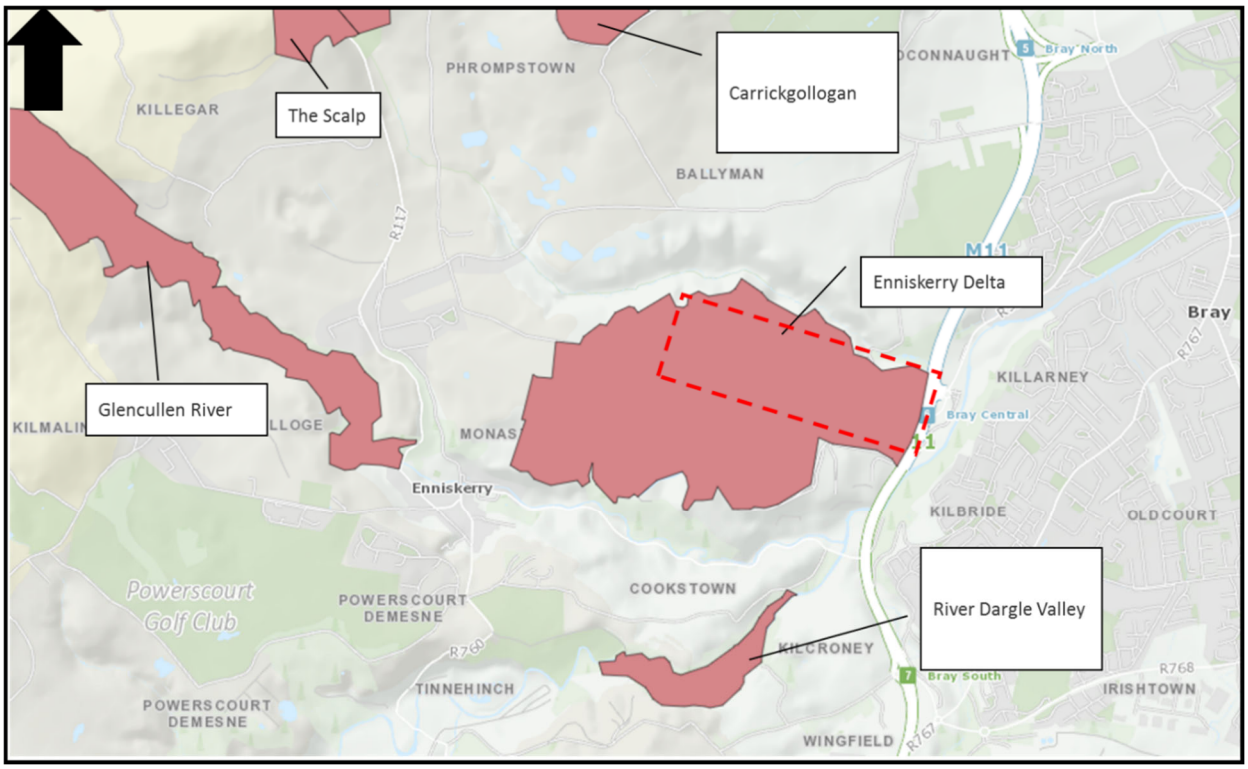
NH28 To facilitate public access to County Geological Heritage Sites, on the principle of "agreed access" subject to appropriate measures being put in place to ensure public health and safety and subject to the requirements of Article 6 of the Habitats Directive. Chapter 10 | Heritage Wicklow County Development Plan 2016-2022"

The GSI have been consulted in relation to the proposed construction of this development (see Chapter 1). The GSI have made no submissions in relation to this development.

Glencullen River GHS is located ca. 1km south west of the Site, described as *'a narrow, steep-sided wooded valley in the northeast Wicklow mountains'* (GSI, 2021). River Dargle Valley GHS is located ca. 1km south of the Site, described as *'a stretch of the river meandering from a wide and flat valley into cascades'* (GSI, 2021). The Scalp GHS is located ca. 1.90km south of the Site which comprises of *'a deep channel that was formed by meltwater erosion'* (GSI, 2021). Carrickgollogan GHS is located ca. 1.4km south of the Site, described as *'a small prominent hill'*. This is a geological anomaly as the Cambrian quartzites are much older than the Ordovician slates (GSI, 2021). Refer to **Figure 6.9** (GSI, 2021).

No karst features have been noted within 2km of the Site.

Figure 6-12: Geological Heritage Areas (GSI 2022)



6.3.1.7 Economic Geology

According to the GSI mineral locality mapping, there are a number of small gravel pits in the area as shown on **Figure 6.10** below. There are 2no. mineral locations immediately adjacent to the site. These include the following:

- Roadstone Limited Facility. Disused sand and gravel to the south of the site and site of the permitted Waste Recovery Facility (W0269-01) identified above. The facility is now used as a retail outlet for stone products, aggregate and ready-mix.
- Disused Sand and Gravel pit to the north east of the site. It is currently operated by Panda Waste as a licenced waste management waste transfer station.

Parts of the proposed development site have previously been worked for sand and gravel abstraction, evidenced by the location of the historic landfill sites within the development boundary.

Figure 6-13: Mineral Localities (GSI 2022)

6.3.2 Hydrogeology

6.3.2.1 Groundwater Wells

The GSI Well Card Index is a record of wells drilled in Ireland. This Index shows a number of wells in the vicinity of The Site. While much useful information can be obtained from this Index, it is important to note that it is by no means exhaustive, as it requires individual drillers to submit details of wells in each area.

The well card data presented in **Table 6.2** below shows the occurrence of recorded wells within a 2km radius of the site area, information regarding the depth to bedrock, and hence the depth of overburden is noted for each well where available. See **Figure 6.11** below for locations of these wells. From the GSI well card data presented in **Table 6.2** below, it can be seen that the majority of the wells in the area are used for domestic and agricultural use.

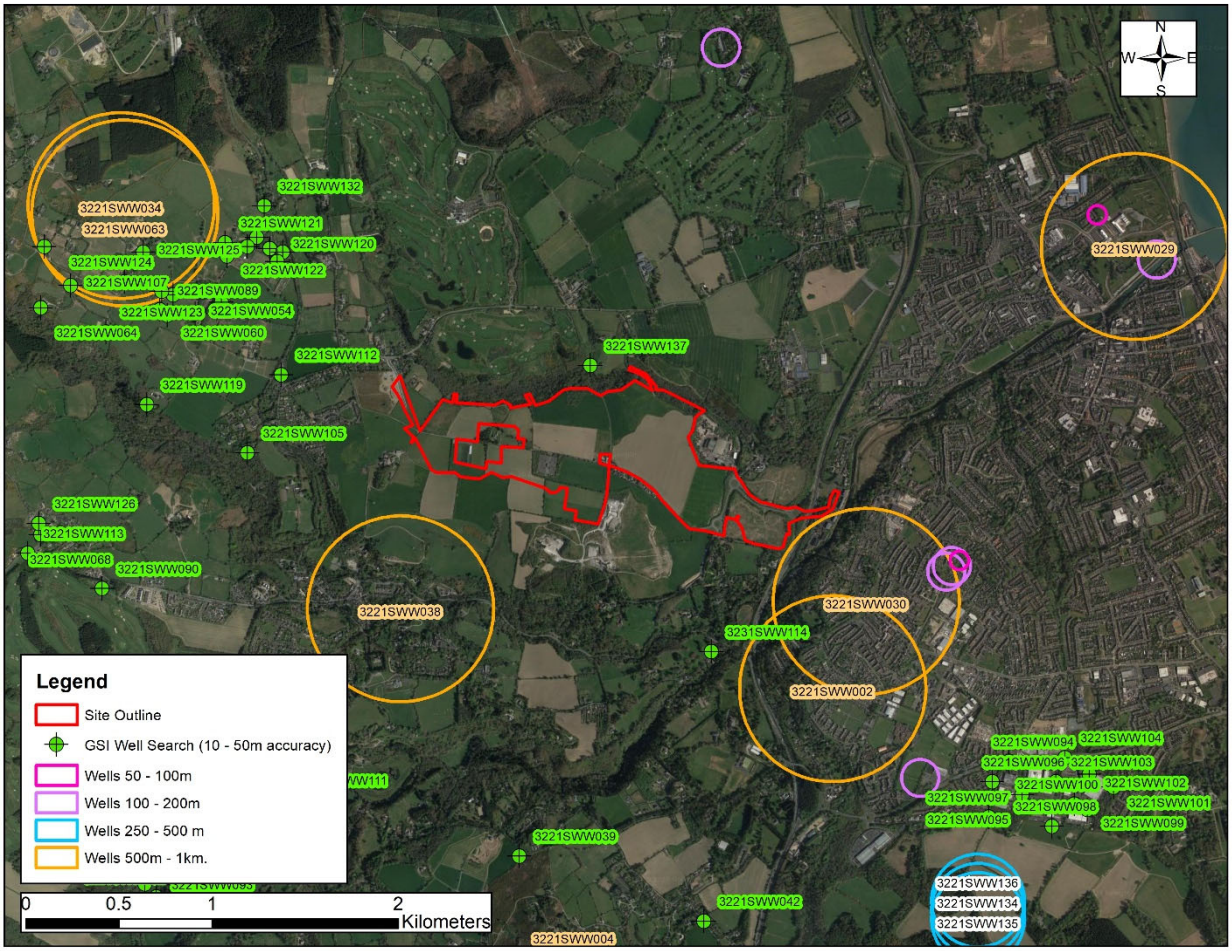
Table 6.1: GSI Well Card Data for the Site location and Surrounding Areas (Source: GSI, 2021)

GSINAME	ORIGNAME	TYPE	Depth (metres)	Depth to Rock (m)	EASTING	NORTHING	TOWNLAND	COUNTY	Use	Yield Classification
3221SWW137	St Kevins Well	Spring			323600	218590	BALLYMAN	Dublin		
3221SWW001		Borehole	26.5	13.7	321620	218930	MONASTERY	Wicklow		Poor
3221SWW039		Borehole	55.8		323220	215950	NEWTOWN	Wicklow	Domestic use only	
3221SWW042		Borehole	42.7	30	324210	215600	HOLLYBROOK	Wicklow	Domestic use only	Good
3221SWW044		Borehole	8.7	6	321290	218890	MONASTERY	Wicklow		
3221SWW054	Monitoring BH No. 1	Borehole	13.6	13.5	321480	218870	MONASTERY	Wicklow		
3221SWW059	Monitoring BH No. 2	Borehole	16	16	321360	218970	MONASTERY	Wicklow		
3221SWW060	Monitoring BH No. 3	Borehole	6.2	6.2	321330	218860	MONASTERY	Wicklow		
3221SWW064		Borehole	68.6	15.2	320650	218900	KILLEGAR	Wicklow	Domestic use only	Moderate
3221SWW065		Borehole		9.1	320670	219230	KILLEGAR	Wicklow	Domestic use only	Poor
3221SWW068		Borehole	79.2	6.1	320650	217680	PARKNASILLOGE	Wicklow	Domestic use only	Poor
3221SWW089		Borehole	11.8		321300	218990	MONASTERY	Wicklow		
3221SWW090	TW No. 1	Borehole	75	7.5	320980	217390	POWERSCOURT	Wicklow		Poor
3221SWW091	TW No. 2	Borehole	13		321210	215800	POWERSCOURT	Wicklow		Moderate
3221SWW092		Borehole	29.8		321270	215730	POWERSCOURT	Wicklow		Excellent
3221SWW093		Borehole	90	45	321270	215690	POWERSCOURT	Wicklow		Poor
3221SWW094		Dug well	2		325850	216460	IRISHTOWN	Wicklow		
3221SWW095		Dug well	2		325920	216280	IRISHTOWN	Wicklow		
3221SWW096		Dug well	1.8		325760	216350	IRISHTOWN	Wicklow		
3221SWW097		Dug well	2.2		325740	216160	IRISHTOWN	Wicklow		
3221SWW098		Dug well	2.2		326080	216110	IRISHTOWN	Wicklow		
3221SWW099		Dug well	2.2		326270	216200	IRISHTOWN	Wicklow		
3221SWW100		Dug well	2.6		326200	216230	IRISHTOWN	Wicklow		
3221SWW101		Dug well	2.2		326410	216320	IRISHTOWN	Wicklow		
3221SWW102		Dug well	2.2		326280	216390	IRISHTOWN	Wicklow		
3221SWW103		Dug well	2.4		326100	216350	IRISHTOWN	Wicklow		
3221SWW104		Dug well	2.5		326150	216480	IRISHTOWN	Wicklow		
3221SWW105		Borehole	48.8		321760	218120	MONASTERY	Wicklow		
3221SWW106		Borehole	30.5		321810	219280	KILLEGAR	Wicklow		
3221SWW107		Borehole	36.6		320810	219020	KILLEGAR	Wicklow		
3221SWW108		Borehole	21.3		321760	219230	KILLEGAR	Wicklow		
3221SWW109		Borehole	30.5	12.2	321880	219220	KILLEGAR	Wicklow		
3221SWW111		Borehole	15		322000	216250	TINNEHINCH	Wicklow		
3221SWW112	GSI 97/13	Borehole	8	8	321940	218540	MONASTERY	Wicklow		
3221SWW113	GSI 97/4	Borehole	4	4	320580	217580	KILMALIN	Wicklow		
3221SWW118	Well no. 2	Unknown			321950	219200	KILLEGAR	Wicklow	Domestic use only	
3221SWW119	Well no. 5	Borehole			321220	218380	KILLEGAR	Wicklow	Domestic use only	
3221SWW120	Well no. 8	Borehole			321920	219150	KILLEGAR	Wicklow	Domestic use only	
3221SWW121	Well no. 9	Unknown			321640	219250	KILLEGAR	Wicklow	Domestic use only	
3221SWW122	Well no. 10	Unknown			321650	219180	KILLEGAR	Wicklow	Domestic use only	
3221SWW123	Well no. 11	Unknown			321000	218770	KILLEGAR	Wicklow	Domestic use only	
3221SWW124	Well no. 12	Unknown			321100	219040	KILLEGAR	Wicklow	Domestic use only	
3221SWW125	Well no. 13	Unknown			321200	219200	KILLEGAR	Wicklow	Domestic use only	
3221SWW126	W/S401	Borehole	67.1	2.4	320640	217740	KILMALIN	Wicklow	Agri & domestic use	Poor
3221SWW132	w/s1104	Borehole	39.6	30.5	321850	219450	KILLEGAR	Wicklow	Agri & domestic use	
3231SWW114	GSI 97/15	Borehole	6.3	6.3	324250	217050	COOKSTOWN	Wicklow		

The well card data shows that the wells recorded close to the site location indicates the depth of overburden to range from 6.30 to 8.00 mbgl. Also, based on the well data record there is a spring located to the north (c. 150 metres) of The Site – 3221SWW137. This is the location of St. Kevin's Well. St Kevin's well is an ancient well. The well is situated inside a small circular mound with four stone steps on the northside leading down to the water.

There are no public water supplies or group water schemes in close proximity of The Site.

Figure 6-14: GSI Well Locations (Source: GSI, 2021). Note the circles show general location of wells only



6.3.2.2 Aquifer Classification and Water Body Status

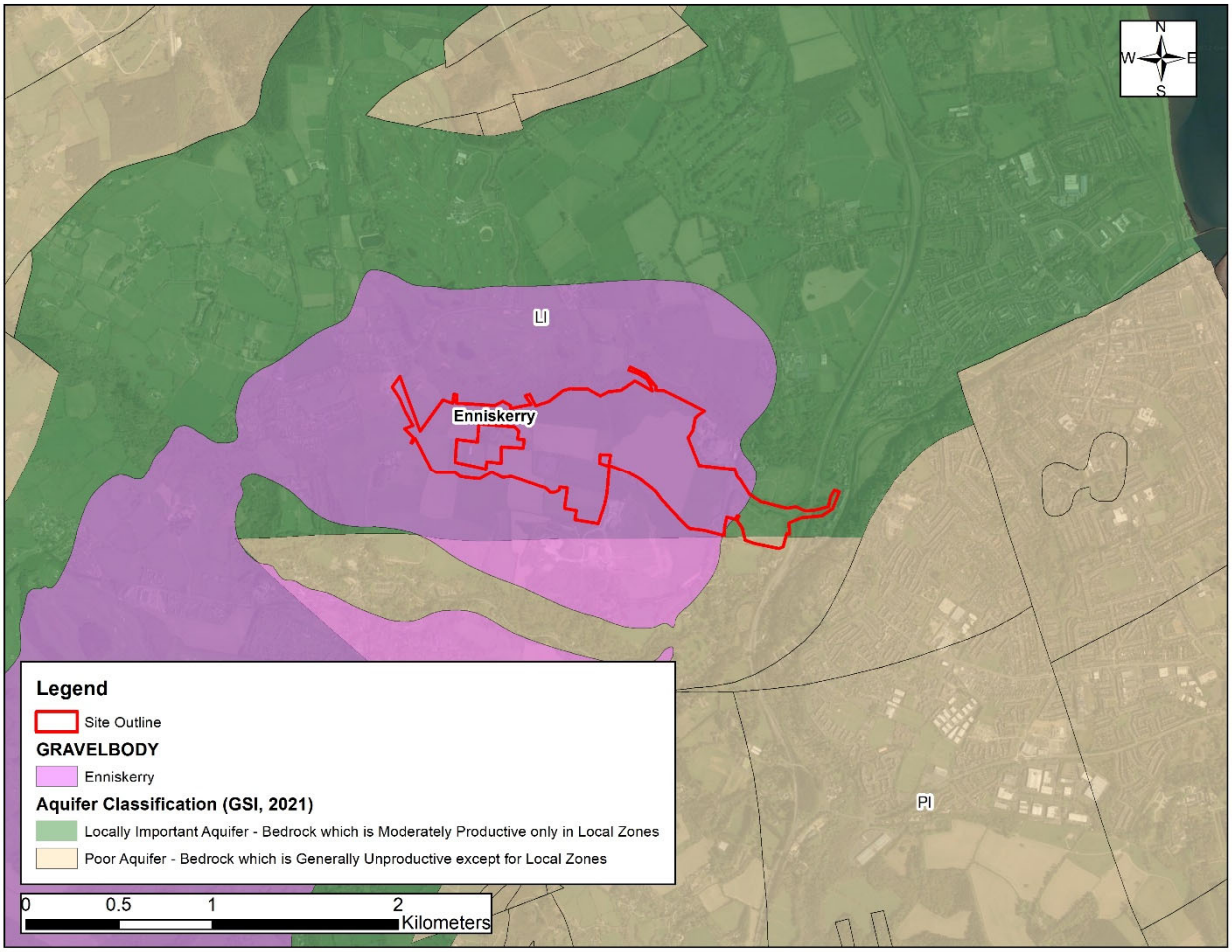
Groundwater can be defined as water that is stored in, or moves through, pores and cracks in sub-soils. Aquifers are rocks or granular deposits that contain sufficient void spaces, and which are permeable enough, to allow water to flow through them in significant quantities. The potential of rock or deposits to store and transport water is governed by permeability of which there are two types, intergranular and fissure permeability.

Intergranular permeability is found in sediments, sands, gravels and clays and fissure permeability is found in bedrock, where water moves through (and is stored in) cracks, fissures, planes and solution openings. The aquifer underlying the study area is a gravel aquifer and therefore the primary characteristic of this aquifer is defined by intergranular permeability which apply in the case of a quaternary aquifer.

The major aquifers underlying The Site are part of the broader Enniskerry Gravels Aquifer and Wicklow Bedrock Aquifer and these have been generally classified by the GSI as a Locally Important (LI) Aquifers. Refer to **Figure 6.12**, below.

The major bedrock aquifer surrounding The Site has been classified by the GSI as a Locally Important (LI) Aquifer which is moderately productive in local zones only (refer to **Figure 6.12**, below). The south-eastern corner of The Site is slightly underlain by a different classified aquifer body – Poor Aquifer (Pl) which is described as bedrock which is generally unproductive expect for local zones.

Figure 6-15: Gravel & Bedrock Aquifers (Source: GSI, 2021).



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

The WFD requires 'Good Water Status' for all European waters to be achieved through a system of river basin management planning and extensive monitoring. 'Good status' means both 'good ecological status' and 'good chemical status'.

The Site is within two groundwater waterbodies – 'Enniskerry Gravels' and 'Wicklow'. Both groundwater bodies are classed as 'Good' status under most recent WFD groundwater status (2013-2018) with a current WFD risk score under 'Good' for 'Enniskerry Gravels' GWB. The 'Wicklow' GWB score is currently 'Under Review'.

There are no karst features identified within The Site or in the vicinity of the area.

6.3.2.3 Aquifer Vulnerability

The GSI, EPA, and the Department of Environment, Heritage and Local Government (DoEHLG) have developed a programme of Groundwater Protection Schemes, with the aim of maintaining the quantity and quality of groundwater in Ireland, and in some cases improving groundwater quality, by applying a risk assessment approach to groundwater protection and sustainable development.

As part of this scheme, the GSI have mapped the vulnerability of the country's aquifers. Reference to the GSI Vulnerability data indicates that The Site is classified as having a *'High'* aquifer vulnerability which indicates that the soil cover is >3.0m of high to medium permeability soil at the site, given by the cohesive and granular deposits (Gravels subsoil) which overlay the bedrock aquifer (Refer to **Figure 6-13** and **Table 6.3** below). Comparison with the site investigation results and GSI Well Card Data (**Table 6.2)** confirms that the surrounding area can be classified as *'Moderate'* to *'High'*.

Figure 6-16: Aquifer Vulnerability (Source: GSI, 2021).

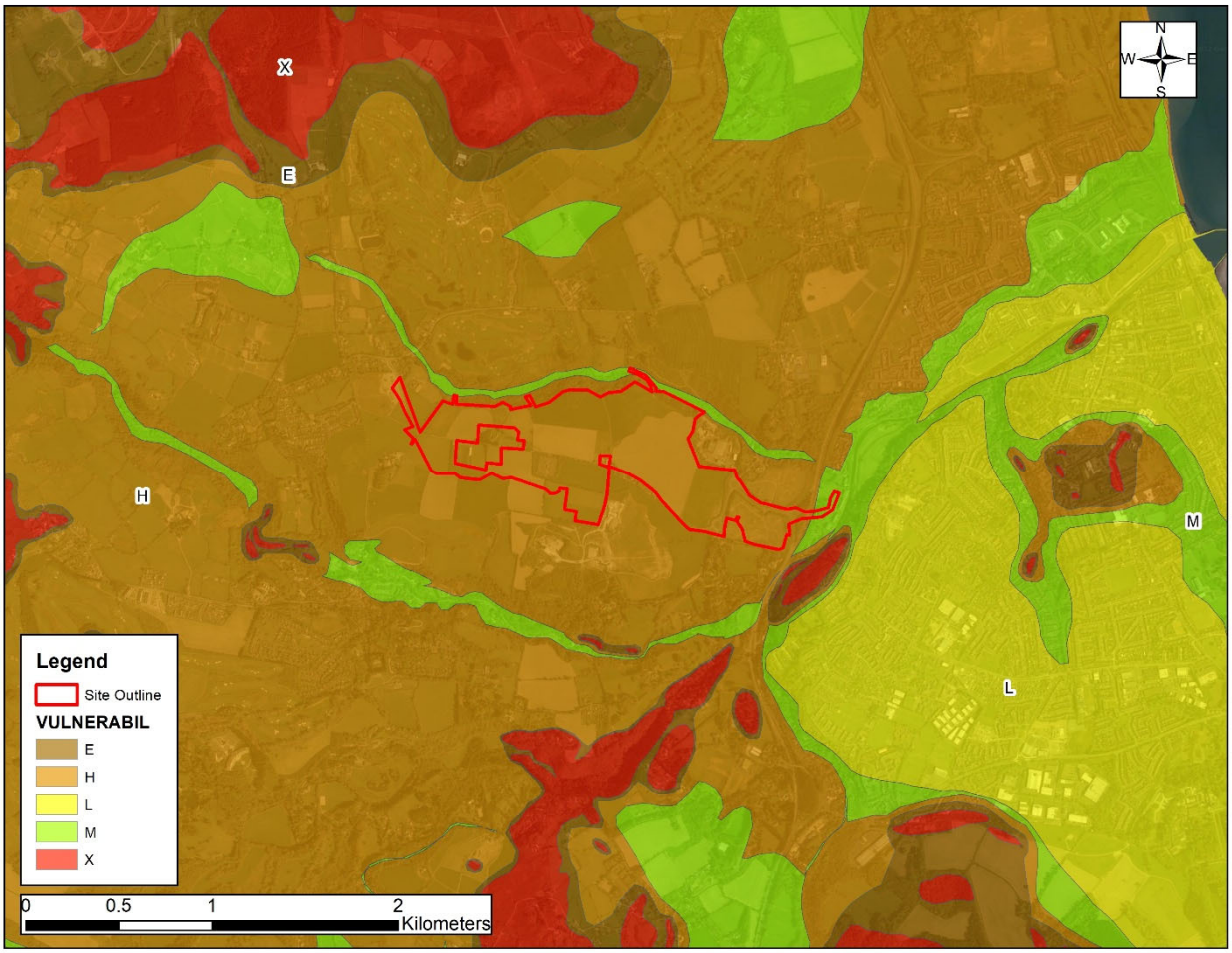


Table 6.2: Vulnerability Mapping Guidelines (Source: GSI, 2021)

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High permeability (sand/gravel)	Moderate permeability (e.g. Sandy subsoil)	Low permeability (e.g. Clayey subsoil, clay, peat)	(Sand/gravel aquifers only)	(<30 m radius)
Extreme (E)	0 - 3.0m	0 - 3.0m	0 - 3.0m	0 - 3.0m	-
High (H)	>3.0m	3.0 - 10.0m	3.0 - 5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0 - 10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A

Notes: (1) N/A = not applicable.
(2) Precise permeability values cannot be given at present.
(3) Release point of contaminants is assumed to be 1-2 m below ground surface.

6.3.2.4 Groundwater Flow & Monitoring

The Enniskerry groundwater is recharged by rainwater percolating through the topsoil and the unsaturated sand and gravel deposits. Surface runoff is estimated at approximately 20% of effective rainfall (GSI, 2016). The GSI recharge map (www.gsi.ie) for the area presents an annual recharge value of 575 mm/year, due to the presence of the relatively permeable gravels at the surface.

Expected groundwater flow within the granular aquifer is towards the local river, where groundwater discharges emerge as springs and seeps along the lowest boundary of the groundwater body and regionally towards the Irish Sea. Previous reports have shown the local groundwater regime over the site is dominated by the County Brook Stream (Fassaroe Stream) valley to the north, and the valley of the River Dargle to the east.

The Ballyman Glen which runs along the County Brook Stream (Fassaroe Stream) adjacent to the Fassaroe landfill sites comprises riparian wet woodland and contains a small strip of fen. The fen is very alkaline and is associated with petrifying springs and seepage areas, which have given rise to thick deposits of marl. The nature of the springs suggests they are discharging from the gravel unit, which is mainly derived from limestone. The earth of the banks around the landfill is unstable, and as a result, silt is being released into the County Brook Stream (Fassaroe Stream).

There are no recorded large abstractions from the Enniskerry groundwater body.

Borehole drilling was completed for the installation of gas, combined gas/leachate and groundwater monitoring boreholes between the 15th of January 2016 and 1st of March 2016 with a total of fifty-seven (57) monitoring boreholes installed across the five landfill sites. This site investigation was part of environmental risk assessment of the site carried out RPS. The five (5) no. landfills will be remediated as part of this development.

The objective of the installation of the groundwater monitoring boreholes was to demonstrate the local geological sequence; demonstrate the presence of a contamination plume where present; and confirm groundwater levels / flow directions.

As part of the environmental assessment works conducted by RPS in 2016, groundwater samples were taken from a total of 8 newly installed groundwater monitoring boreholes (including one gas borehole G20), targeting both up-gradient and down-gradient locations where possible. The boreholes which did not intercept groundwater include BH03, BH04, BH11 and BH13, which are all in Site 2. The height of water column in the other boreholes (BH01, BH05, BH06, BH07, BH08, BH09 and BH10) ranges from 5.0m to 9.0m with an average of 7.0m.

The groundwater level dataset (29th March 2016) demonstrates that the flow direction in all sites does follow topography being orientated towards the river to the north and north-east. The hydraulic gradient steepens towards the valleys and is flatter on the plateau.

In terms of groundwater quality, inorganics such as aluminium, ammonia, arsenic, calcium, chromium, iron, lead, manganese, nickel and zinc were generally elevated across the five (5) no. sites. Groundwater quality results were generally slightly elevated compared to the EPA interim report “Towards Setting Guideline Values for the Protection of Groundwater in Ireland” (2003) and the Groundwater Regulations Threshold Values (GTV) (S.I. 9 of 2010).

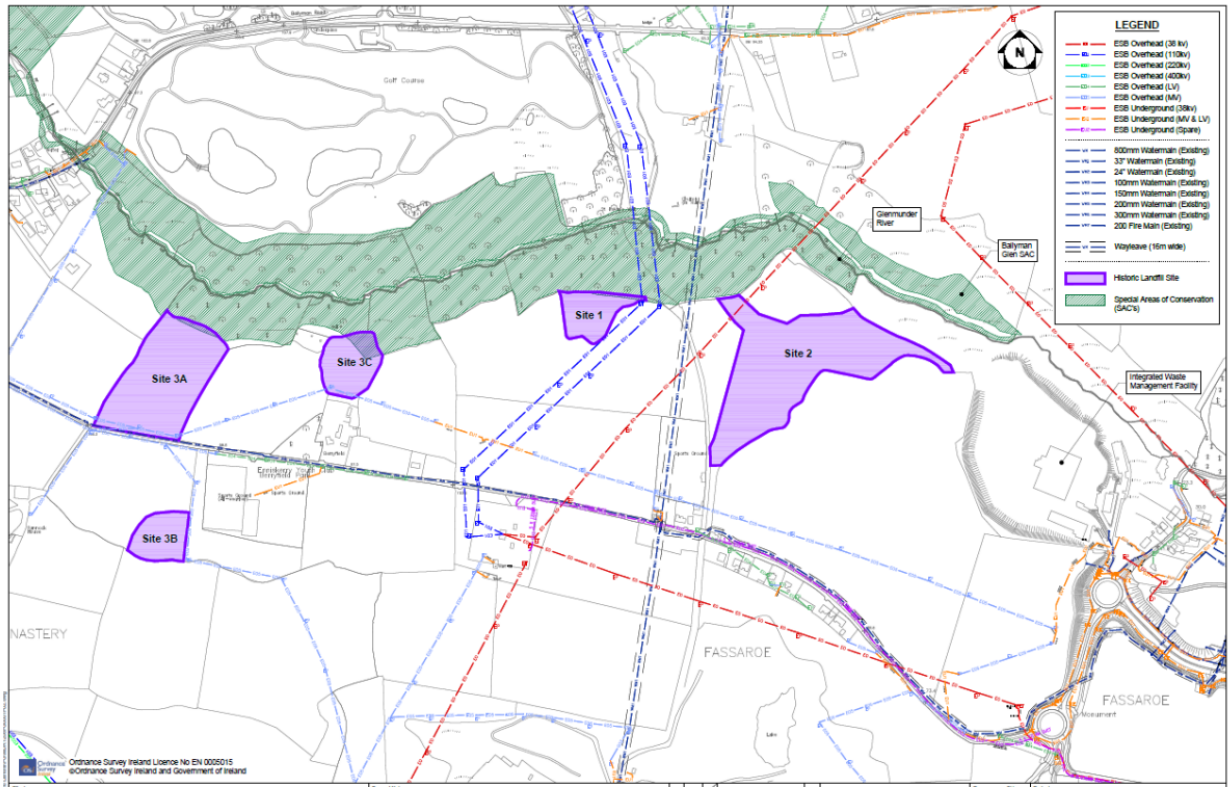
6.3.2.5 Landfills

There are five (5) no. historic landfill locations within the northern part of the overall Action Area Plan lands which were previously operated by Wicklow County Council. These landfill sites had previously been used for quarrying activities. The landfill operations ceased in the early 1990s at which time these areas were covered in topsoil and returned to agricultural use.

In accordance with the requirements of the Waste Management Act 1996, four (4) no. of these former landfill sites are classified as Historic Unlicensed Waste Disposal sites which require Certificates of Authorisation from the EPA for their remediation. One of the sites, though operated by Wicklow County Council, does not fall under the certification requirements of the Waste Management Act due to its age. In any event, applications were made by Wicklow County Council to the EPA for the remediation of the four (4) no. sites. The Environmental Risk Assessment for the applications had regard to the presence and need for remediation of all five (5) no. sites. In November 2019, the EPA issued final Certificates of Authorisation for the remediation of the four (4) no. sites.

Further detail in regard to the landfills, remediation approach and design measures are further discussed in Chapter 2 of this EIA Report, Volume 3 Parts 3 and 4 of the EIAR and the Historic Landfill Remediation Strategy Report and Gas Management Strategy lodged as part of the current application documentation.

Figure 6-17: Location of Historic Landfill on Fassaroe Lands



6.3.2.6 Tufa Springs

The County Brook waterbody valley which is known as Ballyman Glen is designated an SAC (Site Code: 000713) selected for the following habitats and/or species listed on Annex I/II of the E.U. Habitats Directive; petrifying springs with tufa formation and alkaline fens.

RPS (RPS, 2016) carried out an initial site inspection on 12th October 2015. In total nine (9) no. discrete springs were noted along the southern riverbank of the County Brook River (Fassaroe Stream) between Site 1 and Site 3a. Spring 1 was found at the base of a steep embankment adjacent the river. The ground was quite soft underfoot and there were clear signs of ochre staining and hydrocarbon sheen at surface. Spring 3, which is more typical of the other springs on site emerges diffusely from wet embankments which coalesce into a small channel as the water collects downstream.

Emerging groundwater spring flows feed the tufa deposits and alkaline fen and they are therefore considered to be Groundwater Dependant Terrestrial Ecosystems (GWDTE).

A recent Survey of the applicant site was conducted by Wetlands Ireland in February 2020. Wetland Surveys Ireland Ltd. were commissioned by RPS Group to undertake an ecological survey of qualifying Annex I habitats (alkaline fen and petrifying spring) within part of the Ballyman Glen Special Area of Conservation (SAC), in counties Dublin and Wicklow.

A map showing the distribution of Annex I alkaline fen and petrifying spring habitats recorded within the study area is presented in Figure 7.5 in Chapter 7 of this EIAR. The springs are indicated as point features, although in places more extensive tufa seepage zones extend from the spring locations and these are indicated by polygon features labelled as Seepage Zone I to Seepage Zone VII.

An assessment of conservation status of five representative springs was conducted by Wetlands Ireland at Ballyman Glen. Each spring was assessed according to; range and area, structures and functions, and future prospects. The overall condition assessment of four springs was considered unfavourable – inadequate while a single spring was deemed to be in favourable conservation status.

The main reason that four of the five springs did not attain favourable conservation status was due to the high levels of deer grazing and associated trampling effects on the surface of springs. Most of the springs within the Glen are likely to conform to this as deer grazing is occurring at a similar intensity throughout the wooded slopes of the glen. The exception being those springs along the riverbank where trampling by deer is less evident.

A further assessment of conservation importance was undertaken using a scoring system. This confirmed that the springs varied from being of moderate to high conservation importance.

Evaluation: There are extensive seepage areas on both slopes of Ballyman Glen which are associated with calcareous springs. These springs and seepage areas correspond with the EU Annex I habitat Petrifying springs with tufa formation (Cratoneurion) [7220] and are therefore deemed to be of international conservation significance (Wetlands Ireland, 2020).

6.3.2.7 Conceptual Site Model (CSM)

The proposed development site is underlain by a thick sequence of unsaturated sand and gravels that form the principal aquifer unit (Enniskerry Gravels) in the local area and overlain by a clay cap which is approximately 1 to 2m thick. The waste bodies are directly underlain by unsaturated gravels in the case of Site 1 and Site 3b. The majority of the waste is underlain by unsaturated conditions at Site 2 and Site 3a, however the most northerly parts of the sections, in closest vicinity to the river, appear to intercept the water table. In Site 3c the base of the waste appears to intercept the top of the water table across the majority of the site.

The sands and gravels are a glacial outwash deposits that comprise glaciofluvial and glaciolacustrine sediments formed as part of the Fassaroe Delta. The sediments are arranged in the typical delta sequence: topset gravels composed of up to 2 metre depth of horizontally bedded gravels on top; foreset gravels which are steeply dipping and well bedded deposited at the front of the delta; and bottomset, finer sediments of sands and silts, usually underlying the foresets and representing sediment that was originally deposited beyond the steep delta front on the sea floor. The thickness of the sand and gravel unit was not established during the drilling programme as it extended below the maximum reach of the drilling rig on site (35 metres below ground level). However, bedrock outcrop was noted in the riverbed to the north of the site, the County Brook River (Fassaroe Stream).

The unconsolidated sands and gravels are comprised largely of limestone from the Irish Midlands, and form part of the Enniskerry gravel aquifer body, classed as locally important gravel aquifer of “Good” WFD status. Groundwater discharges emerge as springs and seeps along the lowest boundary of the groundwater body in the river valley and feed a small strip of alkaline fen and tufa deposits within the Ballyman Glen. The aquifer vulnerability at the site is classified as High, due to the proximity of the gravel aquifer to ground level.

The underlying bedrock consists of Ordovician Metasediments of the Maulin Bedrock Formation characteristic of dark blue-grey slate, phyllite & schist. The Maulin Formation is classified by the GSI as a locally important, moderately productive bedrock aquifer in local zones (Ll). The Maulin Bedrock Formation forms part of Wicklow Groundwater Body which is a very large but characteristic of a poorly productive aquifer flow regime.

The bedrock is characterised by a significantly lower transmissivity than the overlying sand and gravel deposits. It is therefore assumed that the contact with the underlying bedrock constitutes the hydraulic base to the overlying granular sand/gravel aquifer system. The groundwater flow regime at Fassaroe is that of a shallow, unconfined, largely granular aquifer system with groundwater flow directions generally reflecting the surface topography.

Groundwater levels measured on 29th March 2016 confirmed that a water-table is present within the sand and gravel deposits, and groundwater flow direction at all sites is ultimately towards the County Brook River (Fassaroe Stream) to the north and northeast. The hydraulic gradient steepens towards the valleys and is flatter on the plateau.

The nearest surface water receptor is the County Brook Stream (Fassaroe Stream) which cuts a steep gorge through the gravel deposits which attains a depth of up to 40m. Flow in the river is estimated to be approximately 20L/s based on the river catchment area and proportional weighting from adjacent flow monitoring locations on the River Dargle. The river is a tributary of the River Dargle, which it joins approximately 1km downstream of the site and ultimately flows into the Irish Sea at Bray, a further 2km downstream.

The nearest sensitive site is the Ballyman Glen SAC (Site Code: 000713), adjacent to the County Brook River (Fassaroe Stream), selected for petrifying springs with tufa formation and alkaline fens. Emerging groundwater spring flows feed the tufa deposits and alkaline fen and they are therefore considered to be Groundwater Dependant Terrestrial Ecosystems (GWDTE).

There are a number of areas in which works are required within Ballyman Glen SAC. These include the following:

- Localised structural stabilisation works at northern boundaries of Landfill site Nos. 2, 3A and 3C, and potentially site No. 1 adjacent to and within Ballyman Glen SAC;
- Landfill remediation of Site No. 3C which overlaps with SAC; and,
- Edge of landfill remediation at Sites 1, 2 and 3A adjacent to and overlapping slightly with the SAC.

The results of the Environmental Risk Assessment (ERA) at Fassaroe showed that there were elevated levels of ammonia and heavy metals in up-gradient and down-gradient boreholes, indicating that groundwater quality within the zone of influence of the landfill sites has been impacted by the historic landfilling of waste.

The vertical pathway for leachate generation is driven by direct rainfall percolating through the waste body. The recharged water travels northeast through higher permeability sections of the waste. The leachate then pools within the base of the waste and from there percolates into the underlying unsaturated sand and gravel deposits. Upon reaching the water-table, the sand and gravel aquifer provides both lateral and vertical migration pathways for leachate mixed with groundwater. The groundwater flow within the sandy gravel deposits is orientated in a northeast direction towards Ballyman Glen SAC.

The proposed landfill capping will:

- Minimise infiltration of water and maximise run off from the landfill areas;
- Promote surface drainage and maximise run off from the landfill areas;
- Control landfill gas migration; and
- Provide a physical separation between waste and plant and animal life. Leachate generation as a result of rainfall infiltration will be significantly reduced by the installation of the capping system.

The storm water management design for the proposed housing and road development routes the storm water to soakaways to promote percolation back to ground. The soakaways are designed to accommodate the 1 in 5-year storm events. Runoff in excess of the 1 in 5-year event will overflow from the soakaway storage to attenuation ponds which discharge to surface water. The storm water management system for the housing and road development (other than the landfill capping measures discussed below) will therefore have a negligible impact on groundwater recharge rates and may even promote additional recharge due to the additional storage provided in the soakaway tanks.

The post-development recharge represents a potential reduction of 7% in the recharge rate. This is based on a reduction from 575mm/yr to 533mm/yr, which is a reduction of 42mm/yr. The reduction in the average groundwater levels as a result of the decrease in recharge rate of 42mm/yr can be estimated based on the storage parameters for the gravel aquifer. A typical effective porosity for a gravel deposit of 15% is adopted for the basis of the assessment. To estimate the drop in levels resulting from a decrease in recharge rate the reduction in question (42mm/yr or 0.042m/yr) is divided by the porosity (15% or 0.15) which yields a water level fluctuation of 0.28m. This result was rounded up to 0.3m for the purposes of reporting.

Similarly, it is estimated that a consistent reduction in recharge percolating to groundwater across the larger landfill cells (landfill site 2) from 575 to 67mm could result in a potential ground water level decrease directly beneath the landfill of up to 3.4m. The observed reduction in groundwater level will be less as the potential drop in groundwater levels directly beneath the landfill will promote groundwater flow in from the surrounding areas, which will equilibrate the levels with the effect of marginal drawdown being observed from the wider area.

The reduced recharge rate in the aquifer could lead to a comparable reduction in the seepage face elevation. Therefore, potentially there may be a drop of 0.3m from the top of the seepage face and the reduction in flow at the springs could reduce by 7%. This is illustrated in a diagram included in **Figure 6-19**, which illustrates the pre and post development water table and artesian levels through a typical valley section. This illustrates that the predicted reduction of 0.3m is a small change when compared to the total saturated thickness of the gravel. The tufa springs are mapped lower down in the river valley, rather than at the top of the seepage face and, therefore, it is unlikely that this minor amount of drawdown would lead to a significant loss of any of the

petrifying springs. The reduced recharge rate (by 7% in comparison to pre-development conditions) could lead to a comparable reduction in flow from the springs (7%), however it is expected the springs would continue to flow and the tufa would continue to be deposited.

The springs and seepages which feed the tufa deposits emanate at the seepage face where groundwater emerges from the river valley. The extent of the seepage face above the river elevation is related to the groundwater elevation in the gravels, which in turn is related to the recharge.

The groundwater receptor is the underlying locally important gravel aquifer i.e., Enniskerry groundwater body and the nearby Ballyman Glen SAC / GWDTE. There are no down-gradient public or private waste supplies considered receptors.

The proposed mixed-use development is located on lands proximal to Sites 1 and 2 with the proposed road alignment intersecting the southern margin of Site 2 (fill) and through the centre of Site 3B (cut). The closest element of the proposed development to Site 1 is apartment complex located approximately <5m to the south of the waste body. The closest development to Site 2 is an apartment complex located c. 20 metres to the west of the waste body.

Two (2) no. local geological cross sections can be seen in **Figure 6-16** and **Figure 61-7** below based on the available data such as geophysical survey report, site investigations borehole logs and supplementary site walkovers. The relevant borehole logs were used to construct the Conceptual Site Model (CSM) for the proposed development.

Figure 6-18: Cross Sections across the Site

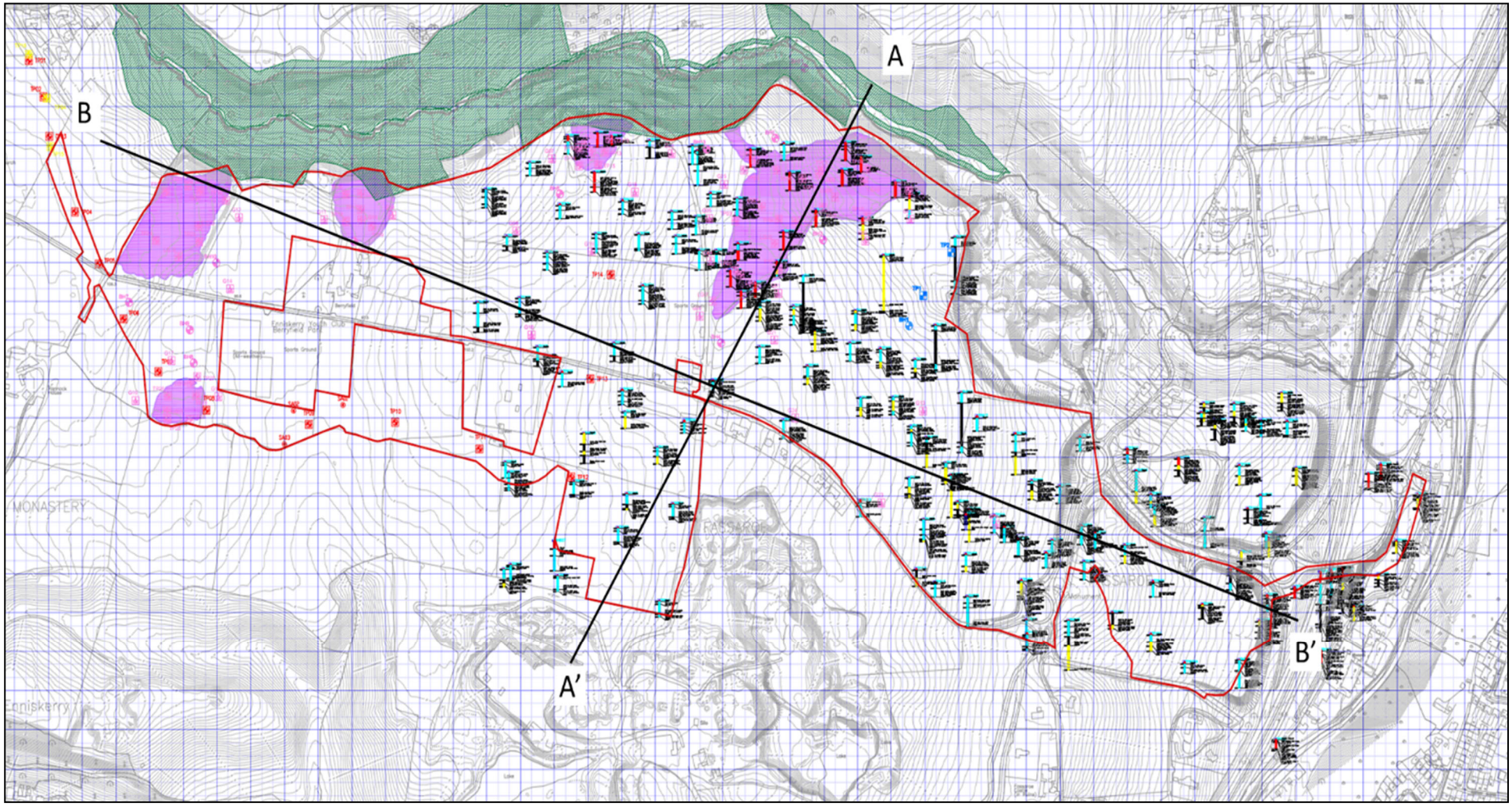


Figure 6-19: Cross Section A-A' across the Site

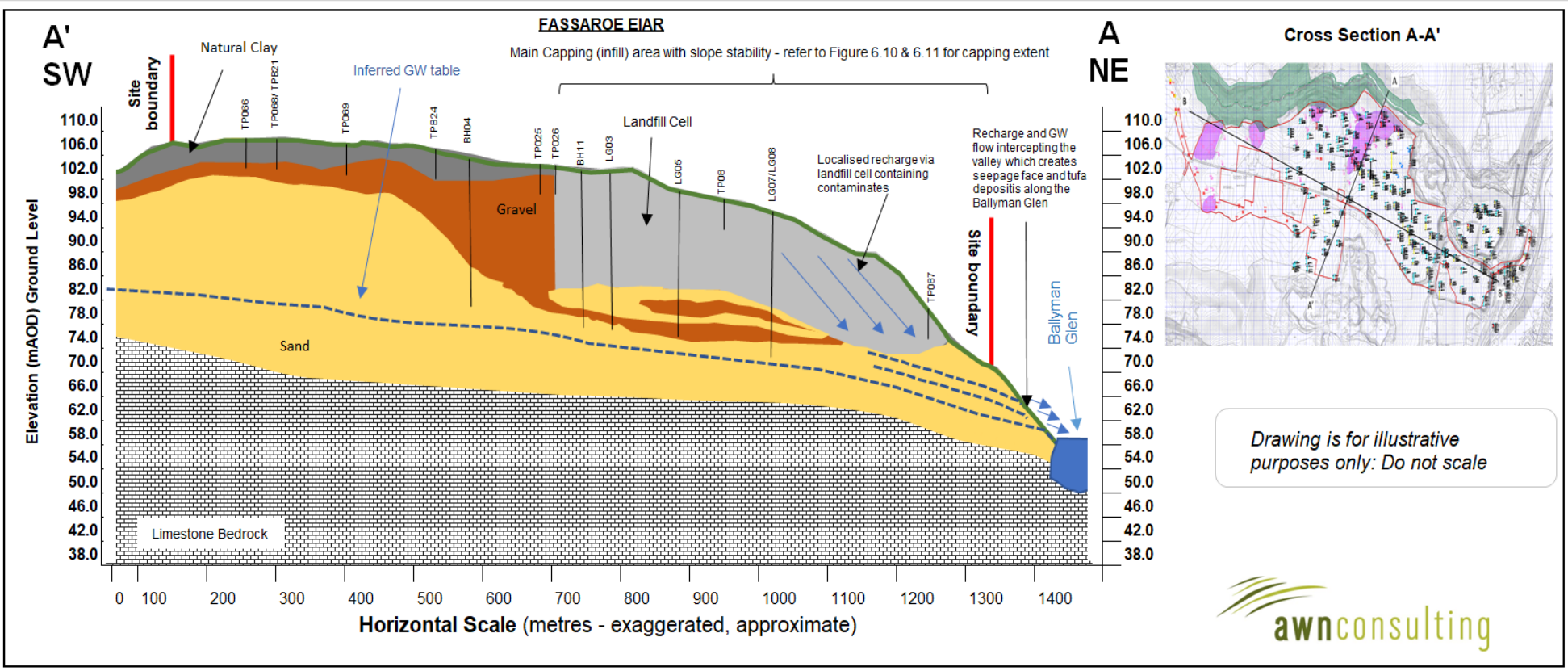


Figure 6-20: Cross Section B-B' across the Site

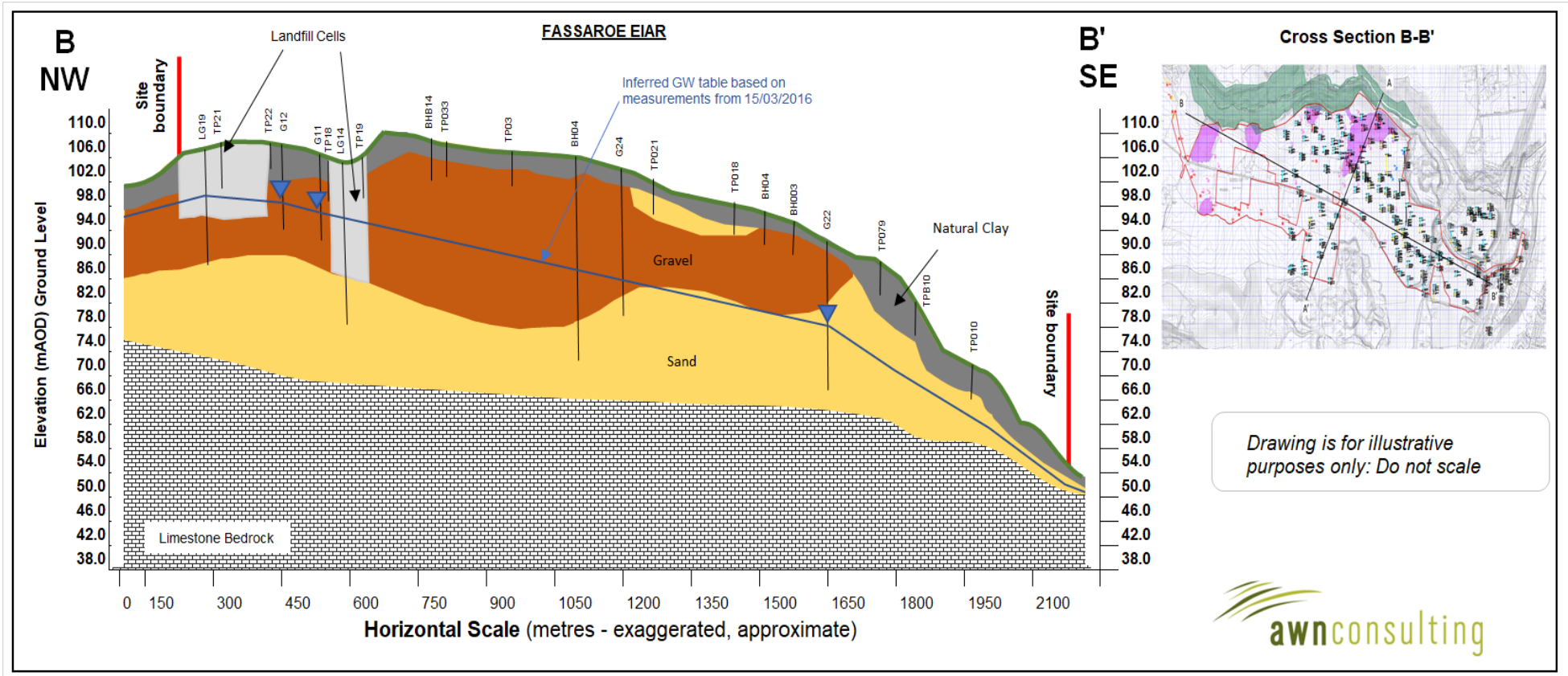


Figure 6-21: Waste (Capping) Extent Across the Proposed Development Site (RPS, 2022)

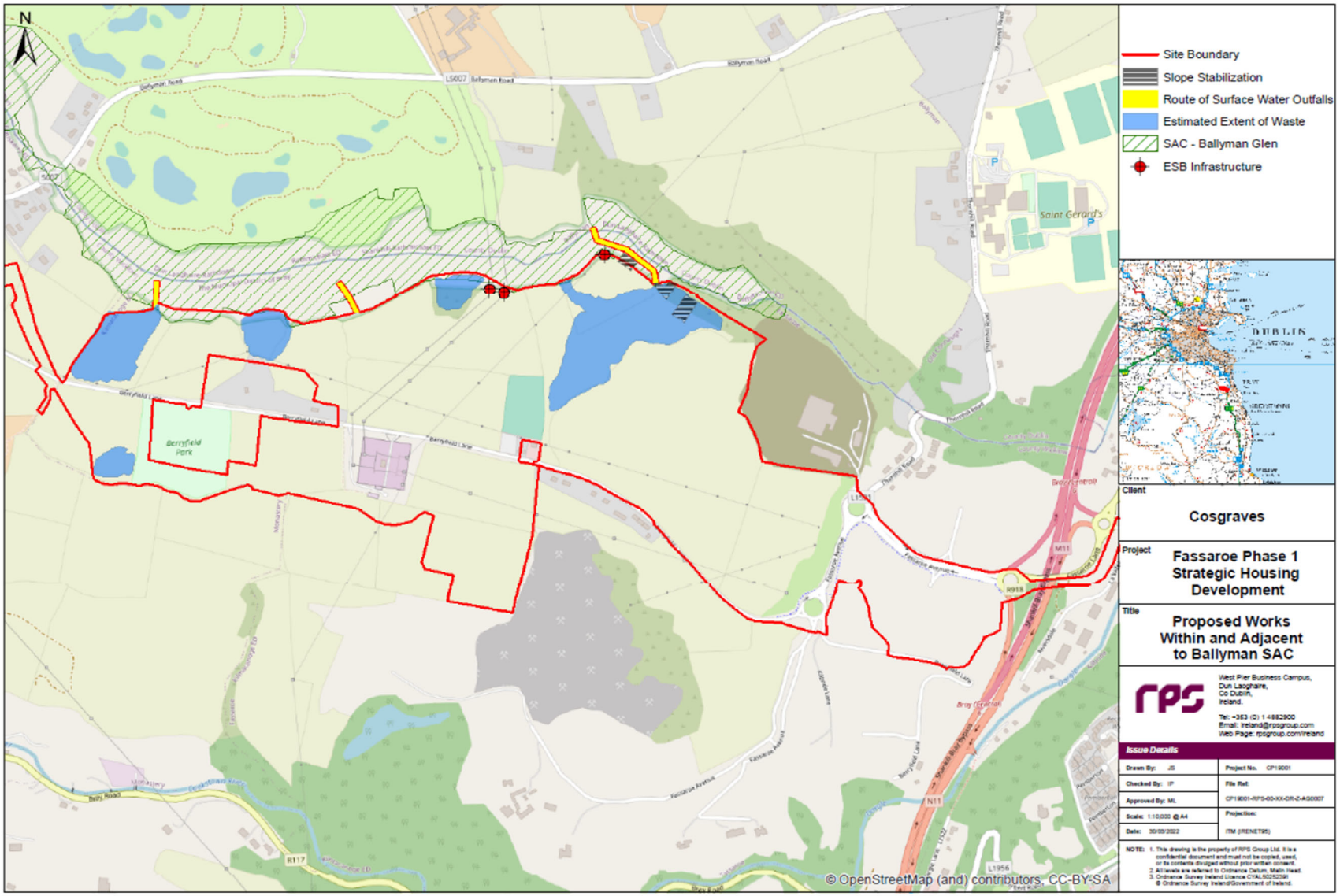
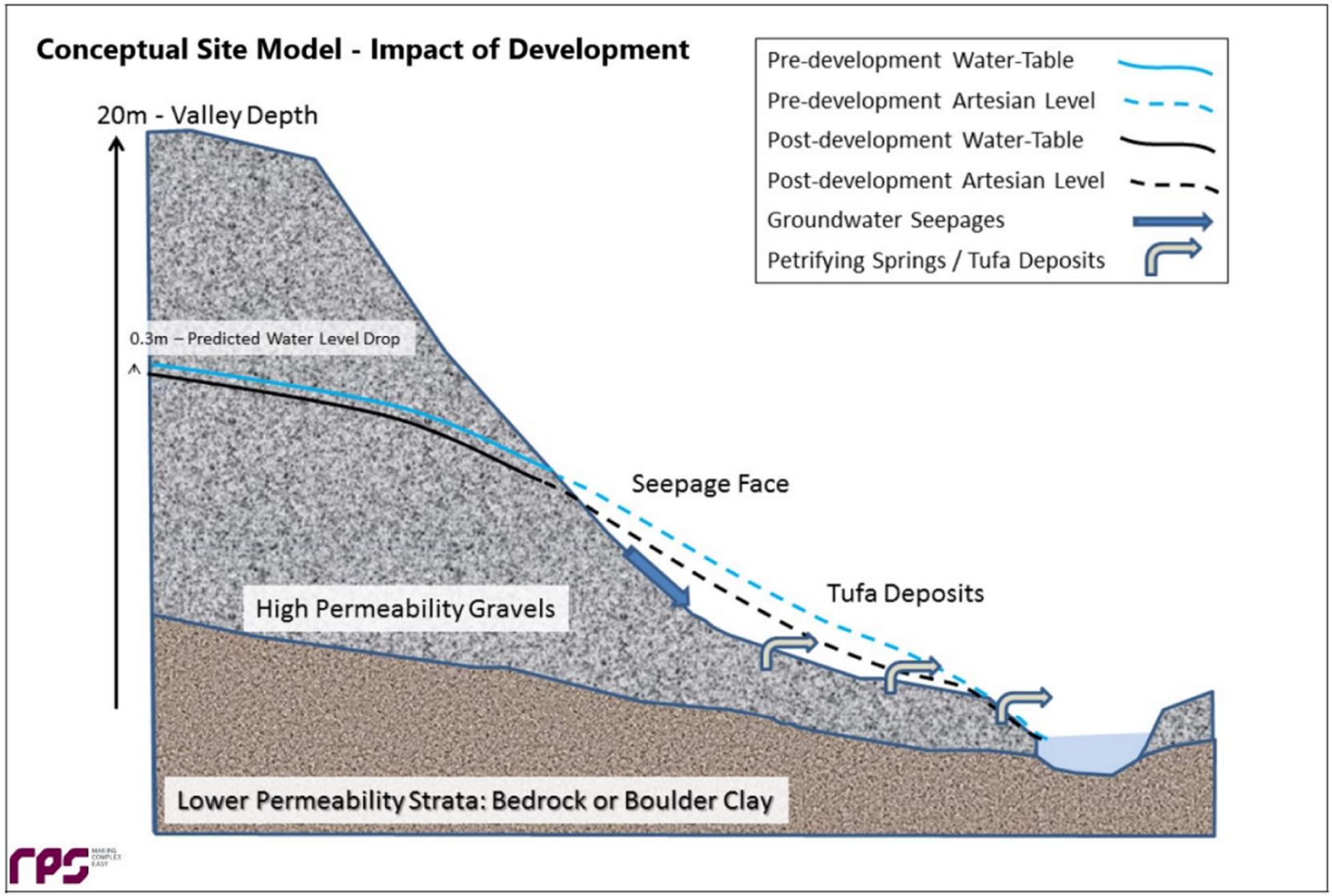


Figure 6-22: Seepage Face Elevation Pre-Development and Post Development (RPS, 2022)



6.3.2.8 Rating of Site Importance of the Hydrogeological Features

Based on the TII (previously NRA)/IGI methodology (refer to **Appendix 6A**) and the criteria for rating the importance of hydrogeological features, the importance of the hydrogeological features at this site is rated as ***'Extremely High Importance'***. This is based on the assessment that the attribute has a high-quality significance or value on an international scale. The aquifer is a locally important (Ll) aquifer underlying The Site and is used for domestic and agricultural proposes. In addition, it hosts the Ballyman Glen SAC and proposed National Heritage Site (pNHA), located along the northern boundary of The Site. Emerging groundwater spring flows feed the tufa deposits and alkaline fen and they are therefore considered to be Groundwater Dependant Terrestrial Ecosystems (GWDTE).

The presence of this and other Natura Sites 2000 are further discussed in Chapter 7 Hydrology and Chapter 8 Biodiversity of this EIA Report.

6.4 Potential Impacts

6.4.1 Features of the Development with Potential Impacts

The likely impacts of works to soils within the site on human health are considered in Chapter 4 Population and Human Health.

The main features of the proposed development that could impact on soils, geology and hydrogeology in the absence of mitigation are as follows:

- Development of the residential properties and associated commercial and retail development;
- Re-profiling of the site topography;
- Excavation and reuse of topsoil and subsoil;
- Construction of underground services (surface water drainage, associated drainage infrastructure, etc);
- Excavation and construction works adjacent to the historic landfills;
- Potential spillages and temporary storage of hydrocarbons onsite; and
- Remediation of landfill areas.

6.4.2 'Do Nothing Scenario'

The site is currently an agricultural field, with the lands used for grazing and crop production. Over-working of the lands could lead to erosion of the topsoil layer. The application of fertilizers and agricultural chemicals could impact on soil and / or groundwater quality. However, with good farm management, the continued farming of the lands will have an imperceptible impact on soils, land and geology.

The RPS Risk Assessment indicates that there is landfill gas and leachate being generated from the historic landfill sites The "Do Nothing" scenario will result in the continued generation of landfill gases and leachate. The volume and composition of the gases and leachate will depend on the nature of the waste, its age, moisture content, presence/absence of oxygen, effectiveness of the capping, etc. Over time, the generation of landfill gases and leachate will decrease. In the meantime, there is ongoing potential for long-term moderate negative impacts on the petrifying groundwater springs, depositing tufa, along the Ballyman Glen SAC to be affected by a deterioration of groundwater quality from leachate.

6.4.3 Construction Phase

6.4.3.1 Land

Approximately 80.16 ha of agricultural land will be taken out of agricultural production used for grazing and crop production. Parts of the site were formerly used for landfill but are now covered in scrub or poor grassland. The area is predominately zoned for New Residential, with Employment to the east, with Community & Education, Open Space and Active Open Space within the Bray Environs LAP Specific

objectives. To the east of the proposed Site the land is used as GB – *'To protect and enhance the open nature of lands between settlements.'*

The potential impact on the altered land use is likely to have a moderate negative impact on the environment of the area, in that it alters the character of the environment, albeit in a manner consistent with existing and emerging trends as planned for in the Bray Environs LAP. This will be a permanent impact.

6.4.3.2 Soils & Geology

Impacts from soils on human health are considered further in Chapter 4- Population and Human Health.

During the construction phase of the development, the following potential impacts on soils and bedrock could occur and have been assessed accordingly:

- Re-profiling and stripping of topsoil will result in exposure of the underlying subsoil layers to the impacts of weather and construction traffic and may result in subsoil erosion and generation of sediment laden runoff;
- Soils beneath the proposed development may become unnecessarily compacted by machinery during construction;
- Topsoil and subsoil may become rutted and deterioration of the topsoil layer and any exposed subsoil layers, resulting in erosion and generation of sediment laden runoff;
- Dust generation can also occur during extended dry weather periods as a result of construction traffic;
- Soils and bedrock may be at risk of becoming contaminated through Site construction activity; in particular the risk of fuel spillages and leakage. There is a risk of direct contact, ingestion or inhalation of volatile hydrocarbons from localised contamination (to onsite construction and maintenance workers) via. potential onsite leaks;
- Works adjacent to neighbouring EPA licenced facilities and,
- Excavation and construction adjacent to the historic landfill sites. The remediation works on the landfill areas are considered in further detail below.

Re-profiling of the site topography to achieve design levels and the construction of the link road and other development works will involve excavation of soils to lower high parts of the Site, and the use of engineered fill to raise low parts of the site to reach design levels for the proposed development and road profile. The total volume of cut is ca.136,053m3 and the volume of fill is ca. 265,800m3 which will be required for the lane realignments, residential sites, apartment blocks, creche, neighbourhood centre and landscape areas, resulting in a net fill of 129,747m3. For the landfill remediation works, 82,865m3 of fill is required for the capping layer of the landfills at a depth of 1m and 24,860m3 of pea gravel for fill is required to a depth of 0.3m.

The site layout and site levels across the site have been designed so as to maximise the opportunity for achieving a sustainable materials balance which will minimise the need for import of material to the site. Due to the need for significant additional fill material on site for the landfill remediation capping however, it has not been possible to avoid a deficit of fill. Based on the development proposed under this current Phase 1 application alone it has been calculated that there will be a deficit of fill material of the order of 129,747m3 required within the Phase 1 development areas.

There is a potential to disturb the waste materials, landfill gases and leachate with works adjacent to the historic landfills. Depending on a number of factors, this work could release or mobilise landfill gases and / or leachate. The excavation of utility trenches or other infrastructure could facilitate the movement of landfill gases and leachate with the potential to contaminate soils in other areas of the development.

Stripping of topsoil will be required across the Site. It is expected that all stripped topsoil will be reused on Site (incorporated into landscaping of back gardens and public open spaces) subject to appropriate testing. Excavation of existing subsoil layers will be required in order to allow road construction, foundation excavation, drainage and utility installation and provision of surface water attenuation facilities. Where feasible, clean excavated material outside the historic landfill areas will be reused as part of the Site development works (e.g. use as fill material beneath houses and as capping material on the landfills and landscaping proposals for the district park and active open space and roads) however should some subsoils prove not suitable for engineering reuse onsite, such material may need to be removed and disposed offsite to a suitably licenced waste recovery / disposal facility.

Soils will be excavated during the construction of the foundations for the housing units and the drainage infrastructure. Weathered bedrock may be encountered. This is a direct, permanent impact on the soils and geology; however, it is not considered to be a significant adverse impact as the removal will have a negligible influence on the overall landform morphology. During construction, soils will be exposed in excavations and in stockpiles. These soils will be subject to erosion by wind and rain. If this occurs the soil might breakdown and change the excavated soil from acceptable soil for reuse to unacceptable soil for reuse.

Activities during construction will primarily comprise the excavation and pouring of foundations for the housing units, installation of the storm water and foul water drainage works, watermains and laying of cable ducts foundations for neighbourhood centre and creche, remediation works to landfills and landscaping works for laying out the District Park and active open space. Tracked excavators and rock-breakers will likely be sufficient to excavate soils and potentially weathered/ fractured bedrock for subsequent relocation to facilitate construction works.

The extent of the foundations for the housing units is likely to be less than 1m deep and may locally encounter weathered bedrock.

The proposed drainage system is expected to be constructed up to 1.2m bgl.

The extent of excavation for service / utility trenches will vary; however, the general depth will be in the region of 1m.

An existing electricity line will be diverted underground along the northern boundary of the site. The maximum depth of the proposed underground cable will be 750mm bgl. Part of the underground cable will pass through historic landfill 2. Across historic landfill 2 the underground cable will be installed in the capping layer above the low permeability capping membrane. Similarly all underground cables required for lighting within the District Park located within the footprint of historic landfill 1 and historic landfill 2 will be installed within the capping layer and above the low permeability membrane. This will ensure that there are no preferential pathways for the movement of landfill gas or leachate created.

Apartment Blocks 1-3 and the neighbourhood centre will require excavations up to 5.5m bgl to facilitate basement construction.

The impacts of the excavation and construction include:

- Hydrocarbons will be stored and used at the site for construction machinery. The potential impact would depend on the volume and location of a fuel spill / leak. Fuel storage tanks on construction sites are typically no larger than 1,300 litres. If a fuel spill occurs the appropriate equipment will be used and disposed of to a licenced facility;
- Soil erosion due to the excavation and earthworks, and temporary storage of excavated soil. The prevention of soil and sediment runoff will be implemented during the construction of the proposed development;
- Soil compaction may occur due to vehicle movements during the construction phrase of the development, resulting in soil erosions and rise in runoff.

The overall magnitude of the above potential impacts, is of moderate long term effects in the absence of mitigation measures.

Parts of the proposed development site have previously been worked for sand and gravel abstraction, evidenced by the location of the historic landfill sites within the development boundary. The ground investigation noted areas of sand and gravel within the development. However due to historic abstraction within the site boundaries the effect on aggregate sterilisation caused by the proposed development is considered to be slight and permeant.

In the absence of mitigation measures the proposed development will have a moderate negative permeant effects in the absence of mitigation measures on the Enniskerry Delta CGS.

6.4.3.3 Remediation of Landfill Areas

The RPS Environmental Risk Assessment (2018) identified the following potential sources of contamination.

- "Potential for hydrocarbons to be present in the shallow soils as a result of historic spills/ leakages of the adjacent quarry and integrated waste management facility from the potential spillages and leakages from the industrial activities (hydrocarbons, metals). Potential hydrocarbons were observed during the walk over in October 2015 in the discrete springs identified at the base of a steep embankment adjacent to the river where there was 'clear signs of ochre staining and hydrocarbon sheen at surface" (RPS, 2018).

The landfill capping works will likely have a positive impact on soils and geology in stabilising the landfill areas, preventing water ingress to the landfill area and prevent the generation of leachate and reduce possible vertical contamination of underlying soils and possible lateral contamination of surrounding soils.

The RPS Environmental Risk Assessment (2018) indicates that outside the landfill areas only natural soils were encountered.

Associated with the remediation of the 5no. historic landfill areas the following issues may arise as identified from the RPS Remediation Strategy Report (RPS 2020).

"Slope stabilisation

In order to accommodate both the construction of the landfill capping system and the Phase 1 development, slope stabilisation measures will need to be installed in the four areas where landslips and potentially unstable fill areas have been identified to the north of Site 2. This will need to be done at an early stage in the Phase 1 development and prior to the installation of the capping system or loading/surcharging on the landfill areas."

Slope stabilisation measures will be designed as part of the capping works. Therefore there will be a significant positive impact on slope stability.

"Settlement

It is possible, given the history of Site 1, 2, 3A, 3B and 3C that only low levels of compaction of waste occurred during filling operations. As such, with the installation of a minimum of 1.3m of cover soils above the waste and additional fill above this to make up the finished ground level, this loading will result in settlement of the landfill areas."

In the absence of mitigation measures there is the potential for a moderate negative short term effect on the integrity of the landfill sites.

"Excavation and Removal of Waste off-site

Site 1

A narrow strip of waste is to be excavated along the southern perimeter of Site 1 in order to set back the waste boundary so that the installation of landfill gas vents can be accommodated on the park area (without extending onto the access road). Approximately 480m3 of waste will be excavated from this location and removed off site to a licenced waste facility.

Site 2

Similar to Site 1, an area of waste on the southern tip of Site 2 is to be excavated 2 in order to avoid having to locate landfill gas cowls on road or residential driveways. Approximately 2,280m3 of waste will be excavated from this location and removed off site to a licenced waste facility.

Site 3B

It is proposed to construct a new access road through Site 3B… In order to accommodate the required levels for the road, the final profile level of Site 3B must be lowered. This will be achieved through the excavation of waste from Site 3B and transportation to a licenced waste disposal facility.

As waste below the road would result in long term settlement, measures would be required to mitigate this impact (e.g. rigid platform, piles, ground replacement). As most of the waste will be excavated to reach the required levels, the option of excavating the remaining waste and replacing it with acceptable material to the base of the road construction is considered the most economical and time efficient approach

Waste within Site 3B currently extends to 4-4.5m bgl. It is proposed that all waste within the footprint of the road pavement in Site 3B will be excavated down to clean material and removed offsite. The estimated volume of waste to be excavated and removed off site is 6,920m3."

"Asbestos

During the site investigations to date only 1 of 53 samples of waste tested positive for asbestos. This waste was in Site 1. Nonetheless there remains a risk that asbestos or Asbestos Containing Material (ACM) could be uncovered during the excavation of waste in Site 3B."

Dust

Dust may be generated during the excavation of landfill waste which may impact construction workers.

"Gas and Odour

The anaerobic decomposition of putrescible waste generates landfill gas which comprises methane and carbon dioxide. Gas monitoring carried out on Site 3B to date has consistently recorded methane concentrations ranging from 25.8% v/v to 70.4% v/v and carbon dioxide ranging from 17.2%v/v to 36.6%v/v. Therefore it is expected that methane and carbon dioxide will be encountered during the Site 3B excavations."

Any likely impact to human health from gas and odour are considered in Chapter 4- Population and Human Health.

In the absence of mitigation measures there is the potential for a moderate short term impact on the environment from the excavation and the removal of waste.

6.4.3.4 Hydrogeology

Excavation and Infilling

The potential impact associated with excavation and infilling on the local hydrogeology is the increase of aquifer vulnerability locally.

It is proposed that there will be minor volumes of excavated waste material generated during the construction phase of the proposed development. The areas of the landfill will be further capped and compacted to avoid any settlement at these areas. In addition, the waste capping material will be placed and compacted (replacing with new as required) over the waste product in accordance with the project engineer's specification. Further discussion on landfill remediation proposals is discussed in detail in Chapter 2 of this EIA Report, Volume 3 Parts 3 and 4 of the EIAR and the Historic Landfill Remediation Strategy Report and Gas Management Strategy lodged as part of the current application documentation.

The proposed landfill capping measures comprise mitigation and management proposals to eliminate any potential adverse impacts of the landfills on the development proposed, and in particular any potential to impact on human health or the uses proposed which include residential and amenity uses. These measures are discussed in detail in Chapter 2 as well as the management of run-off.

The total volume of cut is ca.136,053m3 and the volume of fill is ca. 265,800m3 which will be required for the lane realignments, residential sites, apartment blocks, creche, neighbourhood centre and landscape areas, resulting in a net fill of 129,747m3. For the landfill remediation works, 82,865m3 of fill is required for the capping layer of the landfills at a depth of 1m and 24,860m3 of pea gravel for fill is required to a depth of 0.3m.

The site layout and site levels across the site have been designed so as to maximise the opportunity for achieving a sustainable materials balance which will minimise the need for import of material to the site. Due to the need for significant additional fill material on site for the landfill remediation capping however, it has not been possible to avoid a deficit of fill. Based on the development proposed under this current Phase 1 application alone it has been calculated that there will be a deficit of fill material of the order of 129,747m3 required within the Phase 1 development areas.

Further soil sampling will be undertaken during pre-development works however; it is anticipated that all excavated material will be reused on site. In the event that potentially contaminated soils are encountered, these soils will be segregated, tested and classified as hazardous or non-hazardous in accordance with the EPA Guidance Document: Waste Classification – List of Waste and Determining if Waste is Hazardous or Non-Hazardous (2015) and Council Decision 2003/33/EC. It will then be removed from site by a suitably permitted waste contractor to an authorised waste facility.

Small amounts of waste may need to be removed to accommodate infrastructure in the area. In the event that this occurs, waste material will be removed from site by a licensed waste haulier and taken to a licensed landfill, or where possible, recovered for recycling. The localised disturbance of waste could potentially mobilise landfill leachate resulting in further contamination of the groundwater aquifer. This could occur by the breaching of a confining layer allowing downward vertical migration or lateral movement along utility trenches.

A construction site compound will be established at the site and the working area fenced off to provide a secure site. Due to the scale of development and the phased approach to development this compound will move positions throughout the construction period.

The construction compound will accommodate a site office and staff welfare facilities (including a canteen, drying room, toilets and first aid) as well as storage areas for materials, waste areas and plant and machinery. All surplus plant and materials shall be stored in this location when not in use and will be secured here at night when the site is not operational. Oil storage will be bunded appropriately in 110% bunded structures.

An electricity connection will be provided to the site at the outset. However, it will also be necessary on occasions to use diesel generators. A fuel storage area will be provided at the site compound.

Temporary portable toilet facilities will be provided within the compound. These units will be maintained, and the waste collected therein will be disposed of using an appropriately licensed contractor.

The location of the compound(s) will vary depending on the phasing of the works and the location of the different elements associated with the overall scheme (road, commercial buildings, house building, and retail development). Outside of the main construction compound locations, there may be a number of smaller local work compounds throughout the site which may be used by the Contractor for staff welfare facilities, to store materials for short term use and for plant to park overnight. All vehicle maintenance and refueling will take place at the main compound(s).

Dewatering

There are no major dewatering plans required as part of the planned development. However, minor and localised dewatering will be required during the excavations of the proposed development. The potential impact is the localised lowering of groundwater levels during dewatering which may impact on the nearby Ballyman Glen SAC/ GWDTE. Dewatering will be temporary to short term which will have an imperceptible impact on the nearby SAC.

Accidental Spills and Leaks

During construction of the development, there is a risk of accidental pollution incidences to soil and groundwater 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.
- The use of concrete and cement during pad foundation construction.

6.4.4 Operational Phase

6.4.4.1 Soils & Geology

The development will be serviced by gas so the potential impacts associated with the on-site storage and usage of heating oils are avoided. The aspects of the proposed development that potentially have operational-related impacts on soils and geology in the absence of mitigation are:

- The parking of cars and trucks within the development may results in the leakage of small amounts of oil resulting in contamination of soils. Any leak is likely to be small in scale. The proposed development will comprise of a surface water drainage system with a petrol and oil interceptor to mitigate, the potential impact is ***long-term slight negative***.

6.4.4.2 Landfill Remediation

There are no buildings proposed on the area of the historic landfill sites. The access road crosses a portion of historic landfill sites 2 and 3B. Construction on made ground, such as landfills, could lead to settlement resulting in damage to infrastructure. Unmitigated, the potential impact is **long-term slight to significant negative;** the significance varying with the nature of the settlement (amount and whether differential) and the infrastructure affected.

6.4.4.3 Hydrogeology

There is no requirement for bulk diesel or chemical storage on site during the operation phase of the development. Any accidental emissions during the operational phase from vehicles which could cause localised contamination if the emissions enter the soil and groundwater environment without adequate mitigation. However, it is noted that any accidental discharge will more likely impact stormwater drainage due to the hardstand and drainage infrastructure proposed. This surface water will be discharged through a network of oil-water separators to the proposed series of attenuation systems. The attenuation system will remove all the silt from the water and will contain oil-water separators.

Incorporation of hard stand area and levelling/ compaction of ground level and the use of limited (due to underlying landfill conditions) SUDs techniques will have a minor effect on local recharge to ground; however, the impact on the overall groundwater regime will be insignificant. The hardstanding area will be 3.59 ha. which will not have an overall impact on the groundwater regime of the gravel (11 km^2) or bedrock (3,334 km^2) aquifers.

It is proposed to incorporate soakaways within all of the proposed development areas. These soakaways will be positioned away from the landfill zones to ensure no mobilisation of leachates and other chemicals. This allows water to percolate to ground at pre-development infiltration rates. The surface water network also connects to the ponds within the District Park to allow water from storm events to be attenuated and discharged to the County Brook at controlled runoff rates. This does not lead to loss of groundwater recharge, as such storm events would have resulted in direct runoff to the stream in any case. This will avoid any adverse impact on the Ballyman Glen SAC as it could have led to notable reductions in groundwater which could have potentially affected the petrifying spring locations within Ballyman Glen for which the SAC is designated.

The storm water management design for the proposed housing and road development routes the storm water to soakaways to promote percolation back to ground. The soakaways are designed to accommodate the 1 in 5-year storm events. Runoff in excess of the 1 in 5-year event will overflow from the soakaway storage to attenuation ponds which discharge to surface water. The storm water management system for the housing and road development (other than the landfill capping measures discussed below) will therefore have a negligible impact on groundwater recharge rates and may even promote additional recharge due to the additional storage provided in the soakaway tanks.

The post-development recharge represents a potential reduction of 7% in the recharge rate. This is based on a reduction from 575mm/yr to 533mm/yr, which is a reduction of 42mm/yr. The reduction in the average groundwater levels as a result of the decrease in recharge rate of 42mm/yr can be estimated based on the storage parameters for the gravel aquifer. A typical effective porosity for a gravel deposit of 15% is adopted for the basis of the assessment. To estimate the drop in levels resulting from a decrease in recharge rate the reduction in question (42mm/yr or 0.042m/yr) is divided by the porosity (15% or 0.15) which yields a water level fluctuation of 0.28m. This result was rounded up to 0.3m for the purposes of reporting.

Similarly, it is estimated that a consistent reduction in recharge percolating to groundwater across the larger landfill cells (landfill site 2) from 575 to 67mm could result in a potential ground water level decrease directly beneath the landfill of up to 3.4m. The observed reduction in groundwater level will be less as the potential drop in groundwater levels directly beneath the landfill will promote groundwater flow in from the surrounding areas, which will equilibrate the levels with the effect of marginal drawdown being observed from the wider area.

The reduced recharge rate in the aquifer could lead to a comparable reduction in the seepage face elevation. Therefore, potentially there may be a drop of 0.3m from the top of the seepage face and the reduction in flow at the springs could reduce by 7%. A predicted reduction of 0.3m is a small change when compared to the total saturated thickness of the gravel. The tufa springs are mapped lower down in the river valley, rather than at the top of the seepage face and therefore it is unlikely that this minor amount of drawdown would lead to a significant loss of any of the petrifying springs. The reduced recharge rate (by 7% in comparison to

pre-development conditions) could lead to a comparable reduction in flow from the springs (7%), however it is expected the springs would continue to flow and the tufa would continue to be deposited.

The springs and seepages which feed the tufa deposits emanate at the seepage face where groundwater emerges from the river valley. The extent of the seepage face above the river elevation is related to the groundwater elevation in the gravels, which in turn is related to the recharge.

As the land was previously used as a landfill and agricultural lands, there will a loss of amenity/agricultural land as a result of the proposed development but also redevelopment of brownfield land which is compliant with the zoning for these lands – mixed-use high-density development.

Once the development is complete, the hydrological and hydrogeological environment will not adversely change. Therefore, the impacts of the operational phase of the proposed development on Hydrogeology are considered ***short-term***, ***imperceptible*** and ***neutral impact***.

6.4.5 Cumulative Impacts

6.4.5.1 Soils and Geology

A review was carried out of the Wicklow County Council and Dun Laoghaire Rathdown County Council Planning websites on the 1st of April 2022 There are a number of small planning applications in the surrounding Wicklow County Council and Dun Laoghaire Rathdown County Council areas that due to their size and scale are not likely to have a significant cumulative impact on the proposed development.

The following planning application has the potential to have a cumulative impact with the proposed development on Soils and Geology.

Planning Reference 1715- Wicklow County Council – Granted 26/06/2017- Cosgrave Property Group.

12 no detached 5 bed houses with optional garages, approximately 280m of a new access road to the site (and adjoining agricultural lands) from Ballyman Road (also forms part of road proposals under separate planning application Reg Ref 16/999), public open space (approximately 1.19 ha) together with ancillary site development, drainage and landscaping works all on a site of approximately 5.66 ha

This development consists of a small number of houses and associated roads and open space. The development is by the same developer as the current developer and will likely be complete by the time the within development commences. Significant cumulative impacts are not likely to occur.

There are no other notable developments currently proposed within the Fassaroe area. The main potential for cumulative impact in the immediate vicinity arises from the future development of the remainder of the Action Area lands which allow for considerable amounts of future mixed use high density development. While this EIAR relates to the current Phase 1 application proposals specifically the specialist environmental assessments also have regard to the potential future nature of cumulative impacts that may arise due to the future development of the entire Action Area lands. The potential impact on the land take for the entire Action Area land is likely to have a moderate negative impact on the environment of the area, in that it alters the character of the environment, albeit in a manner consistent with existing and emerging trends as planned for in the Bray Environs LAP. This will be a permanent impact. The remainder of the Action Lands will be developed following the Phase 1 development and therefore during construction there will not be a cumulative impact on soils and geology.

A notable permitted development in the slightly wider area is the Irish Water reservoirs at Ballyman which have been granted permission and which will ultimately serve much of the new development lands of the southern part of Dun Laoghaire Rathdown County Council and northern Wicklow, including the Fassaroe lands themselves.

No significant cumulative impacts on soils and geology environment are anticipated during the construction or operation phases. The remainder of committed developments in the vicinity generally comprise the redevelopment or extension of existing properties.

6.4.5.2 Hydrogeology

The cumulative impact of the proposed development with any/all relevant other planned or permitted developments are discussed below. This section details the cumulative impact to related and permitted, concurrent, and future developments.

Construction Phase

In relation to the potential cumulative impact on hydrogeology during the construction phases, the construction works which would have potential cumulative impacts include:

The anticipated cumulative effect of the Proposed Development with any/all relevant other planned developments as outlined in Chapter 2 or permitted developments as outlined in Chapter 3 are discussed below for construction and operational phases respectively. This consideration has included any other residential developments, other zoned lands in the LAP.

Surface water run-off during the construction phase may contain increased silt levels or become polluted from construction activities. Run-off containing large amounts of silt can cause damage to the underlying aquifer.

Contamination of local water sources from accidental spillage and leakage from construction traffic and construction materials unless project-specific CEMPs are put in place for each development and complied with mitigation measures and protective measures to the surrounding environment.

Where there is a potential for contamination of watercourses, mitigation measures are required to manage sediment run-off and fuel leakages during construction and operation. All developments are required to ensure they do not have an impact on the receiving water environment in accordance with the relevant legislation (S.I No 77/2019 EU Environmental Objectives (Surface Waters) Amendment Regulations 2019 & S.I. No. 366/2016 - European Union Environmental Objectives (Groundwater) Amendment Regulations 2016) such that they would be required to manage runoff and fuel leakages.

The residual cumulative impact on hydrogeology for the construction phase is anticipated to be short-term, neutral in terms of quality and of not significant significance, once appropriate mitigation measures to manage water quality runoff in compliance with legislative requirements are put in place for each development.

Operational Phase

Potential cumulative impacts during the operational phases of existing and permitted development of zoned lands in the LAP area include:

- Increased hard standing areas will reduce local recharge to ground and increase surface water run-off potential if not limited to the green field run-off rate from the site;
- Increased risk of accidental releases from fuel storage/delivery unless mitigated adequately.
- Increased risk of accidental discharge of hydrocarbons from car parking areas and along roads and unless diverted to surface water system with petrol interceptor; and
- Any additional foul discharges should be treated where appropriate and/or diverted to the foul sewer system and not directly to ground.

As a best practice measure, similar mitigation measures to those described in Section 6.5 will need to be implemented in all developments to protect water quality.

Increase in wastewater loading and water supply requirement is an impact of all development. Each development will require approval from Irish Water confirming available capacity in the water and wastewater infrastructure.

Development will result in an increase in hard standing which will result in localised reduced recharge to ground and increase in run-off rates. However, each permitted development is required by the Local Authority to comply with the Greater Dublin Strategic Drainage Strategy (GDSDS) and Local Authority requirements by providing suitable attenuation on site to ensure greenfield run-off rates and ensure that there is no increase in offsite flooding as a result of development.

The residual cumulative impact on hydrogeology for the operational phases is anticipated to be long-term, neutral in terms of quality and not significant, once appropriate mitigation measures to manage water quality runoff in compliance with legislative requirement are put in place for each development.

6.5 Mitigation Measures

The mitigation measures to be employed to avoid, reduce and / or mitigate potential impacts during the construction and operational phases are set out in the sections below.

6.5.1 Construction Phase

6.5.1.1 Geology and Soils

To mitigate against the impacts associated with the re-profiling of the site topography to achieve design levels, an earthworks balance has been carried out. The purpose of this was to maximise the re-use of materials within the site and minimise the need for the importation of material. Where suitable, the soil to be excavated will be re-used on site as fill. This will reduce the volume of material to be taken off site for disposal.

Stripping of topsoil will be carried out in a controlled and carefully managed way and coordinated with the proposed staging for the development. At any given time, the extent of topsoil strip (and consequent exposure of subsoil) will be limited to the immediate vicinity of active work areas. Topsoil stockpiles will be protected for the duration of the works and will be located so as not to necessitate double handling. This will minimise deterioration in topsoil quality and minimise sediment runoff.

The excavation of material will be minimised as much as possible to reduce the impact on soils and geology. There will be approximately 136,053m^3 of soils excavated at the site including clays and gravel aggregates.. To maximise the potential for reuse, topsoil and subsoil will be stored separately. Topsoil and any native soils that can be used for amenity purposes will be stockpiled on the proposed development area for use as required in the final landscaping of the development. While every effort will be made to put this material to beneficial use on the site, some material may not be suitable for reuse. Any unsuitable soil will be taken to a site holding a waste facility permit. Soils found to be contaminated with waste materials will be taken to a licensed waste recovery or disposal facility.

The RPS Environmental Risk Assessment (2018) indicates that outside the landfill areas only natural soils were encountered however the risk of encountering unsuitable material outside the landfill area cannot be fully discounted. Any unsuitable material encountered outside the historic landfill areas including in close proximity to the adjacent EPA licenced facilities will be subject to further environmental testing prior to reuse onsite or transportation offsite.

Any surplus material, or materials which are deemed not suitable for onsite reuse will be managed, transported and disposed of in accordance with the requirements of the Waste Management Act 1996, as amended, and the Waste Framework Directive 2008/98/EC of the European Parliament and Council on waste.

A project specific Detailed Resource and Waste Management Plan (RWMP) (based on the RWMP submitted as part of this planning application) will be fully implemented onsite for the duration of the project. The residual impact will be permanent slight to moderate negative.

The design of road levels and finished floor levels has been carried out in such a way as to minimise cut/fill type earthworks operations. The duration that subsoil layers are exposed to the impacts of weather will be minimised. Disturbed subsoil layers will be stabilised as soon as practicable (e.g., backfill of service trenches, construction of road capping layers, construction of building foundations and completion of landscaping). Similar to comments regarding stripped topsoil, stockpiles of excavated subsoil material will be protected for the duration of the works. Stockpiles of subsoil material will be located separately from topsoil stockpiles.

An existing electricity line will be diverted underground along the northern boundary of the site. The maximum depth of the proposed underground cable will be 750mm bgl. Part of the underground cable will pass through historic landfill 2. Across historic landfill 2 the underground cable will be installed in the capping layer above the low permeability capping membrane. Similarly all underground cables required for lighting within the District Park located within the footprint of historic landfill 1 and historic landfill 2 will be installed within the capping layer and above the low permeability membrane. This will ensure that there are no preferential pathways for the movement of landfill gas or leachate created.

It is likely, given the history of Site 1, 2, 3A, 3B and 3C that only low levels of compaction of waste occurred during filling operations. As such, with the installation of a minimum of 1.3m of cover soils above the waste and additional fill above this to make up the finished ground level, this loading will result in settlement of the landfill areas. A geogrid system will be incorporated into the capping system to reduce differential settlement.

In addition, the earthworks programme for the Phase 1 development will include for the surcharging of Site 1, 2, 3A, 3B and 3C with clean excavated material at an early stage in the development works (once the slope stabilisation works on Site 2 have been completed and prior to installation of the capping system) so that post-capping settlement of the landfill areas is reduced as much as possible.

The following measures will be implemented for soil handling to minimise erosion:

- The areas stripped of topsoil and overburden will be kept to a minimum. Stripping of lands will be phased to suit the pace of development at the site.
- Stockpiled soils will be profiled to minimise erosion from wind and rain.
- Clean surface water runoff will be diverted around earthworks areas to minimise erosion (and the volume of silted water generated). To achieve this, shallow cut-off drains or temporary plastic diversion barriers will be installed.
- Stockpiles of topsoil will be kept to a maximum of 2m high to avoid anaerobic conditions and maintain fertility for reuse.
- Vegetation of stockpiles will be promoted to minimise erosion

The mitigation measures for prevention of soil / bedrock contamination during construction are proposed below:

- Earthworks plant and vehicles delivering construction materials to Site will be confined to predetermined haul routes around the Site.
- Vehicle wheel wash facilities will be installed in the vicinity of the Site entrance and road sweeping implemented as necessary in order to maintain the road network in the immediate vicinity of the Site.
- Dust suppression measures (e.g. dampening down) will be implemented as necessary during dry periods.
- The employment of good construction management practices will serve to minimise the risk of pollution from construction activities at the proposed development in line with the Construction Industry Research and Information Association (CIRIA) publication entitled, Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors, CIRIA - C532 (2001) which are also detailed in Chapter 7 - Water. Specifically, with regard to soils and geology, the following will be adhered to:
  - Fuels, lubricants and hydraulic fluids for equipment used on the construction Site, as well as any solvents, oils, and paints will be carefully handled to avoid spillage, properly secured against unauthorised access or vandalism, and provided with spill containment according to best codes of practice;
  - Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the proposed development for disposal or re-cycling;
  - Any spillage of fuels, lubricants or hydraulic oils will be immediately contained and the contaminated soil removed from the proposed development and properly disposed of;
  - All Site vehicles used will be refuelled in bunded and adequately sealed and covered areas in the construction compound area.
  - All plant and machinery will be serviced before being mobilised to Site;
  - No plant maintenance will be completed on Site, any broken-down plant will be removed from Site to be fixed;
  - Refuelling will be completed in a controlled manner using drip trays at all times;
  - Mobile bowsers, tanks and drums will be stored in secure, impermeable storage areas away from open water;
  - Fuel containers will be stored within a secondary containment system, e.g. bunds for static tanks or a drip tray for mobile stores;
  - Containers and bunding for storage of hydrocarbons and other chemicals will have a holding capacity of 110% of the volume to be stored;
  - Ancillary equipment such as hoses and pipes will be contained within the bund;

- Taps, nozzles or valves will be fitted with a lock system;
- Fuel and chemical stores including tanks and drums will be regularly inspected for leaks and signs of damage;
- Drip-trays will be used for fixed or mobile plant such as pumps and generators in order to retain oil leaks and spills;
- Only designated trained operators will be authorised to refuel plant on Site;
- Procedures and contingency plans will be set up to deal with emergency accidents or spills; and,
- An emergency spill kit with oil boom, absorbers etc. will be kept on-Site for use in the event of an accidental spill. A specific team of staff will be trained in the use of spill containment.
- Strict supervision of contractors will be adhered to in order to ensure that all plant and equipment utilised on-Site is in good working condition. Any equipment not meeting the required standard will not be permitted for use within the Site. This will minimise the risk of soils and bedrock becoming contaminated through Site activity.
- Highest standards of Site management will be maintained, and utmost care and vigilance followed to prevent accidental contamination or unnecessary disturbance to the Site and surrounding environment during construction. A named person will be given the task of overseeing the pollution prevention measures agreed for the Site to ensure that they are operating safely and effectively.
- All Site workers will use appropriate PPE if required to clean up any potential fuel spillage onsite including gloves and dust masks to minimise contact with contaminated soil.
- All excavated materials will be stored away from the excavations, in an appropriate manner at a safe and stable location. The maximum height of temporary stockpiles will be 3m (and 2m for topsoil).
- A comprehensive monitoring and supervisory regime including monitoring of all excavations and stability assessments as required will be put in place to ensure that the proposed construction works do not constitute a risk to the stability of the Site.

Following the implementation of the above mitigation measures the likely impact on soils and geology will be negative slight and short term.

The GSI will be notified in advance of any ground reprofiling works with regard to the Enniskerry Delta County Geological Site (CGS) and they will be given the opportunity to view and document (as required) any excavated area. The residual impact on the Enniskerry Delta will be moderate negative and permanent.

In addition, the earthworks programme for the Phase 1 development will include for the surcharging of Site 1, 2, 3A, 3B and 3C with clean excavated material at an early stage in the development works (once the slope stabilisation works on Site 2 have been completed and prior to installation of the capping system) so that post-capping settlement of the landfill areas is reduced as much as possible.

The following mitigation measures will be implemented during the excavation of waste;

- All excavation and movement of waste should be carried out by mechanical means.
- Strict rules and standards will be enforced regarding PPE around the works area. This will include at a minimum helmets, gloves, Tyvek suits, steel toed boots and safety glasses. Appropriate respiratory equipment will be maintained on site and there will be ongoing monitoring for gaseous hazards. The monitoring will be agreed with the contractor but provision must be made for raising the alarm, emergency procedures and a plan for alerting those outside the work areas.
- In addition, suitable hygiene and welfare facilities and PPE should be provided in accordance with the requirements of the Safety, Health and Welfare at Work (General Application) Regulations 2007, Safety Health and Welfare at Work (Exposure to Asbestos) Regulations 2006 and 2010 amendments and the Safety Health and Welfare at Work (Construction) Regulations 2013 to manage potential risks to construction workers.
- The excavation of the works must be planned to minimise the risk of any material becoming airborne through the creation of dust. The contractor will have to put measures in place for dust suppression (water bowser) and have regard to weather conditions during the works to avoid run-off or severe dryness which could lead to problems with containment. The anaerobic decomposition of putrescible waste generates landfill gas which comprises methane and carbon dioxide. Gas monitoring carried out on Site 3B to date has consistently recorded methane concentrations ranging from 25.8% v/v to 70.4% v/v and carbon dioxide ranging from 17.2%v/v to 36.6%v/v. Therefore it is expected that methane and carbon dioxide will be encountered during the Site 3B excavations. A detailed construction methodology

for the excavation works will be prepared by the contractor and communicated to all site personnel to ensure that no confined spaces or trenches deeper than 1m are created during the excavation of waste. Where confined spaces or trenches greater than 1m are created, gas detection equipment and appropriate breathing apparatus should be used by all personnel in the vicinity of the confined space/trench. The works will be planned to minimise the risk of the release of odours and gases to surrounding areas including the contractor's compound and the wider community. Site operatives in the Site 3B area will be instructed to report all unusual, concentrated or significant odours on-site, so that measures may be taken to identify the source of the odour and eliminate it. Gas monitoring techniques will be put in place by the contractor. For nuisance odours, automated odour control systems may need to be put in place, as necessary, to periodically release a fragrance to mask or neutralise unpleasant odour. A wheel-washing facility shall be established for trucks leaving the site to minimise the transport of potentially odorous clay particles onto adjacent roads.

- A no smoking policy will be strictly enforced onsite.
- The contractor shall excavate the waste in areas as small as possible in order to limit the exposure of the waste. The contractor shall prepare an excavation plan which supports this ethos;
- Should excessive wind conditions prevail, such that there is a risk of uncontrolled exposure to the waste with the consequences of it becoming windblown then the excavation shall cease until the weather becomes more amenable to the safe excavation of the waste. Any exposed areas of waste shall be covered with compacted clean material at the end of every working day as a minimum, in order to minimise the exposure of the waste to the winds;
- An area around the proposed excavation will be delineated which will be regarded as a safety zone beyond which the contractor's machinery is not permitted to leave unless it undergoes full decontamination. The area will be securely fenced off with access strictly controlled;
- Only fully sealed containers shall be used for the removal of waste offsite; and
- Prior to demobilisation, the contractor shall properly decontaminate all equipment and appropriately dispose of the decontamination water, field waste and contaminated personal protective equipment (PPE).
- The Contractor will prepare an Asbestos Management Plan, prepared in accordance with the following guidance and regulations;
  - AGS 2012, Interim Guidance ' Site Investigation Asbestos Risk Assessment for the Protection of Site Investigation and Geotechnical Laboratory Personnel';
  - CIRIA 2014, C733 A Guide to Understanding and Managing Risks; and
  - Safety Health and Welfare at Work (Exposure to Asbestos) Regulations 2006 and 2010."
- Any waste for removal offsite will be tested in accordance with the EPA Guidance Document 'Waste Classification, List of Waste & Determining if Waste is Hazardous or Non-Hazardous' (2015). It will be the Contractors responsibility to ensure that all waste soils are classified correctly and managed, transported and disposed of offsite in accordance with the requirements of the Waste Management Act 1996, as amended, the Waste Framework Directive 2008/98/EC of the European Parliament and Council on waste and any relevant subsequent waste management legislation. An Outline Construction and Demolition Waste Management Plan has been generated for the Site. A project specific Detailed Waste Management Plan will be fully implemented onsite for the duration of the project.

Following the implementation of the mitigation measures outlined above there will be a slight short term negative impact on soils and geology.

6.5.1.2 Hydrogeology

The design has taken account of the potential impacts of the development on the land, soils, geology and hydrogeology environment local to the area where construction is taking place. Measures have been incorporated in the design and CEMP during construction to mitigate the potential effects on the surrounding hydrogeological environment. These measures seek to avoid or minimise potential effects in the main through the implementation of best practice construction methods and adherence to all relevant legislation.

Due to the inter-relationship between land, soils, geology and hydrogeology and water (hydrology) the following mitigation measures discussed will be considered applicable to both.

Construction & Environnemental Management Plan

A project-specific Construction and Environmental Management Plan (CEMP) has been prepared for the proposed development and forms part of the current application. The CEMP will be updated if required on the foot of any conditions of the permission. This CEMP will be maintained by the contractors during the construction and operational phases and covers 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.

All ground works will be undertaken following preparation of a specification with the environmental engineer and following approval that works are in compliance with any licence conditions.

Soil Handling, Removal and Compaction

The excavated waste material will be reused on site, where applicable. However, further testing will be required should any soils be required to be removed from site. All soils removed from site will be disposed of by a licenced contractor to a licenced facility.

Temporary storage of soil will be carefully managed in such a way as to prevent any potential negative impact on the receiving environment and the material will be stored away from any surface water drains. Movement of material will be minimised in order to reduce degradation of soil structure and generation of dust. Stockpiles of soil/subsoil will be restricted to less than 3 metre in height.

With regard to the imported material, it is recommended early discussions with demolition and waste recycling contractors to understand availability of compliant general fill material. This material should be chemically inert and insoluble which poses no threat to human health or the environment but offers an appropriate level of engineering capability without contributing to further contamination

Fuel and Chemical Handling

To minimise any impact on the underlying subsurface strata from material spillages, all oils, solvents and paints used during construction will be stored within temporary bunded areas.

A construction site compound will be established at the site and the working area fenced off to provide a secure site. Due to the scale of development and the phased approach to development this compound will move positions throughout the construction period.

Leakages of oil from oil stores will be prevented by storing these oils in bunded tanks which have a capacity of 110% of the total volume of the stored oil. Ancillary equipment such as hoses and pipes will be contained within the bunded storage container. Drainage from the bunded area(s) shall be diverted for collection and safe disposal.

Refuelling of construction machinery and vehicles and the addition of hydraulic oils or lubricants to vehicles will take place in designated refuelling areas using a prescribed re-fuelling procedure. Plant nappies or absorbent mats to be place under refuelling point during all refuelling to absorb drips. All relevant personnel will be fully trained in the use of this equipment. Guidelines such as “Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors” (CIRIA 532, 2001) will be complied with.

Should there be an oil leak or spill, the leak or spill will be contained immediately using oil spill kits; the nearby dirty water drain outlet will be blocked with an oil absorbent boom until the fuel/oil spill has been cleaned up and all oil and any contaminated material removed from the area. This contaminated material will be properly disposed of in a licensed facility.

All ready-mixed concrete will be brought to site by truck. A suitable risk assessment for wet concreting will be completed prior to works being carried out which will include measures to prevent discharge of alkaline wastewaters or contaminated storm water to the underlying subsoil. The pouring of concrete will take place within a designated area using a geosynthetic material to prevent concrete runoff into the soil/groundwater media. Pours will not take place during forecasted heavy rainfall. Washout of concrete transporting vehicles will not take place on site. Concrete trucks will be washed out off site at the source quarry.

To reduce the volume of cementitious water, only concrete truck chutes will be washed down on site. The concrete trucks will wash down their chutes at a designated chute wash down area in the site compound. The location of the chute washdown area will be appropriately located. The system is sealed with no overflow discharge to the drainage system.

In the event of a spillage on site, the dirty water drains in the immediate area will temporarily be blocked and the pH levels of the water in the associated settlement ponds will be monitored and if necessary, will adjust the pH levels using CO_2 entrainment. Any spillage will be cleared immediately and deposited in the wash down area.

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

6.5.2 Operational Phase

6.5.2.1 Geology and Soils

The mitigation measures to be employed during the operational phase to address the identified potential impacts on soils and geology are:

- Spillage and leaks of oil from cars and trucks parked in the development during the operational phase is unavoidable. To reduce the potential impacts, oil interceptors will be incorporated into the site drainage design. The parking areas will also be paved, so impacts of soils and geology are unlikely.

Small fuel leaks from cars and commercial vehicles may have short term slight negative impacts on soils and geology.

The site is underlain in parts by historical landfill areas. To avoid and reduce potential impacts, landfill areas have been avoided as far as possible in the site design for the construction of buildings and roads with limited road construction within the historic landfill areas. Historic landfill sites 1 and 2 will be incorporated into the District Park. Appropriate remediation proposals and construction methods have been incorporated into the site development and layout for construction on made ground / landfill sites to take account of differential settlement, gas ingress etc. Refer to Chapter 2, Volume 3 Parts 3 and 4 of the EIAR and the Historic Landfill Remediation Strategy Report and Gas Management Strategy lodged as part of the current application documentation for detailed design considerations. There will be a long term positive impact on soils and geology from likely reduced impact from contamination from landfill gas and leachate during the operational phase following the landfill remediation works.

6.5.2.2 Hydrogeology

Due to the inter-relationship between land, soils, geology and hydrogeology and water (hydrology) the following mitigation measures discussed will be considered applicable to both.

During the operational phase of the proposed development site there is limited/ negligible potential for site activities to impact due to the type of development proposed, on the water [and geological] environment of the area due to the type of development – residential.

There will be an increase in water supply and foul water due to the proposed development. These aspects are further discussed in Chapter 7 of this EIA Report. There will be an increase in hardstand as a result of the development of the facilities of c. 3.59 ha. Rainfall which had previously discharged to ground, and field drains to the surrounding hydrological environment will be collected using a network of surface water pipes along buildings and roadways. This surface water will be discharged through a network of oil-water separators to the proposed series of attenuation systems. The attenuation system will remove all the silt from the water and will contain an oil-water separators. Water discharge will be at a greenfield rate. The maximum rate of the 1% Annual Exceedance Pollution event (1:100-year return period).

Table 6.3: Summary Table of Mitigation Measures – Operational Phase

Character of Potential Impact	Mitigation Measure
Operational Phase	
Increased Hardstanding	Surface water drainage system in place. The proposed surface water drains, and the proposed development site have been designed in accordance with the Greater Dublin Strategic Drainage Study (GDSDS).
Fuel Storage	There will be no bulk storage of fuel required for the operation of the proposed residential development.
Increase in Water Supply	The proposed water supply system will be constructed and operated as designed.

All of the above mitigation measures will form part of a site-specific Detailed Construction Environmental Management Plan (CEMP) which will be in operation during the construction phase.

6.5.3 Decommissioning Phase

The mitigation measures associated with decommissioning will be like those associated with construction but of reduced magnitude.

6.6 Predicted Impacts

The residual impacts likely to occur during the construction and operation phase of the proposed development are as follows.

6.6.1 Construction Phase

6.6.1.1 Lands, Geology and Soils

Implementation of the measures outlined above will ensure that the potential impacts of the proposed development on soils and the geological environment are less likely to occur during the construction phase and that any residual impacts will be ***slight negative and short term in duration***. The primary residual impact is the potential removal of material unsuitable for reuse as fill material; however, ***the residual impact is likely to be slight negative and permanent***.

There will be a ***residual negative moderate permanent*** impact on the Enniskerry Delta CGS.

There will be a ***slight negative permanent*** impact on aggregate sterilisation.

The impact on land take is likely to have a ***moderate negative impact*** on the environment of the area, in that it alters the character of the environment, albeit in a manner consistent with existing and emerging trends.

6.6.1.2 Remediation of Landfill Areas

The implementation of the measures outlined above will ensure that the potential impacts on the environment from the remediation of the landfills during the construction phase will be minimal. Slope stabilisation will have a ***positive residual impact*** on slope stability. Capping of the landfills will significantly reduce water ingress into the waste body and reduce the risk of contamination to underlying and surrounding soils and groundwater. ***Any residual impacts from the construction phase will be slight negative and short term in duration.***

6.6.1.3 Hydrogeology

The implementation of mitigation measures described in Section 6.5 above will ensure that the potential impacts on the hydrogeological environment do not occur during the construction phase. The predicted impact, post mitigation measures, will be ***short term-imperceptible-neutral***.

6.6.2 Operational Phase

6.6.2.1 Land Soils and Geology

The impact on land take is likely to have a ***slight negative permanent impact*** on the environment of the area; however, this change is consistent with existing and emerging trends.

There will be a ***long term significant positive impact*** from the incorporation of historic landfill sites 1 and 2 into the district park.

The capping and stabilisation works will have a ***positive impact*** on the operational phase of the development.

Small fuel leaks from cars and commercial vehicles may have ***short term slight negative impacts*** on soils and geology.

6.6.2.2 Hydrogeology

The predicted impacts on the hydrogeological environment during the operational phase will be ***long-term-imperceptible-neutral***.

6.7 Monitoring and Reinstatement Measures

6.7.1 Geology and Soils

6.7.1.1 Construction Phase

GSI will be consulted and given the opportunity to observe the excavated areas outside of the landfill remediation works during the construction phase.

The following monitoring measures to be implemented during the remediation and capping of the landfill sites has been identified from the RPS Remediation Strategy Report (RPS 2020).

“Capping System Construction Quality Assurance (CQA)

CQA Plan

As part of the design, a CQA Plan will be prepared for the installation of the capping system in accordance with the requirements of the EPA Landfill Manual: Landfill Site Design. The CQA Plan will set down the procedures for sourcing, transporting, placing, testing, repairing and protecting the capping materials prior to, during and after construction. The CQA Plan will set out the roles and responsibilities of the various parties on site and the reporting to be provided by the manufacturer, installer and CQA Monitor. This plan will help to ensure the design of the capping system is not compromised during its construction.

CQA Supervision

Third party supervision of the capping works by a specialist CQA consultant is required by the EPA Landfill Manual: Landfill Site Design and will be provided by a suitably qualified and experienced company. The CQA contractor will be responsible for overseeing the capping works and ensure that the main contractor adheres to the Works Requirements. A CQA validation report will be submitted to the EPA following the construction for the capping system. The CQA validation report will set out all aspects of the construction from supply through to final placement and testing.

A quality control system will be put in place for all documentation relating to the capping works. All documentation will be kept on-site and available for inspection at all times. CQA documentation will include the following:

- *Delivery, handling and storage of materials,*
- *Geomembrane panel layout and programme,*
- *Geocomposite panel layout and programme,*
- *Monitoring programme,*
- *Geomembrane seam testing,*
- *Geocomposite seam testing,*
- *Soil inspection, and*
- *Laboratory testing results."*

6.7.1.2 Operational Phase

The following monitoring measures to be implemented during the operational phase of the development have been identified from the RPS Remediation Strategy Report (RPS 2020) and RPS Gas Management Strategy (RPS 2021).

Landfill Gas

Gas monitoring is an important aspect of the Gas Management Strategy in order to:

- *demonstrate effectiveness of protection measures installed;*
- *provide confidence to owners/occupiers that risk is under control;*
- *give early warning of a hazardous situation;*
- *identify malfunction in a gas-control system to enable remedial action to be taken;*
- *keep the developer/ property management company informed and actively engaged in the long-term management of the gas protection measures; and*
- *Identify reduction in gas levels and period of acceptable risk when system can be switched off, i.e. protection no longer required.*

The extent of gas monitoring required post development depends on the nature of the gas regime, the quality and reliability of the monitoring data obtained and the scope of protection measures adopted.

A monitoring plan will be developed in accordance with the EPA Manual for Landfill Monitoring, 2nd edition 2003.

For this development, monitoring boreholes in the gas flow path can be installed and monitored to demonstrate the remedial measures, in particular, the Virtual Gas Curtain, are working and identify any changes in the gas regime as a result of the remedial works, flaring and development works. This can be achieved with real time ongoing monitoring in the first instance. Alarms can be installed also to give advanced warning when gas levels exceed certain pre-set criteria.

Once the level of certainty in the effectiveness of the remedial measures has increased to an acceptable level, monitoring frequency can be reduced to only periodically.

A Monitoring plan will be developed and should include:

- *Gas monitoring plan from specific monitoring points located in vent stacks.*
- *Regular servicing and maintenance of the gas-control system including prevention of weeds and soil accumulating in venting trenches and around external vents to properties.*
- *Preventing uncontrolled excavation, lighting of tires, construction of outbuildings and / or building extensions without consent."*

Gas monitoring will be carried out by Wicklow County Council on a quarterly basis to detect the presence and concentration of landfill gas in all monitoring boreholes.

Surface Water

"To ensure that the constructed subsurface water management system for the landfill cap on Sites 1, 2 and 3B is functioning effectively following the rehabilitation works, samples should be taken at all discharge points twice annually and tested for evidence of leachate and suspended solids against recognised water quality standards. Where the results indicate the presence of contaminants, the source of the contamination should be identified and action taken to remedy any failures in the system. A physical inspection of the surface water management system during sampling rounds should also be carried out to ensure that it is operating effectively.

After the first five years following the rehabilitation of the landfill, monitoring can be carried out at a reduced frequency of once a year. After this time, further monitoring may not be required if results indicate that the surface water management system is effective."

Leachate

"Monthly monitoring to detect the presence of leachate should be carried out at all available boreholes for the first 12 months following installation of the capping. Sampling analysis and characterisation should be carried out at for at least two boreholes per site. Following the first year of monitoring leachate monitoring should be carried out on a quarterly basis and reduced to a frequency of once per year after 5 years."

Topography Settlement

"As the waste landfilled at the site to date has received only a small degree of compaction, it is expected that, following the installation of the capping system and restoration soils/fill above the capping system, settlement will occur. In general, most of the settlement occurs in landfills in the first two years following rehabilitation.

It is therefore proposed that annual topographical surveys be undertaken at the site to monitor the settlement rate for the first two years. Following this, topographical surveys will be conducted every two years (up to 10 years post rehabilitation), unless the settlement rate observed indicates that more frequent surveys are required. By this time it is anticipated that settlement will be very minor so surveys of the site should be undertaken every 5 years, or until the topography of the cell has stabilised."

The following requirements for reporting and monitoring as part of the requirements of the Certificate of Authorisation have been identified by RPS in the Remediation Strategy Report (RPS 2020).

"Requirements of Certificate of Authorisation

Validation Report

The local authority shall compile a validation report in accordance with the requirements of the Code of Practice.

Ongoing Monitoring

The local authority shall biannually conduct and record

a. *A visual inspection of the landfill to ensure that the condition of the site has not deteriorated;*
b. *monitoring for leachate (sample, analyse, characterise and measure the level of leachate) in all leachate monitoring boreholes;*
c. *quarterly monitoring to detect the presence and concentration of landfill gas in all monitoring boreholes*
d. *monitoring (sample, analyse, and characterise) of relevant surface waters both upstream and downstream of the closest landfill;*
e. *monitoring (sample, analyse, and characterise) of groundwater from at least three available groundwater monitoring boreholes, two of which shall be downgradient of the closed landfill; and*
f. *the assessment of monitoring results against trigger levels and/or standard reference values for relevant pollutants including environmental quality standards in the European Communities Environmental objectives (Surface waters) Regulations 2009 and European Communities Environmental Objectives (Groundwater) regulations 2010, as amended.*

***Incidents and** Reporting Requirements*

Incidents

In the event of an incident the local authority shall immediately

i. if necessary contact, the emergency services;

ii. carry out an investigation to identify the nature, source and cause of the incident and any emission arising therefrom

iii. isolate the source of any such emission;

iv. evaluate the environmental pollution, if any, caused by the incident;

v. Identify and execute measures to minimise the emissions/malfunction and effects thereof

vi. identified the date, time and place of the incident; and

vii. Notify the Agency (in accordance with Condition 2.1) and all other relevant authorities including, where relevant, the Water Services Authority and Inland Fisheries Ireland.

Communications

a. the local authority shall establish, maintain and implement a communications program to inform the occupiers and owners of land and buildings adjacent to the closed landfill of the risk posed by landfill gas and its migration.

b. The communications program shall inform future occupiers and owners of properties what they can and should do to protect their property and health and members of the public.

c. the local authority shall communicate directly either in writing or in person at least once each year with said occupiers and owners of properties.

d. the local authority as part of the communications program publish gas monitoring data quarterly and water monitoring data biannually in a manner accessible to the public.

All temporary construction compounds are to be removed upon completion of the construction phase. Such areas are to be reinstated in accordance with the landscape architects plan and engineer's drawings. All construction waste and / or scrapped building materials are to be removed from Site on completion of the construction phase. Oil, fuel etc. storage areas are to be decommissioned on completion of the construction phase. Any remaining liquids are to be removed from Site and disposed of at an appropriate licenced facility.

6.7.2 Hydrogeology

6.7.2.1 Construction Phase

Monitoring requirements during the construction phase are detailed below:

Table 6.4: Summary Table of Monitoring Requirements - Construction Phase

Character of Potential Impact	Mitigation Measure
Construction Phase	
Surface water run-off control	Regular inspection of surface water run-off and control of sediment (fines) will be undertaken, e.g., appropriately sized and located silt traps will be installed during the construction phase.
Implementation of construction mitigation measures	Regular inspection of construction mitigation measures will be undertaken, e.g., concrete pouring, refuelling etc. as part of the implementation of the CEMP for the site.

6.7.2.2 Operational Phase

Monitoring requirements during the operation phase are detailed below:

Table 6.5: Summary Table of Monitoring Requirements - Operational Phase

Character of Potential Impact	Mitigation Measure
Construction Phase	
Soil & Groundwater monitoring	Future monitoring is proposed as part of the proposed development as recommended by RPS in the monitoring programme for the landfills (once remediated).
Oil-water interceptors	Petrol/ oil interceptor(s) will be maintained and cleaned out in accordance with the manufacturer's instructions.
Drainage System	Maintenance of the surface water drainage system and foul sewers as per normal urban developments is recommended to negate/ limit any accidental discharges to ground.

7 HYDROLOGY, FLOOD RISK AND WATER SERVICES

7.1 Introduction

This chapter describes the type of hydrological environment likely to be encountered and in the general area of the proposed development. It also addresses the potential impact of the proposed development on the hydrological environment together with the mitigation measures that will be employed to eliminate or reduce any potential impacts. This chapter also considers the implications of and impacts of the proposed water services.

The site is currently used for agricultural purposes with residential housing located in the surrounding areas. This proposed development comprises the construction of 650 no. housing units on a ca. 80.16 ha Site at Fassaroe, Bray, Co. Wicklow. A detailed description of the proposed development is presented in Chapter 2 - Project Description. The study area comprises of the red line boundary shown on the MCORM Architects planning application drawing PL03 lodged as part of the planning application.

7.2 Methodology

The following section outlines the legislation and guidelines considered, and the methodology for preparing this chapter.

7.2.1 Relevant Legislation and Guidance

This assessment has been completed in accordance with the EIAR guidance and the relevant best practice guidance from the following:

- Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes' by the Transport Infrastructure Ireland (TII, 2009, previously NRA)
- Environmental Protection Agency (EPA) (2015) '*Revised Guidelines on the Information to be contained in Environmental Impact Statements'*;
- Environmental Protection Agency (EPA) (2015) *'Advice Notes on Current Practice (in the Preparation of Environmental Impact Statements)*';
- Environmental Protection Agency (EPA) (2017) *'Guidelines on the Information to be contained in Environmental Impact Assessment Reports – Draft'*;
- European Commission (2017) Environmental Impact Assessment of Projects; Guidance on the preparation of the Environmental Impact Assessment Report; and,
- Department of Housing, Planning and Local Government (DHPLG) (2018) Guidelines for Planning Authorities and an Bord Pleanála on carrying out Environmental Impact Assessment.

7.2.2 Scope of Works

The following scope of works were undertaken by AWN Consulting Limited (AWN) in order to complete the hydrology assessment presented in this chapter;

- Desk-based study including review of available historical information. This desktop study was carried out prior to the site walkover in order to determine the baseline conditions of the study area to obtain relevant background information. The desk-based study involved reviewing information from the following sources:
  - GSI Datasets Public Viewer and Groundwater webmapping (consulted 08th September 2021);
  - EPA Public Viewer and webmapping (consulted 08th September 2021);
  - Ordnance Survey webmapping to assess the surface topography and landforms (consulted 08th September 2021);
  - River Basin Management Plan for Ireland 2018-2021.
  - The Planning System and Flood Risk Management, Guidelines for Planning Authorities (Department of the Environment, Heritage and Local Government (DoEHLG) and the Office of Public Works (OPW));

  - Office of Public Works (OPW) flood mapping data (www.floodmaps.ie)
  - South Dublin City Council (2005), Greater Dublin Strategic Drainage Study: Technical Documents of Regional Drainage Policies. Dublin: Dublin City Council; and
  - 'Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors' (CIRIA 532, 2001); and,
  - National Parks and Wildlife Services (NPWS) – Protected Site Register (consulted 08th September 2021).
- Reviewing and obtaining the relevant information from the previous completed Ground Investigation Reports and associated reports based on the design of the proposed development. In total nine (9) no. ground investigations have been completed for in the vicinity and surrounding area of the proposed site. The sources of information used were:
  - Soil Infiltration Test Report, Geoenvironmental Environmental Consultants, March 2015;
  - Cosgrave Property Development Fassaroe Historic Landfill – Environmental Risk Assessment, Atkins, 15 June 2010;
  - Warehouses & Ancillary Offices Geotechnical Interpretative Report, Atkins, October 2002;
  - Proposed Development at La Vallee, Fassaroe Geotechnical Investigation, Glover Site Investigations Ltd, September 2001;
  - N11 Fassaroe Interchange Preliminary Geotechnical Investigation, Glover Site Investigations Ltd, May 2000;
  - Fassaroe Development – Geotechnical Interpretative Report Proposed Overbridge at M11 Interchange, Atkins McCarthy, 21 June 2001;
  - Fassaroe Historic Landfill Environmental Risk Assessment, RPS, 03 June 2016;
  - Fassaroe Historic Landfill Gas Management Strategy, RPS, August 2016;
  - Fassaroe Historic Landfill Remediation Report, RPS, August 2016; and,
  - Engineering Report – Fassaroe Phase 1 Development, Atkins, July 2016.

7.2.3 Assessment Criteria

The methodology used in this assessment follows current European and Irish guidance as outlined in:

- EPA (2017). Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.
- EPA (2015). Draft Advice Notes on Current Practice in the Preparation of Environmental Impact Statements.
- National Roads Authority (NRA) (2009). Guidelines on Procedures for the Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.

The rating of potential environmental impacts on the hydrological environment is based on the quality, significance, duration and type of impact characteristic identified. Consideration is given to both the importance of an attribute and the magnitude of the potential environmental impacts of the proposed activities on that cited attribute. The NRA criteria for rating the magnitude and significance of impacts at EIA stage on the related attributes are also relevant in determining impact assessment and are presented in **Appendix 7A**.

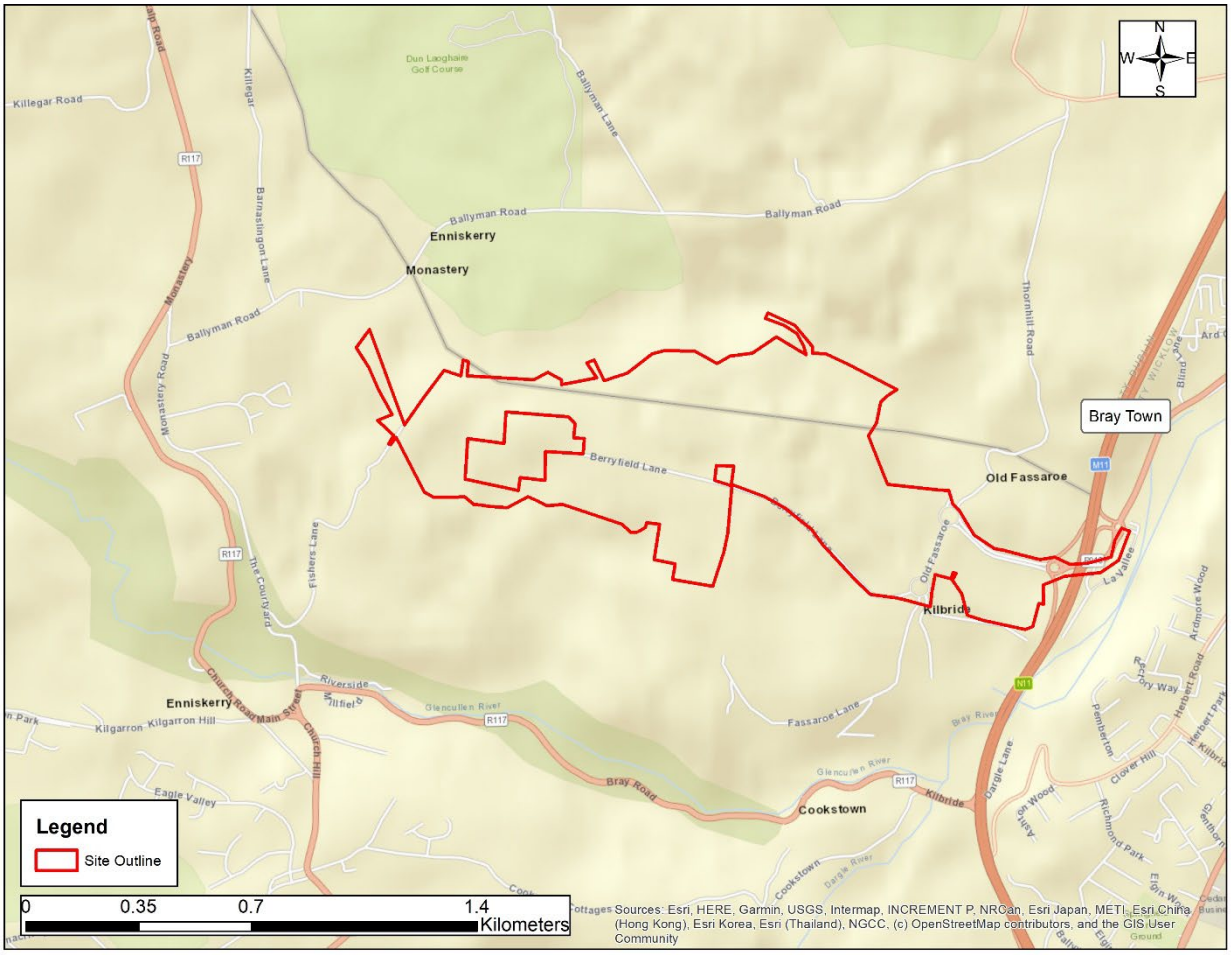
The impact assessment has been undertaken in accordance with guidance on the preparation of an EIAR and the IGI guidance (IGI, 2013) which outlines the following elements:

- Initial Assessment;
- Direct and Indirect Site Investigation & Studies;
- Rating of the hydrological attribute(s) as par NRA/ TII guidelines;
- Mitigation Measures, Residual Impacts and Final Impact Assessment; and,
- Completion of the Hydrological Sections of the EIAR.

7.3 Receiving Environment

The Site forms part of a larger designated new development area under the Bray Municipal District Local Area Plan 2018 -2024 (LAP). The proposed development site is ca. 80.16 ha. and is serviced by the M11/N11 to the eastern boundary. The Action Area lands are framed by the Ballyman Glen in the north and the Cookstown River valley in the south. The most significant operations in the study area are a Roadstone quarry and retail operation within the south-eastern quadrant of the proposed development site. This facility lies outside of the current proposed application site, beyond the south-eastern boundary. There are also a number of residential clusters in the Fassaroe area; at Thornhill Road, adjacent to a Greenstar facility in the north-east, along Kilbride Lane in the south-east, and along Berryfield Lane which runs east-west through the development lands and connects to the Ballyman Road in the west. There are a number of small businesses located within the residential clusters at Thornhill Road and Berryfield Lane. Refer to **Figure 7-1** below.

Figure 7-1: **Site Location Map (ERSi, 2021)**



The proposed development site is mostly gently sloped with a notable slope towards the northern and eastern boundaries. The topography slopes towards the County Brook waterbody which is located along the northern boundary of The Site. Furthermore, the topography also slopes to the eastern boundary towards the M11/ N11 roadway and the Dargle waterbody. The Cookstown River valley lies beyond the southern boundary. The drainage network on site comprises a series of land ditches and minor steams – mainly along the perimeter of the individual lands which make up the whole proposed application site. The local drainage ultimately flows in a northerly to north-easterly direction towards the County Brook waterbody. The County Brook waterbody joins the Dargle River c. 1.36 km at the Upper Dargle Road to the northeast of proposed application site. The Dargle River flows easterly towards Irish Sea at Bray town.

7.3.1 Hydrology

The Site is located within the former Eastern River Basin District (now the Irish River Basin District), as defined under the European Communities Directive 2000/60/EC, which establishes a framework for community action in the field of water policy – this is commonly known as the Water Framework Directive (WFD). The proposed development site is located in the Irish River Basin District and the Dargle WMU (Water Management Unit).

According to the EPA maps, The Site lies within the Ovoca-Vartry Catchment (Hydrometric Area 10) and the Dargle River sub-catchment (sub catchment: 10_5). This sub-catchment is managed by Wicklow County Council (WCC) – the local authority. The current EPA watercourse mapping does not include any existing streams within the proposed application site boundaries (refer to **Figure 7-2** below). In addition, a review of the historical mapping records provided within the GeoHive website do not indicate any watercourses within The Site.

There are three (3) no. watercourses within the vicinity of The Site:

- Country Brook waterbody (IE_EA_10D010250) located along the northern boundary.
- Glencullen waterbody (IE_EA_10G020500) located approx. 0.61 km to the south of The Site.
- Dargle waterbody (IE_EA_10D010250) located approx. 0.23 km to the east of The Site.

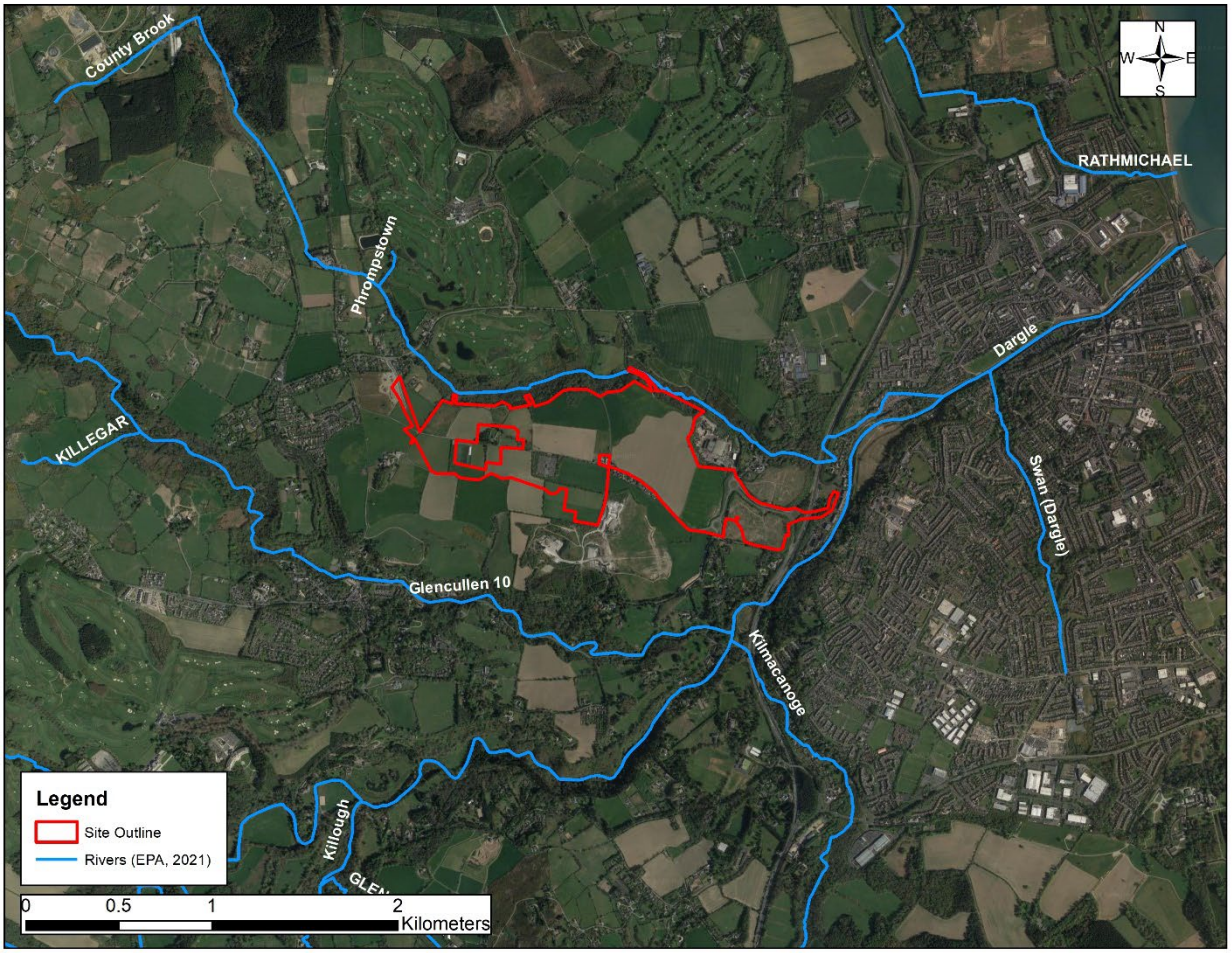
Refer to **Figure 7-2** below for the hydrological environment.

The northern site boundary is bordered along the County Brook River (Fassaroe Stream) (EPA Name: County Brook), which flows eastwards where it flows in to the Dargle River and flows into St. Georges Channel and into the Irish Sea. The Dargle River is a registered salmonid river under the Salmonid Regulations (S.I. 293). The Dargle River catchment forms part of the Eastern River Basin District.

The site is underlain by thick permeable subsoil and as a result the drainage density is low and there are very few field drains in the area and no ponds or tributaries to the County Brook River (Fassaroe Stream). Emergences of springs and seepages are evident in the riparian zone along the County Brook River (Fassaroe Stream).

These springs feed the alkaline fen and tufa deposits. The spring flows which are relatively small coalesce downhill to form a more defined channel.

Figure 7-2: Local Hydrological Environment (EPA, 2021).



7.3.2 Surface Water Quality

As noted above, the application site is located within the Irish River Basin District (formerly the ERBD) under the WFD and within the Hydrometric Area No. 10 of the Irish River Network; the Dargle Catchment area.

The Site is located within the former ERBD (now the Irish River Basin District), as defined under the European Communities Directive 2000/60/EC, establishing a framework for community action in the field of water policy – this is commonly known as the Water Framework Directive (WFD). It is situated in Hydrometric Area No. 10 of the Irish River Network and is located within the Dargle Catchment.

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

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

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

- European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003);
- European Communities (Drinking Water) Regulations 2014 (S.I. 122 of 2014);
- European Communities Environmental Objectives (Surface Waters); Regulations, 2009 (S.I. No. 272 of 2009 as amended SI No. 77 of 2019)
- European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010 S.I. No. 366 of 2016);
- European Communities (Good Agricultural Practice for Protection of Waters) Regulations, 2010 (S.I. No. 610 of 2010);
- European Communities (Technical Specifications for the Chemical Analysis and Monitoring of Water Status) Regulations, 2011 (S.I. No. 489 of 2011);
- Statutory Instrument (SI) No. 293 of 1988 European Communities (Quality of Salmonid Waters) Regulations 1988;
- Local Government (Water Pollution) Acts 1977-1990; and
- SI No. 258 of 1988 Water Quality Standards for Phosphorus Regulations 1998.

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

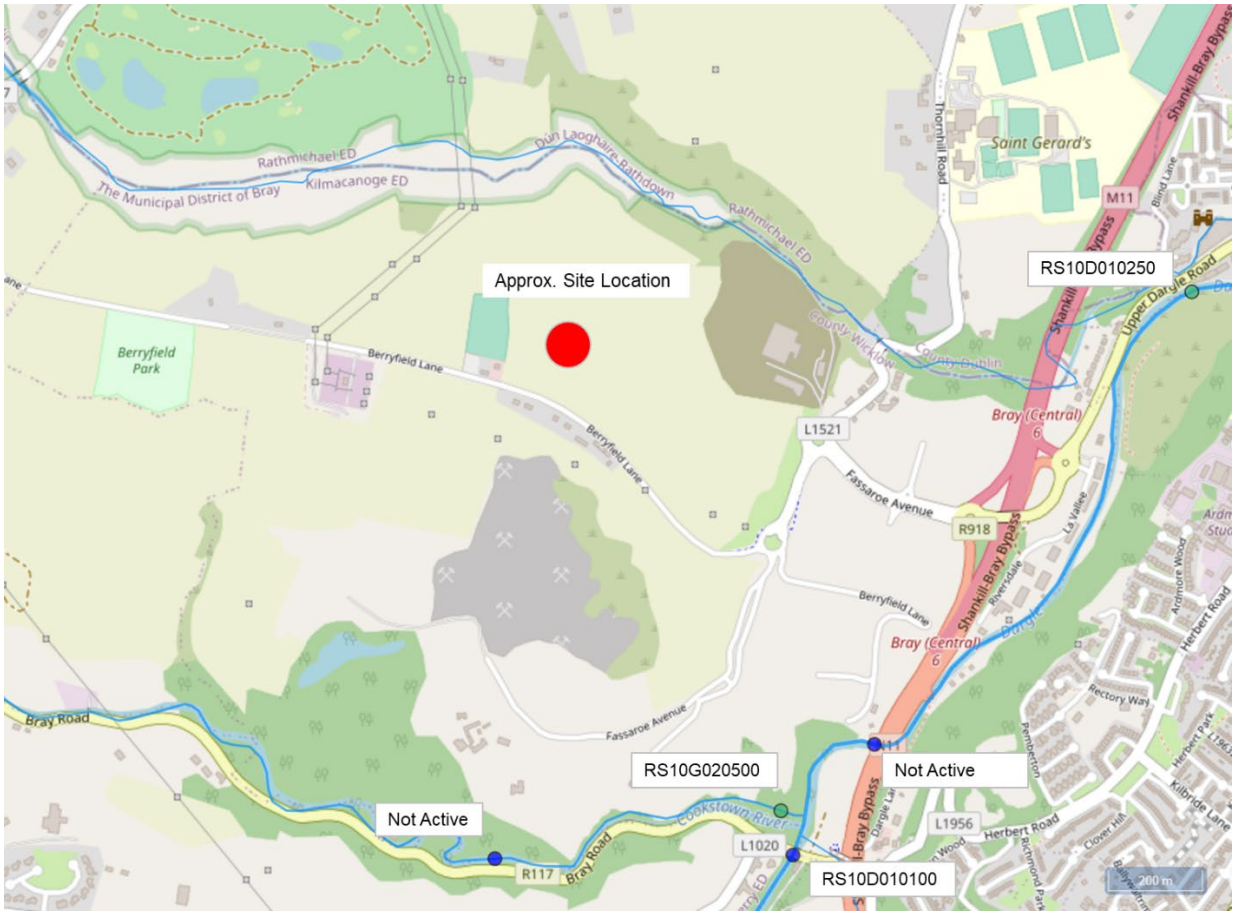
In relation to the subject site, the nearest active EPA monitoring stations located in the Glencullen and Dargle waterbodies River catchment are:

- ‘u/s Dargle River confluence’ (EPA Code: RS10G020500): located in the Glencullen River c. 0.90 km upstream from the proposed development site. The most recent status recorded by the EPA (2020) is classified as Q4/Good.
- ‘Br u/s Glencullen Road’ (EPA Code: RS10D010100): located in the Dargle River c. 1.10 km upstream of the proposed development site. The most recent status recorded by the EPA (2020) is classified as Q4-5/High status.
- ‘1km u/s Bray Bridge’ (EPA Code: RS10D010250): located in the Dargle River c. 0.89 km downstream of the proposed development site. The most recent status recorded by the EPA (2020) is classified as Q4/Good.

There are no active EPA monitoring stations along the County Brook waterbody.

Refer to **Figure 7-3** below for locations of these EPA quality monitoring points in the context of the site.

Figure 7-3: **EPA Surface Water Quality Stations (Source: EPA, 2021)**



The Water Framework Directive (WFD) 2000/60/EC was adopted in 2000 as a single piece of legislation covering rivers, lakes, groundwater and transitional (estuarine) and coastal waters. In addition to protecting said waters, its objectives include the attainment of 'Good Status' in water bodies that are of lesser status at present and retaining 'Good Status' or better where such status exists at present. The WFD requires 'Good Water Status' for all European waters to be achieved through a system of river basin management planning and extensive monitoring. 'Good status' means both 'good ecological status' and 'good chemical status'.

The County Brook waterbody belongs to the Dargle_030 WFD surface water body. Both the County Brook and Dargle waterbodies are currently classified by the EPA as having *'Moderate'* status and there is no risk score assigned to these waterbodies.

The Glencullen River is currently classified by the EPA as having *'Good'* status and 'not at risk of achieving good status'.

7.3.3 Flood Risk

According to the available CFRAM maps, the majority of the site contains no risk of flooding affecting the site from fluvial or coastal sources, since the site lies within Flood Zone C (i.e., where the probability of flooding from rivers is less than 0.1% or 1 in 1,000). Part of the northern boundary is within Flood Zone B due to the presence of the Country Brook waterbody – fluvial flooding. However, there are no residential buildings planned for this area, therefore all residential buildings are within Flood Zone C.

The predictive flood information from the Eastern CFRAMS indicates flooding of the County Brook stream to the north of the proposed development. The flooding is contained within the steep sided valley which is 15 - 50m lower than the proposed development area. The impacts of flood risk on the proposed development site are therefore below the 1% AEP (1 in 100 year) event which is the baseline national design standard for fluvial affected areas.

The proposed development will increase the impermeable area within the catchment and so has the potential to increase the volume and rate of runoff to the receiving watercourses. Surface water runoff will therefore be managed in an appropriate way through use of SuDS techniques and systems in accordance with the Wicklow Development Plan, GDSDS and CIRIA report C753 'The SuDS Manual V-6'. To this extent runoff will be restricted to 'Greenfield Runoff' rates. Details of the proposed surface water management system are presented in the Atkins Engineering Planning Report.

A Stage 1 Flood Risk Assessment was carried out by Atkins (Atkins, 2022) and is attached to this application. The Stage 1 flood risk assessment was completed in accordance with The Guidelines and the following conclusions can be drawn;

- There is no historic risk of flooding within the development site.
- The OPW CFRAM flood extent maps studies have not been carried out in the area of the site and therefore do not show any flood risk at the site. On the basis of the maps and the topography the site could be considered to be located within Zone C, low probability of flooding.
- Given that the proposed development site is located in Zone C, low probability of flooding, is thus appropriate from a flood risk perspective subject to the completion of this FRA which considers other sources of flood hazard than river flooding and subject to it meeting the normal range of proper planning and sustainable development requirements.
- Given that the proposed development is located in Zone C and is appropriate development, consideration of the Justification Test is not required.
- The proposed development is not at risk of flooding from the 1% AEP event.

7.3.4 Areas of Conservation and Natural Heritage Areas

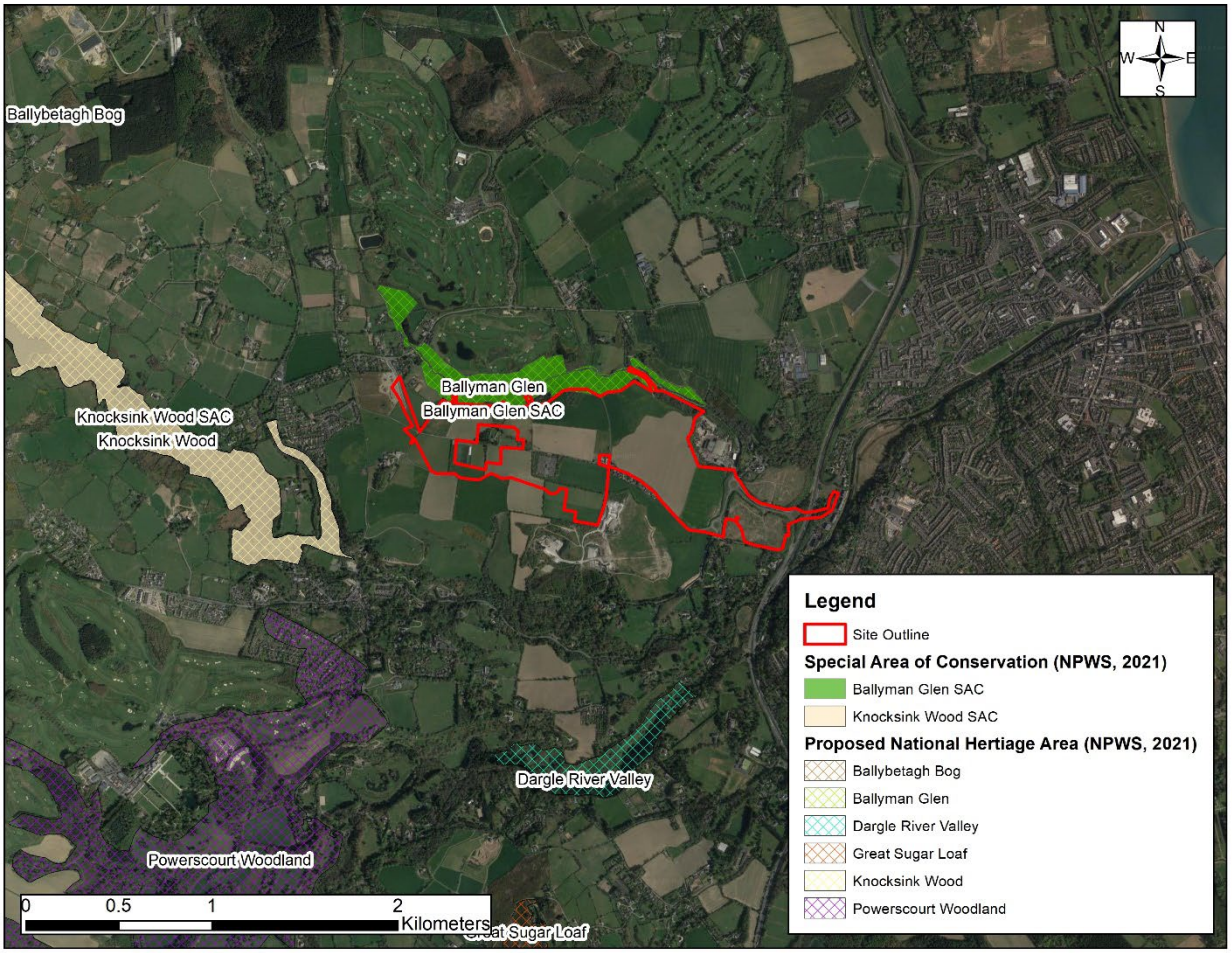
According to the NPWS (2021) on-line database there are a number of special protected areas in the vicinity of The Site. The closest European listed sites are as follows;

- Ballyman Glen Special Area of Conservation (SAC) and proposed National Heritage Area (pNHA) (Site code: 00713), located along the northern boundary of The Site.
- Knocksink Wood SAC (Site code: 000725), c. 0.50 km to the south-west (upgradient of The Site).
- Powerscourt Woodland pNHA (Site code: 001768), c. 1.10 km to the south-west.
- Dargle River Valley pNHA (Site code: 001754), c. 1.20 km to the south.
- Great Sugar Loaf pNHA (Site code: 001769), c. 2.05 km to the south.
- Ballybetagh Bog pNHA (Site code: 001202), c. 2.50 km to the north-west.

Natural flow within The Site eventually discharge to the County Brook waterbody (Ballyman Glen SAC & pNHA), which in turn joins the Dargle River just before it enters Irish Sea at Bray Town. There is a direct surface water link between the proposed development site and the European sites associated with County Brook waterbody – Ballyman Glen SAC & pNHA. It is assumed that any drainage ditches along the southern boundary discharge towards the Glencullen River.

Figure 7-4 below presents the location of these protected areas in the context of The Site.

Figure 7-4 Natura 2000 Sites in the Context of The Site (NPWS, 2021).



7.3.5 Tufa Springs

The County Brook waterbody valley which is known as Ballyman Glen is designated a SAC (Site Code: 000713) selected for the following habitats and/or species listed on Annex I/II of the E.U. Habitats Directive; petrifying springs with tufa formation and alkaline fens.

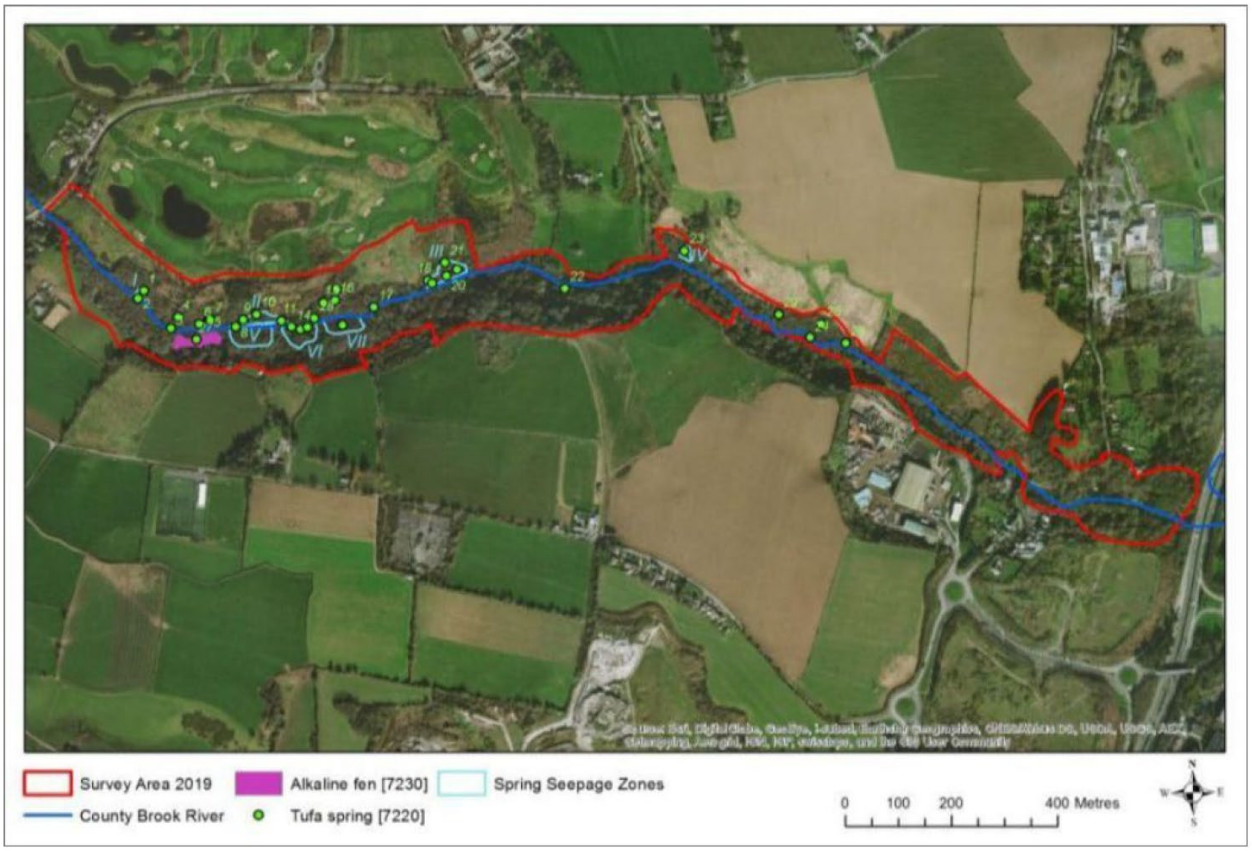
RPS (RPS, 2016) carried out an initial site inspection on the on the 12th of October 2015. In total nine (9) no. discrete springs were noted along the southern riverbank of the County Brook River (Fassaroe Stream) between Site 1 and Site 3a. Spring 1 was found at the base of a steep embankment adjacent the river. The ground was quite soft underfoot and there were clear signs of orchre staining and hydrocarbon sheen at surface. Spring 3, which is more typical of the other springs on site emerges diffusely from wet embankments which coalesce into a small channel as the water collects downstream.

Emerging groundwater spring flows feed the tufa deposits and alkaline fen and they are therefore considered to be Groundwater Dependant Terrestrial Ecosystems (GWDTE).

A recent Survey of the applicant site was conducted by Wetlands Ireland in February 2020. Wetland Surveys Ireland Ltd. were commissioned by RPS Group to undertake an ecological survey of qualifying Annex I habitats (alkaline fen and petrifying spring) within part of the Ballyman Glen Special Area of Conservation (SAC), in counties Dublin and Wicklow.

A map showing the distribution of Annex I alkaline fen and petrifying spring habitats recorded within the study area is presented in **Figure 7.5** below. The springs are indicated as point features, although in places more extensive tufa seepage zones extend from the spring locations and these are indicated by polygon features labelled as Seepage Zone I to Seepage Zone VII.

Figure 7-5: Distribution and Extent of Annex I Habitats Within the Study Area (Wetlands Ireland, 2020)



An assessment of conservation status of five representative springs was conducted by Wetlands Ireland at Ballyman Glen. Each spring was assessed according to; range and area, structures and functions, and future prospects. The overall condition assessment of four springs was considered unfavourable – inadequate while a single spring was deemed to be in favourable conservation status.

The main reason that four of the five springs did not attain favourable conservation status was due to the high levels of deer grazing and associated trampling effects on the surface of springs. Most of the springs within the Glen are likely to conform to this as deer grazing is occurring at a similar intensity throughout the wooded slopes of the glen. The exception being those springs along the riverbank where trampling by deer is less evident.

A further assessment of conservation importance was undertaken using a scoring system. This confirmed that the springs varied from being of moderate to high conservation importance.

Evaluation: There are extensive seepage areas on both slopes of Ballyman Glen which are associated with calcareous springs. These springs and seepage areas correspond with the EU Annex I habitat Petrifying springs with tufa formation (Cratoneurion) [7220] and are therefore deemed to be of international conservation significance (Wetlands Ireland, 2020).

7.3.6 Water Services

7.3.6.1 Foul Water

Irish Water (IW) records indicate that the nearest existing public foul drainage network as a 525mm diameter concrete gravity sewer located on the Upper Dargle Road to the east of the N11 and circa 800m from the proposed development area. An existing private 450mm diameter foul sewer, which was previously installed by the applicant Cosgrave Property Group (CPG) as part of the upgrade works at the junction of the N11, is located between the eastern extent of the Phase 1 development and the N11. This existing foul sewer is currently under the private ownership of the applicant and will be used to convey foul drainage flows from the proposed development under the N11 and ultimately discharge to the existing public sewer along the Upper Dargle Road identified in IW's records.

7.3.6.2 Water Supply

The existing water supply infrastructure in the area comprises of a 24" trunk main which traverses lands to the east of the of the proposed Fassaroe Phase 1 development and a 33" main which traverses beneath the proposed Fassaroe Phase 1 development western lands of the Fassaroe Development. Both of these mains are fed by the Vartry Reservoir and convey supply to the IW Sandyford revisor and surrounding environs. An 800mm trunk main interconnector was constructed in 2009. This interconnector pipe runs along Berryfield Lane and connects both the 24" and 33" main together.

7.3.7 Landfills

There are five (5) no. historic landfill locations within the northern part of the overall Action Area Plan lands which were previously operated by Wicklow County Council. These landfill sites had previously been used for quarrying activities. The landfill operations ceased in the early 1990s at which time these areas were covered in topsoil and returned to agricultural use.

In accordance with the requirements of the Waste Management Act 1996, four (4) no. of these former landfill sites are classified as Historic Unlicensed Waste Disposal sites which require Certificates of Authorisation from the EPA for their remediation. One of the sites, though operated by Wicklow County Council, does not fall under the certification requirements of the Waste Management Act due to its age. In any event, applications were made by Wicklow County Council to the EPA for the remediation of the four (4) no. sites. The Environmental Risk Assessment for the applications had regard to the presence and need for remediation of all five (5) sites. In November 2019, the EPA issued final Certificates of Authorisation for the remediation of the four (4) no. sites.

Further detail in regard to the landfills, remediation approach and design measures are discussed in Chapter 2 of this EIA Report, Volume 3 Parts 3 and 4 of the EIAR and the Historic Landfill Remediation Strategy Report and Gas Management Strategy lodged as part of the current application documentation.

7.3.8 Rating of Importance of Hydrological Attributes

Based on the TII methodology (2009) (See **Appendix 7A**) the importance of the hydrological features (such as the presence of the Annex I habitats and the status of the Ballyman Glen SAC) at this application site is rated as ***'Extremely High Importance'*** based on the assessment that the attribute has a high-quality significance or value on an international scale due to the presence of the petrifying springs (Annex I habitat) within Ballyman Glen SAC located along the northern boundary of The Site.

7.4 Do Nothing Scenario

The land is zoned for development and as such is likely to be developed for this or an alternative development in keeping with the land use zonation. Without development, drainage would continue as current.

7.5 Potential Impacts

An analysis of the potential impacts of the proposed development on the hydrological environment during the construction and operation is outlined below. Due to the inter-relationship between soils, geology and hydrogeology and surface water the following impacts discussed will be considered applicable to Chapter 6 of the EIAR.

Construction Phase

The key civil engineering works which will have a potential impact on the water and hydrological environment during construction of the proposed development are summarised below.

- Excavations are required for the foundations for the main residential buildings and associated commercial buildings, soil stripping for car parks and foundations for the installation of associated services included within the residential development;
- Excavations of waste and general landfill material;

- Possible discharge of collected rainwater/ minor dewatering during excavation works and groundworks (the extent of which is dependent on the time of year development works are carried out); and
- Construction activities will necessitate storage of cement and concrete materials, temporary oils, and fuels on site. Small localised accidental releases of contaminating substances including hydrocarbons have the potential to occur from construction traffic and vehicles operating on site.

Operational Phase

There will be no storage of hazardous chemicals in the proposed development site during operation. There will be an increase in hardstanding areas (3.59 ha) and a resultant increase in run-off rate for storm water due to the proposed development. There will be wastewater generated during operation and water supply is required for operation.

7.5.1 Construction Phase

7.5.1.1 Construction Phase

7.5.1.1.1 Excavation and Infilling

It is proposed that there will be minor volumes of excavated waste material generated during the construction phase of the proposed development. The areas of the landfill will be further capped and compacted to avoid any settlement at these areas. In addition, the capping material will be placed and compacted (replacing with new as required) over the waste product in accordance with the project engineer's specification. The landfill remediation proposals are detailed in Chapter 2 of this EIA Report, Volume 3 Parts 3 and 4 of the EIAR and the Historic Landfill Remediation Strategy Report and Gas Management Strategy lodged as part of the current application documentation.

The total volume of cut is ca.136,053m^3 and the volume of fill is ca. 265,800m^3 which will be required for the lane realignments, residential sites, apartment blocks, creche, neighbourhood centre and landscape areas, resulting in a net fill of 129,747m^3.

For the landfill remediation works, 82,865m^3 of fill is required for the capping layer of the landfills at a depth of 1m and 24,860m^3 of pea gravel for fill is required to a depth of 0.3m. The site layout and site levels across the site have been designed so as to maximise the opportunity for achieving a sustainable materials balance which will minimise the need for import of material to the site. Due to the need for significant additional fill material on site for the landfill remediation capping however, it has not been possible to avoid a deficit of fill. Based on the development proposed under this current Phase 1 application alone it has been calculated that there will be a deficit of fill material of the order of 129,747m^3 required within the Phase 1 development areas.

All capping activities will be carried out in a controlled and methodical manner to ensure the integrity of the surrounding hydrological environment in terms of water quality and hydromorphology of the watercourse especially the nearby County Brook Stream (which hosts the Ballyman SAC) and the downgradient Dargle River. The potential impact of this is a possible increase in surface water run-off and sediment loading which could potentially impact local drainage and water quality on the County Brook Stream and the downgradient Dargle.

Further soil sampling will be undertaken during pre-development works however; it is anticipated that all excavated material will be reused on site. In the event that potentially contaminated soils are encountered, these soils will be segregated, tested and classified as hazardous or non-hazardous in accordance with the EPA Guidance Document: Waste Classification – List of Waste and Determining if Waste is Hazardous or Non-Hazardous (2015) and Council Decision 2003/33/EC. It will then be removed from site by a suitably permitted waste contractor to an authorised waste facility.

A construction site compound will be established at the site and the working area fenced off to provide a secure site. Due to the scale of development and the phased approach to development this compound will move positions throughout the construction period.

The construction compound will accommodate a site office and staff welfare facilities (including a canteen, drying room, toilets and first aid) as well as storage areas for materials, waste areas and plant and machinery. All surplus plant and materials shall be stored in this location when not in use and will be

secured here at night when the site is not operational. Oil storage will be bunded appropriately in 110% bunded structures.

7.5.1.1.2 Increased Sediments Loading in Run-off

Surface water runoff during the construction phase may contain increased silt levels or become polluted from construction activities. Runoff containing large amounts of silt can cause damage to surface water systems and receiving watercourses. Silt water can arise from dewatering excavations, exposed ground, stockpiles and access roads.

During the construction phase at this site there is potential for an increase in run-off due to the compaction of soils. This will reduce the infiltration capacity and increase the rate and volume of direct surface run-off. The potential impact of this is a possible increase in surface water run-off and sediment loading which could potentially impact local drainage on the County Brook Stream and the downgradient Dargle.

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

7.5.1.1.3 Accidental Spills and Leaks

As with all construction projects there is potential for water (rainfall and/or groundwater) to become contaminated with pollutants associated with construction activity. Contaminated water which arises from construction sites can pose a significant short-term risk to surface water quality for the duration of the construction if contaminated water is allowed to discharge into nearby watercourses. The potential main contaminants are oils, hydrocarbons and high alkaline waters.

During construction of the development, there is a risk of accidental pollution incidences to the County Brook Steam from the following sources:

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

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

Welfare facilities will be provided for the contractors on site during the construction works. These facilities are portable sanitary facilities will be provided with waste collected and disposed of appropriately.

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

7.5.2 Operational Phase

The development does not include the storage of bulk storage tanks for fuel oil distribution pumps. However, it is noted that any accidental discharge of hydrocarbons (from operational vehicles) to stormwater drainage may arise from areas of hardstand and drainage infrastructure proposed. This discharge will have the potential to impact on the water quality of the nearby watercourses. Drainage from the hardstanding areas will discharge through a petrol interceptor. There will be an increase of hardstanding areas (3.59 ha) due to the proposed development.

Storm water runoff from the site will be treated through the use of a Bypass Interceptor prior to discharge to the receiving watercourse and existing storm drainage networks.

Furthermore, due to the increase in hardstanding area there is a potential impact on the river morphology and river flows with the potential increase in surface run-off. However, the drainage system has be adequately designed to control flows at a greenfield runoff rate which is further described in Section 7.6 Mitigation Measures below.

The proposed landfill capping will:

- Minimise infiltration of water and maximise run off from the landfill areas;
- Promote surface drainage and maximise run off from the landfill areas;
- Control landfill gas migration; and
- Provide a physical separation between waste and plant and animal life. Leachate generation as a result of rainfall infiltration will be significantly reduced by the installation of the capping system.

The storm water management design for the proposed housing and road development routes the storm water to soakaways to promote percolation back to ground. The soakaways are designed to accommodate the 1 in 5-year storm events. Runoff in excess of the 1 in 5-year event will overflow from the soakaway storage to attenuation ponds which discharge to surface water. The storm water management system for the housing and road development (other than the landfill capping measures discussed below) will therefore have a negligible impact on groundwater recharge rates and may even promote additional recharge due to the additional storage provided in the soakaway tanks.

The post-development recharge represents a potential reduction of 7% in the recharge rate. This is based on a reduction from 575mm/yr to 533mm/yr, which is a reduction of 42mm/yr. The reduction in the average groundwater levels as a result of the decrease in recharge rate of 42mm/yr can be estimated based on the storage parameters for the gravel aquifer. A typical effective porosity for a gravel deposit of 15% is adopted for the basis of the assessment. To estimate the drop in levels resulting from a decrease in recharge rate the reduction in question (42mm/yr or 0.042m/yr) is divided by the porosity (15% or 0.15) which yields a water level fluctuation of 0.28m. This result was rounded up to 0.3m for the purposes of reporting.

Similarly, it is estimated that a consistent reduction in recharge percolating to groundwater across the larger landfill cells (landfill site 2) from 575 to 67mm could result in a potential ground water level decrease directly beneath the landfill of up to 3.4m. The observed reduction in groundwater level will be less as the potential drop in groundwater levels directly beneath the landfill will promote groundwater flow in from the surrounding areas, which will equilibrate the levels with the effect of marginal drawdown being observed from the wider area.

The reduced recharge rate in the aquifer could lead to a comparable reduction in the seepage face elevation. Therefore, potentially there may be a drop of 0.3m from the top of the seepage face and the reduction in flow at the springs could reduce by 7%. The predicted reduction of 0.3m is a small change when compared to the total saturated thickness of the gravel. The tufa springs are mapped lower down in the river valley, rather than at the top of the seepage face and therefore it is unlikely that this minor amount of drawdown would lead to a significant loss of any of the petrifying springs. The reduced recharge rate (by 7% in comparison to pre-development conditions) could lead to a comparable reduction in flow from the springs (7%), however it is expected the springs would continue to flow and the tufa would continue to be deposited.

The springs and seepages which feed the tufa deposits emanate at the seepage face where groundwater emerges from the river valley. The extent of the seepage face above the river elevation is related to the groundwater elevation in the gravels, which in turn is related to the recharge. Therefore, the capping of the landfill areas can potentially lead to improving the water quality within the County Brook Stream. The capping of the landfills with an impermeable membrane will block percolation of rainwater through the waste body with consequent likely impact on quality of groundwater flowing into County Brook Stream/ Dargle River downstream and in turn on the water quality.

The springs and seepages which feed the tufa deposits emanate at the seepage face where groundwater emerges from the river valley. The extent of the seepage face above the river elevation is related to the groundwater elevation in the gravels, which in turn is related to the recharge.

7.5.2.1 Storm Water & Surface Water Run-Off

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

It is proposed to incorporate soakaways within all of the proposed development areas. This allows water to percolate to ground at pre-development infiltration rates. The surface water network also connects to the ponds within the District Park to allow water from storm events to be attenuated and discharged to the County Brook at controlled runoff rates. This does not lead to loss of groundwater recharge, as such storm events would have resulted in direct runoff to the stream in any case. This will avoid any adverse impact on the Ballyman Glen SAC as it could have led to notable reductions in groundwater which could have potentially affected the petrifying spring locations within Ballyman Glen for which the SAC is designated.

Surface water runoff will be managed through the use of appropriate SuDS which include;

- Swales within Open Space / Park areas adjacent to roads / car parks
- Permeable paving in light traffic areas (parking bays)
- Extensive Green roofs (sedum) to suitable apartment blocks
- Intensive Green courtyards to suitable apartment blocks
- Underground modular system within green corridors / park areas
- Storm Water Attenuation ponds
- Soakaway
- Filter drains in rear gardens
- Tree pits
- Vortex flow control devices

All surface water run-off, which does not infiltrate into the ground will pass through the proposed SUD mechanisms and a suitably sized by-pass Separators or similar approved before entering the nearby waterbody.

There are 6 no. proposed drainage sub-catchment areas within the proposed development for the purpose of site control. The outfall from each catchment is segregated by the use of a vortex control device to limit / manage discharge from each catchment. It noted that for the purpose of discharge rates, the large open space (public park) has been removed for consistency of overall discharge rates.

The SuDS techniques proposed within the development are as outlined below:

- Landscape ponds with permanent water located within the proposed class 1 open space (public park) and to the east of the site adjacent to the N11 will be used to as storm water attenuation. It is noted that the storm water attenuation volume required is separate to permanent water level required within the landscape ponds.
- Swales are to be used within the site as conveyance systems for surface water runoff from sections of road, footpaths or shared surfaces. Discharge into the swale will be via drop kerbs / side inlet gully's or over edge flows.
- Permeable paving will be used in light traffic areas to the front of residential units. The permeable paving will allow for attenuation, infiltration to ground, reduction of peak flow rates and improved water quality. Roof run-off from the front roof area of residential housing units will discharge directly into the subbase below each permeable paving area allowing for reduced runoff from these roof areas.
- Extensive green roof and intensive green courtyards will be provided on suitable buildings as in accordance with sustainable drainage best practice. The green roofs / courtyards will provide reduced peak flow rates, attenuation, evaporation and improved water quality.
- Underground modular system will be used to manage surface water. The modular system will allow for storm water attenuation underground for storm events up to 1 in 100-year events and including for climate change. The modular systems will also allow for infiltration to ground.
- Filter drains within rear gardens of the housing units will allow for infiltration to ground, reduced peak flow rates and improved water quality. Only roof run-off from the rear roof of the residential unit will discharge into the filter drain. The filter drain will allow for infiltration to ground and reduce the overall site runoff.
- Vortex flow control devices will be used throughout the site to allow for storm water control and reduce peak runoff.
- As such there is no potential for increase in off-site flooding or impact on water quality as a result of the proposed development.

Further details are provided in within the engineering report (Atkins Stormwater Impact Assessment report) prepared for planning.

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

A number of measures will be put in place to minimise the likelihood of any spills entering the water environment to include the design drainage system with hydrocarbon interceptors. Refer to the Engineering Report for further details.

To minimise any impact on the river morphology, flow and water quality to receiving water flows, the design incorporates effective attenuation to greenfield run-off rates for new hardstanding areas (3.59 ha) following the Institute of Hydrology Report Number 124 (IH 124) Methodology. The proposed attenuation storage volumes are sized to accommodate any potential increase in surface water run-off rates up to the 1000-year return period storm event with an allowance for climate change effects. Run-off rates are controlled by an attenuated system which discharges attenuated water at greenfield run-off rates. The attenuated water flow will be discharged into the agricultural ditch along the western boundary of the site. These rates will mimic existing run-off rates and will not change the morphology of the nearby waterbody.

All outfall structures will be designed with an outlet structure that includes headwall, wingwalls and a bed apron to prevent local scouring of the banks and the channel bed. This, together with management of flow to mimic current run-off rates, will ensure no measurable impact on river morphology, existing surface water flow hydraulics or the potential for an increase in the risk of flooding.

7.5.2.1 Wastewater

The foul water network will be designed and arranged in accordance with the requirements of the Greater Dublin Strategic Strategy (GDSDS) and the Greater Dublin Regional Code (GDRC) in conjunction with “Recommendations for Site Development Works for Housing Areas” (current edition) published by the (DOEHLG). Cognisance has also been taken of the recommendations contained within the Building Regulations Part H – Drainage and Waste Water Disposal. The Guidelines published by Irish Water will also be followed. The foul water network will be laid as a separate system and drains will be laid such as to minimise the risk of misconnections.

Irish Water (IW) records indicate that the nearest existing public foul drainage network is a 525mm diameter concrete gravity sewer located on the Upper Dargle Road to the east of the N11 and circa 800m from the proposed development area. An existing private 450mm diameter foul sewer, which was previously installed by the applicant Cosgrave Property Group (CPG) as part of the upgrade works at the junction of the N11, is located between the eastern extent of the Phase 1 development and the N11. This existing foul sewer is currently under the private ownership of the applicant and will be used to convey foul drainage flows from the proposed development under the N11 and ultimately discharge to the existing public sewer along the Upper Dargle Road identified in IW’s records.

With regards to this discharge location, Irish Water issued a Confirmation of Feasibility (COF) letter on 8th November 2021 stating, “Wastewater Connection Feasible without upgrades by Irish Water – Further review of the foul network may be required at application stage”.

During the operational phase, the site will operate in compliance with the requirements of an Irish Water (IW) licence for discharge to sewer.

The foul drainage network for the proposed Fassaroe Phase 1 development has been designed based upon the criteria set out above including an allowance for the entire masterplan lands. Additional loading for the masterplan lands has been incorporated into the design model of the foul network to future proof the Phase 1 installation and prevent any requirements for future upsizing of the foul network.

It is proposed that the average discharge from the proposed development is 3.72 l/s with a peak discharge of 21.24 l/s. These flows consider the residential Phase 1A & 1B (houses, duplex and apartments) and the commercial Phase 1A & 1B.

“Micro Drainage” which is an industry standard tool for design and assessment of gravity sewer drainage networks has been used to simulate the proposed network, including the masterplan lands. A full clash detection was also carried out with the proposed storm drainage layout.

The majority of the Fassaroe Phase 1 development will discharge to an existing manhole (Ref F52) adjacent to the southern roundabout at the south-eastern corner of the development site. The eastern apartment blocks will discharge separately to another existing manhole (Ref F17) to the east of the development site.

There is no trade effluent proposed for this development. Pre application consultation has been undertaken with Irish Water and further details are provided within the engineering report prepared for planning.

7.5.2.2 Water Supply

The existing water supply infrastructure in the area comprises of a 24" trunk main which traverses lands to the east of the of the proposed Fassaroe Phase 1 development and a 33" main which traverses Open Space (OS) of the proposed Fassaroe Phase 1 development western lands of the Fassaroe Development. Both of these mains are fed by the Vartry Reservoir and convey supply to the IW Sandyford revisor and surrounding environs. An 800mm trunk main interconnector was constructed in 2009. This interconnector pipe runs along Berryfield Lane and connects both the 24" and 33" main together.

With regards to the water supply, Irish Water issued a Confirmation of Feasibility (COF) letter on the 8th of November 2021 stating *"Water Connection Feasible Subject to upgrades - In order to accommodate the proposed connection at the development, upgrade works are required to increase the capacity of the water network. Irish Water currently has a project on our current investment plan (Ballyman High Level Reservoir & associated trunk mains) which will provide the necessary upgrade and capacity. This upgrade project is scheduled to be completed by Q1 2022 (this may be subject to change) and the proposed connection could be completed as soon as possibly practicable after this date. In addition, the network will have to be extended by approximately 600 metres via a 300mm watermain in order to connect the development. Irish Water currently does not have any plans to extend its network in this area. Should you wish to consider extending you're the water infrastructure to the point to connection to the Irish Water network, please contact Irish Water."*

Following completion of the proposed Ballyman High Level Reservoir & associated trunk mains by IW, potable water supply for the proposed developed will be transferred and the temporary reservoir will be disconnected from the mains supply system. The proposed potable water supply network for the site has been designed in accordance with Irish Water Code of Practice and standard construction details. The watermain throughout the site will be sized to meet Irish Water requirements and standards.

Following receipt of the COF from IW, further discussions have confirmed that a temporary reservoir within the proposed development taking a feed from the existing 800mm trunk main interconnector to the proposed Fassaroe Phase 1 development is acceptable to feed a temporary onsite reservoir until the Ballyman High Level Reservoir & associated trunk mains are completed. The proposed temporary onsite reservoir will be located within apartment blocks 1-3 within the Eastern area of the development. The purpose of the proposed temporary onsite reservoir located within the apartment block 1-3 is to ensure ongoing management and maintenance.

In line Fire Hydrants will be located on the watermains in accordance with Irish Water standard construction details and "2006 Building Regulations" (Part B Fire Safety), so that no Fire Hydrant is > 46m and < 6m from any building. Fire Hydrants will be provided at a minimum rate of 1 for every 1000 m^2 of the area covered at ground level in accordance with "2006 Building Regulations" (Part B Fire Safety).

In accordance with IW requirements the planning design drawings were issued and reviewed by Irish Water Connection and Developer Services (CDS) in advance of making the planning application.

7.6 Mitigation Measures

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

Due to the inter-relationship between land, soils, geology, hydrogeology and hydrology, the following mitigation measures discussed will be considered applicable to all.

7.6.1 Construction Phase

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

7.6.1.1 Construction & Environmental Management Plan

The works Contractor will undertake the works in accordance with the provisions of the Construction Environmental Management Plan (CEMP) provided at Appendix 2B. This may be added to address other detailed construction matters. The CEMP provided with this application set out the minimum requirements and standards which must be met during the construction stage and includes any relevant mitigation measures outlined in this EIA Report. It will be updated by the Contractor to address any subsequent planning conditions relevant to the proposed development.

The CEMP is formulated in accordance with best international practice including but not limited to:

- CIRIA, (2001), Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors;
- Construction Industry Research and Information Association (CIRIA) Environmental Good Practice on Site (C650), 2005;
- BPGCS005, Oil Storage Guidelines;
- Eastern Regional Fisheries Board, (2006), Fisheries Protection Guidelines: Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites;
- CIRIA 697, The SUDS Manual, 2007; and
- UK Pollution Prevention Guidelines (PPG) UK Environment Agency, 2004.

7.6.1.2 Surface Water Run-Off

As there is potential for run-off to enter current stormwater systems and indirectly discharge to a watercourse, mitigations will be put in place to manage run-off during the construction phase.

Care will be taken to ensure that exposed soil surfaces are stable to minimise erosion and potential consequent sedimentation of surface water features and waterbodies. All exposed soil surfaces will be within the application site which limits the potential for any offsite impacts.

Should any discharge of construction water be required during the construction phase, discharge will be to foul sewer. Pre-treatment and silt reduction measures on site will include a combination of silt fencing, settlement measures (such as silt or sediment traps) and hydrocarbon interceptors.

Any minor ingress of groundwater and collected rainfall in excavations will be pumped out during construction. Extensive monitoring will be adopted to ensure that the water is of sufficient quality to discharge to the sewer. The use of slit traps and an oil interceptor (if required) will be adopted if the monitoring indicates the requirements for the same with no silt or contaminated water permitted to discharge to the sewer. There may be localised pumping of surface run-off from the excavations during and after heavy rainfall events to ensure that the excavations are kept relatively dry.

The temporary storage of soil will be carefully managed. Stockpiles will be tightly compacted to reduce runoff and graded to aid in runoff collection. This will prevent any potential negative impact on the stormwater drainage and the material will be stored away from any surface water drains. Movement of material will be minimised to reduce the degradation of soil structure and generation of dust. Excavations will remain open for as little time as possible before the placement of fill. This will help to minimise the potential for water ingress into excavations. Soil from works will be stored away from existing drainage features to remove any potential impact.

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

Weather conditions will be considered when planning construction activities to minimise the risk of run-off from the site and the suitable distance of topsoil piles from surface water drains will be maintained.

7.6.1.3 Fuel and Chemical Handling

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

Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles will take place in a designated area or within the construction compound which will be away from surface water gullys or drains. In the event of a machine requiring refuelling outside of this area, fuel will be transported in a mobile double skinned tank. An adequate supply of spill kits and hydrocarbon adsorbent packs will be stored in this area. All relevant personnel will be fully trained in the use of this equipment. Guidelines such as “Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors” (CIRIA 532, 2001) will be complied with.

Where feasible all ready-mixed concrete will be brought to site by truck. A suitable risk assessment for wet concreting will be completed prior to works being carried out which will include measures to prevent discharge of alkaline wastewaters or contaminated storm water to the underlying subsoil. Wash down and washout of concrete transporting vehicles will take place at an appropriate facility offsite.

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

Emergency response procedures will be outlined in the detailed CEMP. All personnel working on the site will be suitably trained in the implementation of the procedures.

7.6.1.4 Soil Removal and Compaction

Temporary storage of soil will be carefully managed in such a way as to prevent any potential negative impact on the receiving environment. The material will be stored away from any surface water drains (see Surface Water Run-off section above). Movement of material will be minimised to reduce degradation of soil structure and generation of dust.

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

All excavated materials will be visually assessed for signs of possible contamination such as staining or strong odours. Should any unusual staining or odour be noticed, samples of this soil will be analysed for the presence of potential contaminants to ensure that historical pollution of the soil has not occurred. Should it be determined that any of the soil excavated is contaminated, this will be segregated and appropriately disposed of by a suitably permitted/licensed waste disposal contractor.

7.6.2 Operational Phase

During operation measures there is no requirement for bulk fuels or chemical storage, no requirement for discharge to ground and no requirement for abstraction of groundwater.

The implementation of the design and mitigation measures highlighted above (Section 7.5) will ensure that the predicted impacts on the hydrological [and therefore the hydrogeological] environment do not occur during the operational phase and that the residual impact will be ***long-term-imperceptible-neutral***. Following the TII (2009) criteria (refer to **Appendix 7A**) for rating the magnitude and significance of impacts on the hydrological related attributes, the magnitude of impact is considered ***negligible***.

7.7 Predicted Impacts

7.7.1 Construction Phase

The implementation of mitigation measures outlined above (Section 7.6) will ensure that the potential impacts on the hydrological environment identified in section 7.5.1 do not occur during the construction phase and that the residual impact will be ***short-term-imperceptible-neutral***. Following the TII criteria (refer to Appendix 7.1) for rating the magnitude and significance of impacts on the hydrological related attributes, the magnitude of impact is considered ***negligible***.

7.7.2 Operational Phase

The implementation of mitigation measures highlighted above (Section 7.6) will ensure that the potential impacts on the hydrological environment identified in section 7.5.2 above do not occur during the operational phase and that the residual impact will be ***long-term-imperceptible-neutral***. Following the TII criteria (refer to **Appendix 7A**) for rating the magnitude and significance of impacts on the hydrological related attributes, the magnitude of impact is considered ***negligible***.

7.8 Cumulative Impact

The cumulative impact of the proposed development with any/all relevant other planned or permitted developments are discussed below.

7.8.1 Construction Phase

Contractors for the proposed development will be contractually required to operate in compliance with the CEMP which includes the mitigation measures outlined in this EIA report. Other developments will also have to incorporate measures to protect water quality in compliance with legislative standards for receiving water quality (European Communities Environmental Objectives (Surface Water) Regulations (S.I. 272 of 2009 and S.I. 77 of 2019). As a result, there will be minimal cumulative potential for change in the natural hydrological regime. The cumulative impact is considered to be neutral and imperceptible.

7.8.2 Operational Phase

All developments are required to manage discharges in accordance with S.I 272/2009 and 77/2019 amendments. As such there will be no cumulative impact to surface water quality and, therefore, there will be no cumulative impact on the Surface Waterbody Status. The operation of the proposed development is concluded to have a long-term, imperceptible significance with a neutral impact on surface water quality.

7.9 Monitoring and Reinstatement Measures

7.9.1 Construction Phase

Monitoring requirements during the construction phase are detailed below:

Table 7-1: **Summary Table of Monitoring Requirements – Construction Phase**

Character of Potential Impact	Mitigation Measure
Construction Phase	
Surface water run-off control	Regular inspection of surface water run-off and control of sediment (fines) will be undertaken, e.g. appropriately sized and located silt traps will be installed during the construction phase.
Implementation of construction mitigation measures	Regular inspection of construction mitigation measures will be undertaken, e.g. concrete pouring, refuelling etc. as part of the implementation of the CEMP for the site.

7.9.2 Operational Phase

Monitoring requirements during the operation phase are detailed below:

Table 7-2: **Summary Table of Monitoring Requirements – Operational Phase**

Character of Potential Impact	Mitigation Measure
Construction Phase	
Soil & Groundwater monitoring	Future groundwater monitoring is proposed as part of the proposed development as recommended by RPS in the monitoring programme for the landfills (once remediated) and as per the Certificates of Authorisation from the EPA.
Oil-water interceptors	Petrol/ oil interceptor(s) will be maintained and cleaned out in accordance with the manufacturer's instructions.
Drainage System	Maintenance of the surface water drainage system and foul sewers as per normal urban developments is recommended to negate/ limit any accidental discharges to ground.

No reinstatement is anticipated.

8 AIR QUALITY AND CLIMATE

8.1 Introduction

This chapter of the EIAR has been prepared to assess the Air Quality and Climate impacts associated with the proposed development.

The Chapter has been prepared by Paul Chadwick who has a BA (Mod) Chemistry, an M. Phil in Atmospheric Chemistry as well as 23 years' experience in preparing EIA for residential, waste, infrastructural, industrial and commercial development.

This chapter identifies, describes and assesses the impact of the development on the subject site and surrounding area in terms of air quality during the construction and operational phases of the scheme. Particular attention will be focused on sensitive receptors such as residential areas and local amenities (i.e., schools and business etc.) that are adjacent to the site.

In addition, this chapter identifies, describes and assesses the impact of the proposed development in terms of greenhouse gas emissions during the construction and operational phases of the development. Construction activities have the potential for greenhouse gas emissions. These include the use of construction materials, materials transport and construction machinery. Greenhouse gas emissions from the operational phase of the development will arise as a result of increased traffic volumes associated with the development in addition to space heating and energy use on site.

This assessment has been carried out in accordance with the Directive 2014/52/EU and also having regard to the following guidance, amongst other:

- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, August 2018);
- EPA Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR) (2017);
- Guidelines on the Information to be contained in Environmental Impact Statements (EPA, 2002);
- Advice Notes on Current Practice (in the Preparation of Environmental Impact Statements) (EPA, 2003);
- Revised Guidelines on the Information to be Contained in Environmental Impact Statements (EPA 2015);
- Planning and Development Regulations 2001, as amended, in particular by the European Union (Planning & Development) (Environmental Impact Assessment) Regulations 2018 (SI No. 296 of 2018);
- Environmental Impact Assessment of Projects – Guidance on the preparation of the Environmental Impact Assessment Report, European Commission, 2017;
- Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes (Rev. 1) (TII, formerly NRA, 2011);
- Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe;
- Air Quality Standards Regulations 2011 (S.I. No. 180/2011);
- World Health Organization, WHO Global Air Quality Guidelines (2021);
- Design Manual for Roads and Bridges (DMRB), Sustainability and Environment Appraisal, LA 105 Air Quality (UK Highways Agency, 2019);
- The National Policy Position on Climate Action and Low Carbon Development 2013;
- The Climate Action and Low-Carbon Development Act 2015 and the Climate Action and Low Carbon Development (Amendment) Act 2021;
- The Climate Action Plan 2021; and
- The National Climate Change Adaptation Framework 2018.

This section should be read with reference to the Planning Application site layout plans for the site and project description provided in **Chapter 2** of this EIAR.

8.2 Assessment Methodology

8.2.1 Assessment Approach

8.2.1.1 Air Quality

A desktop assessment for air quality was undertaken using existing background EPA air quality data in order to identify the existing pollutant trends in the area and to establish spatial information to determine compliance with relevant ambient air legislation. Future air quality trends for the key traffic-derived pollutants (nitrogen dioxide (NO_2) and particulate matter) with and without the proposed scheme in place were then predicted using the screening air quality assessment from the Design Manual for Roads and Bridges (DMRB), Sustainability and Environment Appraisal, LA 105 Air Quality (UK Highways Agency, 2019).

8.2.1.2 Climate

A desktop climate assessment for the area was undertaken using climate data from the Met Eireann 30-year averages. It is not possible to apportion the increase in greenhouse gas emissions from this project alone with specific climate impacts. However, existing trends in residential and transport related greenhouse gas emissions are considered with reference to the targets outlined in Ireland's National Policy Position on climate action and low carbon development.

8.2.2 Assessment Criteria

8.2.2.1 Air Quality

During the construction phase, dust is considered the principal pollutant to atmosphere. However, there is no Irish or European Union or Commission guideline or legislative limits for total suspended particles, so the limits provided by the TA Luft guidance *Technical Instructions on Air Quality Control* (TA Luft, 2002) are employed. TA Luft is a German technical regulation on air quality control. In accordance with this guidance construction activities are required to maintain monthly dust levels below the guideline limit of 350mg/m_2/day as an annual average at sensitive residential receptors. Below this threshold, the potential for dust nuisance to impact people in the nearest residential, commercial or other structures would be minimised.

In addition to the potential for human effects, dust or particles falling onto plants can physically smother the leaves affecting photosynthesis, respiration and transpiration. The DMRB has reported that based on a literature review the most sensitive species (Epiphytic lichen and Sphagnum dominated communities) appear to be affected by dust deposition at levels above 1000mg/m^2/day which is significantly greater than the level at which dust deposition may start to cause a perceptible nuisance to humans (350mg/m^2/day).

In May 2008, the European Commission introduced a Directive on ambient air quality and cleaner air for Europe (2008/50/EC), which has been transposed into Irish Legislation through the revised Air Quality Standards Regulations (S.I. 180 of 2011). These Air Quality (AQ) Standards are presented in **Table 8-1**. The legislation specifies limit values in ambient air for sulphur dioxide (SO_2), lead (Pb), benzene (C_6H_6), particulate matter (PM_{10} and $PM_{2.5}$), carbon monoxide (CO), nitrogen dioxide (NO_2) and oxides of nitrogen (NO_x). These limits are mainly for the protection of human health and are largely based on review of epidemiological studies on the health impacts of these pollutants.

Furthermore, the Air Quality Standards Regulations (S.I. 180 of 2011) specify limits that apply to the protection of the wider environment including ecological receptors.

The 2011 TII Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes specify the significance criteria for determining air quality impacts. The predicted increases or decreases from the key areas along the route have been recorded to determine the significance of any impact in relation to the TII criteria as presented in **Table 8-2, Table 8-3** and **Table 8-4**.

Table 8-1: Limits as Specified in Air Quality Standards Regulations 2011 (S.I. 180 of 2011)

Pollutant	Criteria	Value
Nitrogen Dioxide	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	200 µg/m^3 NO_2
	Annual limit for protection of human health	40 µg/m^3 NO_2
	Annual limit for protection of vegetation	30 µg/m^3 NO + NO_2
Benzene	Annual limit for protection of human health	5 µg/m^3
Carbon Monoxide	Maximum daily 8-hour running mean	10 mg/m^3
Lead	Annual limit for protection of human health	0.5 µg/m^3
Sulphur Dioxide	Hourly limit for protection of human health - not to be exceeded more than 24 times/year	350 µg/m^3
	Daily limit for protection of human health - not to be exceeded more than 3 times/year	125 µg/m^3
	Annual limit for protection of vegetation	20 µg/m^3
rticulate Matter PM_{10}	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50 µg/m^3 PM_{10}
	Annual limit for protection of human health	40 µg/m^3 PM_{10}
Particulate Matter $PM_{2.5}$	Annual target value for the protection of human health	20 µg/m^3 $PM_{2.5}$

Table 8-2: Definition of Impact Magnitude for Changes in Ambient Air Pollutant Concentrations (Source: TII, 2011)

Magnitude of Change	Annual Mean NO_2 / PM_{10}	No of Days with PM_{10} Conc greater than 50µg/m^3	Annual Mean PM
Large	Increase/decrease ≥4µg/m^3	Increase/decrease >4 days	Increase/decrease ≥2.5µg/m^3
Medium	Increase/decrease 2 - <4µg/m^3	Increase/decrease 3 of 4 days	Increase/decrease 1.25 - <2.5µg/m^3
Small	Increase/decrease 0.4 - <2µg/m^3	Increase/decrease 1 or 2 days	Increase/decrease 0.25 - <1.25µg/m^3
Imperceptible	Increase/decrease <0.4µg/m^3	Increase/decrease <1 day	Increase/decrease <0.25µg/m^3

Table 8-3: Air Quality Impact Descriptors for Changes to Annual Mean Nitrogen Dioxide and PM_{10} and $PM_{2.5}$ Concentrations at a Receptor (Source: TII, 2011)

Absolute Concentration in Relation to Objective/Limit	Changes in Concentration		
	Small	Medium	Large
Increase with Proposed Project			
Above Objective/Limit Value with development (≥40µg/m³ of NO_2 or PM_{10}) (≥25µg/m³ of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value with development (36-<40µg/m³ of NO_2 or PM_{10}) (22.5-<25µg/m³ of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value with development (30-<36µg/m³ of NO_2 or PM_{10}) (18.75-<22.5µg/m³ of $PM_{2.5}$)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value with development (<30µg/m³ of NO_2 or PM_{10}) (<18.75µg/m³ of $PM_{2.5}$)	Negligible	Negligible	Slight Adverse
Decrease with Proposed Project			
Above Objective/Limit Value with development (≥40µg/m³ of NO_2 or PM_{10}) (≥25µg/m³ of $PM_{2.5}$)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value with development (36-<40µg/m³ of NO_2 or PM_{10}) (22.5-<25µg/m³ of $PM_{2.5}$)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value with development (30-<36µg/m³ of NO_2 or PM_{10}) (18.75-<22.5µg/m³ of $PM_{2.5}$)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value with development (<30µg/m³ of NO_2 or PM_{10}) (<18.75µg/m³ of $PM_{2.5}$)	Negligible	Negligible	Slight Beneficial

Table 8-4: Air Quality Impact Descriptors for Changes in Number of Days with PM_{10} Concentrations Greater than 50µg/m³ at a Receptor (Source: TII, 2011)

Absolute Concentration in Relation to Objective/Limit	Changes in Concentration		
	Small	Medium	Large
Increase with Proposed Project			
Above Objective/Limit Value with development (≥35days)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value with development (32-<35days)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value with development (26-<32days)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value with development (<26 days)	Negligible	Negligible	Slight Adverse

Absolute Concentration in Relation to Objective/Limit	Changes in Concentration		
	Small	Medium	Large
Decrease with Proposed Project			
Above Objective/Limit Value with development (≥35days)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value with development (32-<35days)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value with development (26-<32days)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value with development (<26 days)	Negligible	Negligible	Slight Beneficial

In addition, to the statutory limits for the protection of human health listed in Air Quality Standards Regulations (S.I. 180 of 2011), the World Health Organisation (WHO) has published a set of air quality guidelines to offer quantitative health-based recommendations for air quality management. The WHO guidelines are based on reducing the risk to human health and in some cases the levels differ from the EU statutory limits as these limits are based on balancing health risks with technological feasibility, economic considerations and various other political and social factors in the EU.

The most recent publication from the WHO was in 2021 and the WHO recommended air quality guidelines (AQG) and interim targets are presented in **Table 8-5**. These guidelines are not legally binding standards; however, they do provide WHO Member States with an evidence-informed tool that they can use to inform legislation and policy. The levels are presented as an ultimate guideline as well as a series of interim targets which are proposed as incremental steps in a progressive reduction of air pollution and are intended for use in areas where pollution is high. It is notable that the AQG recommended by the WHO are significantly lower than the Air Quality Standards Regulations (S.I. 180 of 2011) for key traffic pollutants such as NO_2 and particulates.

Table 8-5: WHO Recommended Air Quality Guideline (AQG) Levels and Interim Targets (2021)

Pollutant	Averaging Time	Interim Target				AQG
		1	2	3	4	
$M_{2.5}$ (µg/m^3)	Annual	35	25	15	10	5
	24-hour	75	50	37.5	25	15
M_{10} (µg/m^3)	Annual	70	50	30	20	15
	24-hour	150	100	75	50	45
O_3 (µg/m^3)	Annual	100	70	-	-	60
	24-hour	160	120	-	-	100
NO_2 (µg/m^3)	Annual	40	30	20	-	10
	24-hour	120	50	-	-	25
SO_2 (µg/m^3)	24-hour	125	50	-	-	40
CO (mg/m^3)	24-hour	7	-	-	-	4

8.3 Baseline Scenario (Existing Environment)

8.3.1 Receiving Environment

The proposed development is a Strategic Housing Development at Fassaroe, Bray, Co. Wicklow which comprises a residential mix of houses and apartments as well as supporting services and amenities including neighbourhood centre uses, a district park, a creche, roads infrastructure, a pedestrian / cycle bridge over the N11 to Dargle Road and associated services and infrastructural works. The application also seeks planning permission for the remediation of 5 no. historic landfill sites **(Site 1, 2, 3A, 3B and 3C)** within the application site previously operated by Wicklow County Council and for which the EPA has already issued consent by way of Certificates of Authorisation.

The proposed development is bounded by the N11 to the east, Ballyman Glen and the County Brook Stream to the north, the Cookstown River to the south and by agricultural land to the west. Overall, majority of the land within the zoned lands are currently in agricultural use, as are the lands within Phase 1, although there are a number of other notable uses within the overall lands.

There are a number of residential clusters in the area which are most sensitive to changes in air quality in the area. These include those at Thornhill Road adjacent to the waste recovery facility in the northeast; along Kilbride Lane in the southeast; and along Berryfield Lane which runs east west through the site and connects to the Ballyman Road in the west. There are a number of small businesses located within the residential clusters at Thornhill Road and Berryfield Lane. Other key sensitive receptors in the area include the Enniskerry Football Club to the west of the development.

The key non-human receptor in the area with potential sensitivity to air quality impacts is the Ballyman Glen which is a designated as a Special Area of Conservation (SAC, Site Code 000713). The features of interest within the site are Petrifying springs with tufa formation (*Cratoneurion*) and Alkaline fens. This site lies partially within and adjacent to the northern boundary of the site.

8.3.2 Existing Sources of Pollution in the Area

There are a number of potential sources of existing pollution within the vicinity of the proposed development as follows:

- Road traffic on the national routes and on the local road network will generate levels of gaseous (NO_x, CO, VOCs) and particulate (PM_{10} and $PM_{2.5}$) pollution along the road network. Emissions are higher under congested traffic conditions so areas where there are bottlenecks or slow-moving traffic (such as during morning or evening peaks) are at higher risk of elevated levels of traffic derived pollution.
- Space heating for residential and commercial premises is likely to generate levels of gaseous (NO_x, SO_2, CO) and particulate (PM_{10} and $PM_{2.5}$) pollution. The extent of the emissions depends on the fuel used with solid fuels (coal, peat, wood) generating higher levels of pollution followed by liquid fuels (oil) and gaseous fuels (such as natural gas) generating the lowest emissions. The EPA note that solid fuel combustion for home heating is the largest source of PM_{10} within Ireland.
- Agricultural activities in the area have the potential to generate dusts and odours depending on the season and activity undertaken.
- Waste, energy and industrial operations in an area can give rise to air quality impact and there are a number of facilities in the surrounding area that are licenced by the EPA (**Table 8.6**).

Table 8-6: EPA IE/IPC Licence Holders Within the Vicinity of the Proposed Development

Distance	Licence	Operator	Address	Licence
c. 10 m	W0053	Starrus Eco Holdings Limited (Fassaroe)	Bray Depot, La Vallee House, Fassaroe , Bray, Wicklow	IEL
c. 2.2 km	P0567	Nypro Limited	Corke Abbey, Bray, County Dublin, Dublin	IPC
c. 1 km	P0105	A. O. Smith Electric Motors (Ireland) Limited	Boghall Road, Bray, Wicklow	IPC
c. 1.5 km	P0968	Alert Packaging Limited	IDA Bray Business Park, Southern Cross Route, Bray, Wicklow	IPC

Furthermore, within the area there are five historic unregulated landfill locations which were previously used by the local authority. These landfill sites ceased operation in the early 1990s at which time these areas were covered in topsoil and returned to agricultural use. In the intervening years a series of site investigations of these sites have been carried out to determine the nature of the waste and the level of risk posed by each site. It is noted (from the Environmental Risk Assessment prepared by RPS in 2018 (to accompany applications by Wicklow County Council for Certificates of Authorisation as included in Volume 3 Part 3 of this EIAR) and from the Addendum to the Environmental Risk Assessment prepared by RPS in 2022 to accompany this current SHD application (Volume 3, Part 4 of this EIAR) that all sites are currently producing methane and carbon dioxide through the anaerobic degradation of waste within the landfills and these gases are migrating laterally and vertically across the site through pipes, geology, etc. The presence of these landfills acts as a potential source of odour as a result of other trace gases (such as H_2S) which are commonly associated with landfill gas. No odours were detected during any of the site visits and there is no record of odour complaints in the area but there is a residual risk of odour nuisance from these sites.

Overall, the air emission sources outlined above as well as the effect of the emission sources presented in **Table 8-6** are likely to be reflected in the base air monitoring data that is presented in **Section 8.3.3** of this report.

8.3.3 Baseline Air Quality

Air quality data available from the Environmental Protection Agency (EPA) monitoring network was assessed. In Ireland, four air quality zones have been identified within S.I. No. 180/2011 - Air Quality Standards Regulations 2011 and are as follows:

- Zone A: Dublin Conurbation;
- Zone B: Cork Conurbation;
- Zone C: Other cities and large towns comprising Galway, Limerick, Waterford, Clonmel, Kilkenny, Sligo, Drogheda, Wexford, Athlone, Ennis, Bray, Naas, Carlow, Tralee, Dundalk, Navan, Letterkenny, Celbridge, Newbridge, Mullingar, Balbriggan, Greystones, Leixlip and Portlaoise; and
- Zone D: Rural Ireland, i.e. the remainder of the State excluding Zones A, B and C.

The subject site is located within air quality Zone C (Other Cities and Large Towns), due to the proximity of this scheme to the town of Bray (c. 2 km east). From the EPA report on ambient air quality in 2020 the most representative monitoring station in terms of the subject site is Bray, County Wicklow which is located in the grounds of Bray Town Council yard on Wurzburg Road.

This station monitors $PM_{2.5}$ and the annual mean in 2019 and 2020 for Bray was 7µg/m^3 and 5µg/m^3, respectively, which are well below the statutory limit for the protection of human health (20µg/m^3) and equal to or above the WHO guideline for the protection of human health (5µg/m^3). The EPA note that the main source of $PM_{2.5}$ particles is solid fuel burning for home heating.

The Bray monitoring station does not record all ambient air quality parameters outlined in the Directive on ambient air quality and cleaner air for Europe (2008/50/EC), therefore air quality in the receiving environment is described using the average annual mean value concentrations from all measured monitoring stations in Zone C areas.

Table 8-7 shows the annual mean value concentrations measured for SO_2, PM_{10}, $PM_{2.5}$ NO_2, CO and Benzene in Zone C for years 2020 and 2019. The table compares the annual mean measured levels with the limit values defined in the National Air Quality Standards Regulations 2011 (S.I No. 180 of 2011).

Table 8-7: Extract of Summary Data from EPA Ambient Air Monitoring for Zone C in 2020 and 2019

Pollutant	Unit	Annual Mean Concentration in 2020[1]	Annual Mean Concentration in 2019[2]	Annual Limit for Protection of Human Health or Vegetation (unless specified otherwise)
Sulphur Dioxide (SO_2)	µg/m^3	2.67	2.13	20
Particulate Matter (PM_{10})	µg/m^3	14.40	16.27	40
Particulate Matter ($PM_{2.5}$)	µg/m3	9.54	12.22	20
Nitrogen Dioxide (NO_2)	µg/m^3	11.14	12.00	40
Nitrogen Oxides (NOx)	µg/m3	21.63	25.43	-
Carbon Monoxide (CO)	mg/m^3	0.20	0.10	10 (as an 8-hour average)
Benzene	µg/m^3	0.04	0.12	5

The Clear Air Together project took place in October-November 2021 where approximately 1,000 citizens across Dublin measured NO_2 using diffusion tubes. While this monitoring was a single month, the data provides for some illustrative spatial data in the Bray/Shankill area and the relevant results in the area are shown below.

- Ferndale Road, Old Conna (circa 500m west of the M11) 4.16 µg/m^3 NO_2; and
- Mountain View, Shankill (circa 70m east of the M11) 11.24 µg/m^3 NO_2.

As expected there is a decrease in NO_2 levels with distance from the motorway and the site of the proposed development is expected to show levels that are more aligned with the Ferndale Road levels.

In summary, the existing and recent baseline levels of SO_2, PM_{10}, $PM_{2.5}$, NO_2, CO and Benzene based on data from the EPA monitoring network are currently below ambient air quality limit values in Zone C and by extension the levels in the vicinity of the proposed development are also considered to be below the limit values for both years shown. The 2019 limit values are of particular note for the current assessment as these are likely to be more representative of normal conditions than those for 2020 given the reduced traffic volumes on Irish roads in 2020 due to COVID-19 lockdown restrictions that year.

[1] EPA, Air Quality in Ireland 2020 summary data table. Available at: https://www.epa.ie/publications/monitoring--assessment/air/Summary-Data-Tables---2020.pdf (accessed Feb, 2022)

[2] EPA, Air Quality in Ireland 2019 summary data table Available at: https://www.epa.ie/publications/monitoring--assessment/air/Summary-Data-Tables---2019.pdf (accessed Feb, 2022)

8.3.4 Baseline Climate

The weather in Ireland is influenced by the Atlantic Ocean, resulting in mild, moist weather dominated by maritime air masses. The prevailing wind direction is from a quadrant centred on west-southwest. These are relatively warm winds from the Atlantic and frequently bring rain. Easterly winds are weaker and less frequent and tend to bring cooler weather from the northeast in spring and warmer weather from the southeast in summer. The site is close to the east coast and would experience a higher frequency of easterly winds than more inland locations or those on the west coast.

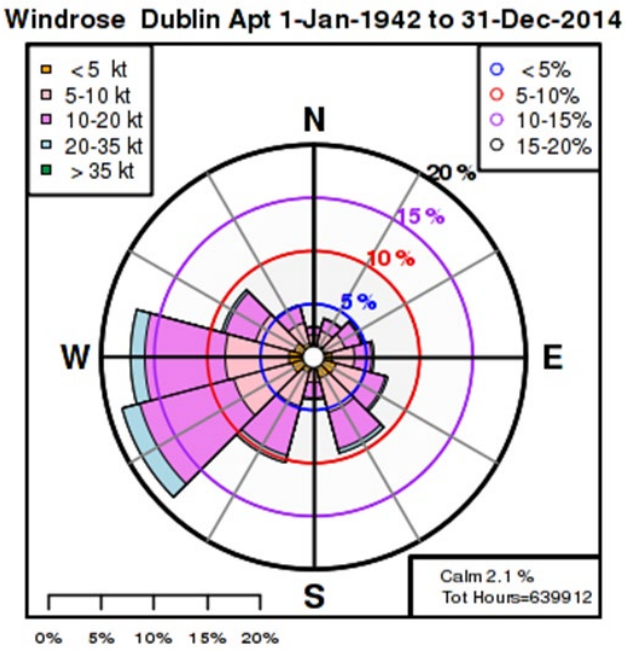
The nearest meteorological station to the subject site is the Met Éireann Station in Dublin Airport which lies to the east of the subject site. The 30-year averages from the station at Dublin Airport are presented in **Table 8-8**.

Table 8-8: 30-year Average Meteorological Data from Dublin Airport (Annual Values from 1981-2010), source: www.met.ie)

Parameter	30-year Average
Mean Temperature (°C)	9.8
Mean Relative Humidity at 0900UTC (%)	83.0
Mean Daily Sunshine Duration (hours)	3.9
Mean Annual Total Rainfall (mm)	758.0
Mean Wind Speed (knots)	10.3

The prevailing wind direction for the area is between west and southwest as presented in the windrose for Dublin Airport Met Station for 1981-2010 in **Figure 8-1**. Northerly and north-easterly winds tend to be very infrequent (less than 5%) with easterly and south-easterly winds marginally more frequently (5-10%). Wind characteristics are typically moderate with relatively infrequent gales with an average of 8.2 days with gales per annum with an average maximum wind gust of 80 knots during the year.

Figure 8-1: Windrose for the Dublin Airport Met Station 1942 to 2014 (source: www.met.ie)



8.3.4.1 Climate Policy

8.3.4.1.1 National

CO_2 emissions have a global climate warming effect. This is regardless of their rate of release, location or the weather when they are released into the atmosphere. This is unlike pollutants that affect local air quality where the rate of release, location and prevailing weather, as well as the amount of pollutant, determines the local concentrations and the impact. Local ambient concentrations of CO_2 are not relevant and there are no limits or thresholds that can be applied to particular sources of carbon emissions – any amount of CO_2 released into the atmosphere will contribute to climate warming, the extent of which is determined by the magnitude of the release. Although CO_2 emissions are typically expressed as kilogrammes or tonnes per year, there is a cumulative effect of these emissions because CO_2 emissions have a warming effect which lasts for 100 years or more.

It is difficult to assess the scale and significance of any adverse (increased) changes in CO_2 emissions resulting from the proposed development in a similar way to other impacts within this EIAR. The effect – the term used to describe an environmental response resulting from an impact, or series of impacts – is not possible to assess for individual CO_2 emissions. However, commentary and context to the calculated CO_2 emissions reported is provided with reference to historic and projected national emissions in Ireland.

The National Policy Position on Climate Action and Low Carbon Development was published on 23rd April 2014. The policy sets a fundamental national objective to achieve transition to a competitive, low-carbon, climate-resilient and environmentally sustainable economy by 2050. The policy states that GHG mitigation and adaptation to the impacts of climate change are to be addressed in parallel national strategies – respectively through a series of National Mitigation Plans and a series of National Climate Change Adaptation Frameworks.

The National Policy Position envisages that development of National Mitigation Plans will be guided by a long-term vision of low carbon transition based on the following:

- An aggregate reduction in carbon dioxide (CO2) emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors; and
- In parallel, an approach to carbon neutrality in the agriculture and land-use sector, including forestry, which does not compromise capacity for sustainable food production.

Further to the National Policy Position, the Climate Action and Low Carbon Development Act 2015 (No. 46 of 2015) was enacted on the 10th of December 2015. The Climate Act sets out the proposed national objective to transition to a low carbon, climate resilient and environmentally sustainable economy by the end of 2050.

On 14th May 2018, the European Council adopted a regulation on greenhouse gas emission reductions – EU effort Sharing Regulation sets out 2030 targets for member states. The starting point is an average of 2016 – 2018 emissions with binding emission reduction targets of 30% compared to 2005 levels.

The Climate Action and Low Carbon Development (Amendment) Act 2021 was published in 2021 which will commit the State, in law, to move to a climate resilient and climate neutral economy by 2050.

In 2021, the Climate Action Plan was published and sets out Ireland's plan to address climate disruption and the impact it has on the environment, society, economy and our natural resources. It commits Ireland to a legally binding target of net zero GHG emissions by no later than 2050, and a reduction of 51% (compared to 2018 levels) by 2030. The Climate Action Plan outlines 475 actions that need to be taken across all the key sectors.

Specifically in relation to the transport sector, key actions include encouraging the uptake of biofuels, providing additional public transport and active travel options and accelerating the uptake of Electric Vehicles (EVs) to achieve a target of 945,000 EVs on the road by 2030. Furthermore, specifically in relation to new housing a key action related to phasing out use of fossil fuels for space and water heating in all new buildings and promoting the use of electric heat pump or other low carbon technology in new and existing residential and commercial buildings, amongst others.

Targets also include developing coherent reduction strategies for waste and resource use, and increasing the level and quantity of recycling to develop a more circular economy

In addition to reducing GHG emissions, the Climate Action Plan also highlights the importance of considering future climate change, such as increases in severe weather events and increased incidence of flooding and building climate change resilience into new developments.

8.3.4.1.2 Regional

Wicklow County Council under the guidance of the Climate Action Regional Office (CARO) have, in 2019, adopted a Climate Adaptation Strategy for County Wicklow[3] which is a response to the impacts that climate change is having and will continue to have on the County and its citizens. The most immediate risks to Wicklow are those which are due to changes in extremes such as floods, precipitation, storms and higher sea levels.

In order to prepare for the challenges of climate change and adapting to its effects, six key thematic areas of equal priority have been identified within the Climate Change Adaptation Strategy for County Wicklow as follows:

- Local Adaptation Governance and Business Operations;
- Infrastructure and Built Environment;
- Land Use and Development;
- Drainage and Flood Management;
- Nature, Natural Resources and Cultural Infrastructure; and
- Community Health and Wellbeing

The development of these thematic areas is supported by named objectives and actions that form that basis of the strategy.

8.4 Impact Assessment

8.4.1 Do-Nothing

The 'Do-Nothing' scenario refers to the site remaining in its current condition as per the existing baseline scenario and no activity associated with the proposed development taking place. Under such a scenario, the existing baseline trends in air quality and climate, as set out in **Section 8.3.3** will pertain for the following reasons:

- The site would remain in its current agricultural land use with low levels of dust generated periodically. the absence of any major construction on site would eliminate the potential for temporary dust nuisance;
- Existing traffic to the site is minimal and the 'do-nothing' scenario would eliminate the need for the construction and operational traffic associated with the proposed development;
- Remaining as a greenfield site for agricultural use would eliminate the risk of odour from the remediation of historical landfills by the proposed development; and
- The carbon impact of the proposed construction and operation stages of the proposed development would be reduced under the 'do-nothing' scenario where the carbon emissions would be reduced to the current agricultural releases associated with the site.

8.4.2 Construction Phase

8.4.2.1 Potential Air Quality Impact of Construction Phase

The construction phase of this development has the potential to generate a number of short-term emissions to atmosphere. Construction activities are likely to generate some dust emissions. The potential quantity of dust emissions will depend on the type of construction activity being carried out such as excavations, mixing concrete, sawing wood and construction traffic travelling across exposed ground. Dust dispersion across the development site and out into the wider environment will be determined primarily by meteorological factors including levels of rainfall, wind speed and wind direction. The short-term impact from dust depends on the

[3] Wicklow County Council Climate Change Adaptation Strategy, Available at: https://www.wicklow.ie/Portals/0/Documents/Climate%20Action/Adaptation%20Strategy/Climate%20Adaptation%20Strategy.pdf (Assessed Feb 2022)

distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The majority of any dust produced during the construction phase will be deposited close to the source and as such any impacts from dust deposition will typically be close to the source, within several hundred metres of the construction compound.

Where there are operations at a construction site there is a risk that dust may cause an impact at sensitive receptors in close proximity to the source of the dust generated. The risk of dust impact is best described in the TII Guidelines, and these distances are presented in **Table 8-9**.

Table 8-9: T II Assessment Criteria for the Impact of Dust Emissions from Construction Activities, (with standard mitigation in place)

Source		Potential Distance for Significant Effects (Distance from Source)		
Scale	**Description**	**Soiling**	**PM_{10}**	**Vegetation Effects**
Major	Large Construction sites, with high use of haul routes	100m	25m	25m
Moderate	Moderate Construction sites, with moderate use of haul routes	50m	15m	15m
Minor	Minor Construction sites, with minor use of haul routes	25m	10m	10m

It is important to note at the outset that one of the principal factors affecting dust generation and dust deposition relates to moisture content. Moisture increases the mass of a dust particle meaning particles are less friable and hence, less prone to dust dispersion. In most construction projects, the principal means of dust suppression is through maintaining a high moisture level on dust particles.

Given the extent of works the scale of the construction site is considered to be ‘major’. There are several residential/commercial properties located within 100 metres of the works particular along Berryfield Lane and along Thornhill Road. These properties are likely to experience a ‘temporary slight adverse' dust impact during construction in the absence of additional mitigation. Additional mitigation for these properties is presented in **Section 8.5**. All other properties are located outside of the 100 metres threshold and hence, these properties will experience no adverse dust impact from the proposed construction phase.

8.4.2.2 Potential Climate Impact of Construction Phase

The construction phase of the potential development has the potential to generate a number of greenhouse gas emissions in the short term. Emissions from construction activities will arise from embodied carbon in site materials as well as vehicles delivering this material to the construction site. The principal sources of greenhouse gases are listed below:

- Quarried Material – stone, aggregate, sand, etc.
- Concrete, Mortars, Cement.
- Metals – includes steel sub structure, reinforcement, cladding, piping, etc.
- Plant Emissions - both mobile (excavators, dozers, etc.) and fixed (generators, batching plants, etc.).
- Material Transport – both materials in and wastes removed from the site and personnel transport.

The design of the construction phase can be proactive in mitigating potential greenhouse gas emissions. As a mitigation measure it is proposed that a carbon foot-printing exercise is carried out during construction to assist in the identification of low carbon products from local sources to minimise emissions of greenhouse gases. The construction of the proposed development is considered to pose a ‘permanent adverse’ impact for climate.

8.4.2.3 Potential Odour Impact of Construction Phase

The disturbance of the areas within and around the historic landfills may generate lateral or vertical pathways for the escape of landfill gas. The fugitive release of this landfill gas has the potential for the generation of odour nuisance through the release of trace gases (such as H_2S and mercaptans) within the landfill gas.

In addition to the potential for odour caused by these excavations, works in these areas may also result in the potential development of additional pathways for landfill gas migration during construction.

There are a number of existing residential properties located to the south of the Landfill Site 2 where the proposed road alignment is planned. Similarly, the Enniskerry Football Club grounds are located adjacent (c. 500 metres southwest) to the area where the proposed road cuts through Landfill Site 3B. These properties are predicted to experience a 'temporary slight adverse' impact from landfill odours in the event that any landfill gas is released during the works. Other receptors in the area will likely experience negligible impacts.

Mitigation for these properties is presented in **Section 8.5.2** of this Chapter.

Contractor operatives working on or close to the historic landfills may be exposed to flammable gases (methane, hydrogen sulphide) during excavation s and site clearance. To manage this risk, all relevant operatives will be suitably training in the HSA Guide to the Safety, Health and Welfare at Work General Application Regulations 2007, Part 8: Explosive Atmospheres at Places of Work.

8.4.3 Operational Phase

8.4.3.1 Potential Air Quality Impact of Operational Phase (Traffic)

There is the potential for a number of emissions to the atmosphere during the operational phase of the proposed development. In particular, the traffic-related air emissions may generate quantities of air pollutants such as nitrogen dioxide and particulate matter.

Road traffic is considered the primary direct impact to air quality from the proposed development. The site is accessed via Junction 6 off the N11 road then via the R918 or internals roads (Berryfield Lane, Thornhill Road).

Projected traffic figures associated with the scheme at key junctions and links as identified in the **Traffic and Transport Assessment** were used to predict the concentrations of traffic-derived pollutants in baseline and future years. The model then combined background concentrations of pollutants, sourced from the 2019 EPA report on ambient air quality (**Table 8-7**), with predicted concentrations. As noted, the 2020 data was impacted by reduced traffic volumes associated with the COVID-19 lockdown and it is felt that 2019 data is more representative data.

Results were generated using an average speed of 100km/hr on the N11 and 60km/hr on the internal roads (Berryfield Lane, Thornhill Road). The parameters assessed were nitrogen dioxide (NO_2) and particulate matter (PM_{10}). These are the pollutants of most concern with regard to road traffic emissions and the Air Quality Standards.

Using the DMRB screening air dispersion model, pollutant concentrations with the development in operation were predicted at the sensitive receptors adjacent to the development site. The following receptor was assessed:

- R1 – Residential house (53.198106, -6.138467) on Thornhill Road c. 100m east of Greenstar Recycling and c.50m Northeast of the Thornhill Roundabout and directly adject to the development.

Increases in ambient concentrations of traffic pollutants NO_2 and PM_{10}, with the development in place (Do-Something) are compared with the current background concentrations of pollutants, sourced from the EPA report on ambient air quality in 2019. In order to quantify the magnitude of change in pollutant concentrations, the descriptors in **Table 8-2** and **Table 8-3** were used.

The results of the impact assessment on the sensitive receptors arising from traffic from the scheme are presented in **Table 8-10**. Results are presented for 2026 Do – Minimum (No Development), A 2026 Do - Something (Phase 1a), a 2031 Do – Something Phase 1a with additional phase 1a developments and a cumulative 2031 Do – Something Phase 1a with additional phase 1a developments and other cumulative developments impact scenarios.

Table 8-10: Local Impact at R1

Scenarios	Nitrogen Dioxide (NO_2) ($\mu g/m^3$)	Particulates (PM_{10}) ($\mu g/m^3$)		Benzene ($\mu g/m^3$)	Carbon Monoxide (mg/m^3)
	Annual Average NO_2	Annual Average PM_{10}	Days >50$\mu g/m^3$	Annual Average Benzene	Annual Average CO
Background	12.00	16.27	3.54	0.12	0.10
2026 Do - Minimum	12.04	16.18	0.37	0.11	0.10
2026 Do - Something (Phase 1a)	12.08	16.20	0.38	0.11	0.10
Change	**+0.04**	**+0.02**	**+0.01**	**0**	**0**
2031 Do – Something with additional phase 1a developments	12.08	16.20	0.38	0.11	0.10
Change	**0**	**0**	**0**	**0**	**0**
2031 Do – Something with additional phase 1a developments and other cumulative developments	12.14	16.22	0.39	0.11	0.00
Change	**+0.06**	**+0.02**	**+0.01**	**+0.00**	**+0.00**
Annual Limit	**40**	**40**	**35**	**5**	**10**
WHO Guideline	25	15	-	-	4

The results of the analysis indicate that the levels of airborne pollution at the residential receptor will remain below the statutory limits for the protection of human health and the WHO guidelines for all future scenarios except for PM_{10} which is already above the PM_{10} WHO guideline in the baseline as a result of solid fuel domestic heating.

The local impact significance of traffic related pollutants, NO_2 and PM_{10}, on air quality at the sensitive receptors with continued use of the scheme is addressed based on the TII criteria in **Table 8-3**.

The impact of the proposed development in both 2026 Do - Something (Phase 1a) and 2031 '2031 Do – Something with additional phase 1a developments and other cumulative developments (cumulative) equates to a 'imperceptible' increase in annual average of NO_2 and PM_{10} at R1. These road traffic impacts during the operation phase are considered 'negligible' for air quality.

8.4.3.2 Potential Impact on Sensitive Ecosystem

In addition to human receptors, designated ecological sites close to a road corridor may be impacted by road traffic emissions through nitrogen deposition. The Ballyman Glen SAC (Site Code 000713) is located to the north of the Phase 1 development and the new distributor road. As the SAC is designated for alkaline fens the area may be sensitive to nitrogen deposition. Given the ecological sensitivity of the area, a nitrogen deposition assessment has been carried out as per the TII Guidelines.

Using the results of the dispersion modelling and the procedures outlined in the TII Guidelines, an assessment of nitrogen deposition on the sensitive ecosystems has been undertaken. **Table 8-11** presents the results in terms of nitrogen deposition on the dry heath at Ballyman Glen SAC as a result of traffic associated with the proposed development in **2026** and **2031**.

Table 8-11: Predications of Nitrogen Deposition at Sensitive Ecosystems in 2026 and 2031

Ecosystem	2026 Do-Minimum (ug/m^3)	2031 High Growth (ug/m^3)	Nitrogen Deposition with Proposed development kg (N) /ha/year
Ballyman Glen SAC	9.9	9.9	0.99
UNECE Critical Load (kg(N)/ha/year) – Dry Heath			10 - 20

The predicted nitrogen deposition levels onto the Ballyman Glen SAC site as a result of the proposed development indicate levels of approximately 0.99 kg (N)/ha/year and shows no difference in the predicted deposition levels from the existing road alignments.

The deposition with the N11 and local roads in operation (0.99 kg(N)/ha/year) is compared to the UNECE critical loads for nitrogen as presented in the TII Guidelines. The UNECE critical load for nitrogen for dry heath areas is 10-20 kg (N)/ha/year. These results indicate that the levels of nitrogen deposition are less than 10% of the critical load as set by UNECE with the proposed development in operation. This low level of nitrogen deposition also applies to the other sensitive habitats that are adjacent to the route but are not in the Natura 2000 network.

Other than nitrogen oxides (NO_x), the other potential impact on sensitive ecosystems will be the potential impact of construction dusts during the construction phase. Dusts can be deposited on the leaves of plants reducing the photosynthetic potential. DMRB guidance states that dust or particles falling onto plants can physically smother the leaves affecting photosynthesis, respiration and transpiration. The literature suggests that the most sensitive species appear to be affected by dust deposition at levels above 1000 mg/m_2/day. As such, once dust deposition rates are maintained within the standard guideline for human nuisance (350mg/m_2/day) the impact of construction dust on sensitive ecosystems is considered negligible.

Further details of the predicted impacts to sensitive ecosystems are presented in **Chapter 5 – Biodiversity** of the EIAR.

8.4.3.3 Potential Climate Impact of Operational Phase

During the operational phase a scheme of this nature has the potential to generate greenhouse gases through increased vehicular traffic in the area as well as from the external lighting, space heating and energy use within the buildings.

However, it is proposed that buildings constructed as part of the proposed development will integrate sustainable energy efficient design principles in order to reduce their potential climate impact. All of the units will be subject to the NZEB (Nearly Zero Energy Building) requirements of the updated Part L of the Irish Building Regulations. In terms of energy ratings all of the units on site will have a Building Energy Rating (BER) of A2 / A3. Energy efficiency will be achieved through building fabric and window elements as well as use of renewable energy solutions which development will incorporate photovoltaic (PV) solar panels, combined heat and power and heat pumps.

These design measures are aligned with the Built Environment actions in the Climate Action Plan 2021, specifically the introduction of NZEB for new dwellings, the phasing out of fossil fuels as the heat source and the installation of heat pumps. In this regard, the built environment elements of the proposed development are fully aligned with climate policy.

In terms of climate adaption, the main potential risk to and from the development relates to fluvial flood risk from the rivers in the area. A flood risk assessment for the proposed development forms part of the SHD planning application and flood risk is also addressed in Chapter 7 - Water services, Hydrology and Flood Risk of this EIAR. In this regard, no specific climate adaption measures are proposed for the development outside of the SUDS drainage design.

The transport emissions from the proposed development are largely dependent on the vehicles used by the residents. In this regard and as outlined in **Section 8.5.5** road traffic emissions are largely by EU driven policy and legislation which continue reduced emission and promote cleaner alternatives.

8.4.3.4 Operational Landfill Gas Management

At all five sites, despite their age, waste is currently generating a residual amount of landfill gas and will continue to do so for some years. Landfill gas migrates along the path of least resistance. At present, the gas simply migrates towards the surface of the landfills. In areas where the existing cover material is not well compacted the landfill gas will migrate through the cover material and into the atmosphere. In areas where the existing clay cover material is well compacted the landfill gas will be prevented from venting through the surface and will therefore migrate laterally through the underlying sand and gravel deposits. This lateral migration of landfill gas is evident in a number of boreholes which have been drilled outside of the waste areas.

With the installation of a low permeability capping layer the gas will be prevented from venting through the surface of the landfill and will therefore build up in pressure and eventually migrate laterally beneath the edges of the sites, potentially towards residential units. To prevent this occurring a gas management system will be incorporated into the rehabilitation measures.

The proposed landfill gas management measures are described in detail in the Fassaroe Historical Landfills, Gas Management Strategy document by RPS, 2022 which forms part of the SHD application. This Gas Management Strategy is as approved to Wicklow County Council by the EPA in 2019 through the Certificate of Approval process. The main gas management strategy comprises of a Virtual Gas Curtain (VGC). This is the favoured and proposed treatment measure due to its effectiveness in controlling gas migration, its durability and ease of installation.

The Virtual Gas Curtain is a fully enclosed barrier that is proposed around the perimeter of each of the landfill sites. The concept of the VGC is to form a low pressure or low gas concentration area relative to the surrounding gassing ground, to encourage gas to flow towards the barrier, and allow subsequent venting to atmosphere.

Geo-composite nodes are inserted at 1m intervals along the curtain length with 3m high vent stacks located at 20 – 25 m intervals. The barrier would need to be advanced to a depth of circa 10m below ground level (BGL) surrounding the landfill sites to intercept any migrating gases. The width of the trench required for installation is 600mm wide and will include a header pipe that connects all the vent nodes together.

In addition, a pumped gas collection system and flare compound is proposed to serve sites 2, 3a and 3c. The flare required is a small 100m3 /hr Lo-Cal flare which will be provided in a small compound of approx. 6m x 6m located just to the west of site no. 3c.

With these standard landfill design measures in place, the potential for fugitive losses of methane is significantly reduced. Any potential losses will be short term and temporary and will readily dilute and disperse with no significant impact for air quality including odour for the area.

8.4.4 Cumulative Impact

The cumulative impact to air quality from the development, along with other permitted and existing developments in the vicinity are considered in this assessment. The assessment of traffic impact presented in **Section 8.4.3.1** includes the cumulative traffic scenario whereby the impact of traffic from the development coupled with other development has been assessed for air quality impact in a future scenario year. These cumulative road traffic impacts during the operation phase are considered 'negligible' for air quality.

8.5 Mitigation Measures

8.5.1 Air Quality Mitigation During Construction Phase

In order to mitigate dust emissions during the construction phase, a dust minimisation plan is provided as part of the CEMP provided at **Appendix 2B** of this EIAR. The dust minimisation plan is prepared with regard to the industry guidelines such as the Building Research Establishment document entitled *Control of Dust from Construction and Demolition Activities* and the Construction Industry Research and Information Association (CIRIA) *Environmental Good Practice on Site*. The dust minimisation plan includes the following mitigation measures:

- Site roads will be regularly cleaned and maintained as appropriate. Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic only.
- Any site roads with the potential to give rise to dust will be regularly watered, as appropriate, during dry and/or windy conditions (also applies to vehicles delivering material with dust potential).
- All vehicles exiting the site will make use of a wheel wash facility prior to entering onto public roads, to ensure mud and other wastes are not tracked onto public roads. Wheel washes will be self-contained systems that do not require discharge of the wastewater to water bodies.
- Public roads outside the site will be regularly inspected for cleanliness and cleaned as necessary.
- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind.
- Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods.
- The transport of soils should be undertaken in covered vehicles.
- All vehicles which present a risk of spillage of materials, while either delivering or removing materials, will be loaded in such a way as to prevent spillage on to the public road.

If the construction contractor adheres to good working practices and the dust mitigation measures outlined above, the levels of dust generated are assessed to be minimal and are unlikely to cause an environmental nuisance. The construction contractor will be required to maintain monthly dust levels below the guideline of 350mg/m^2/day as a 30-day average at sensitive receptors using standard Bergerhoff gauges. Where dust levels are measured to be above this guideline the mitigation measures in the area must be reviewed as part of the dust minimisation plan.

8.5.2 Odour Mitigation During Construction Phase

A detailed construction methodology for the excavation works shall be prepared by the contractor and communicated to all site personnel to ensure that no confined spaces or trenches deeper than 1m are created during the excavation of waste. Where confined spaces or trenches greater than 1m are created, gas detection equipment and appropriate breathing apparatus should be used by all personnel in the vicinity of the confined space/trench.

The works must be planned to minimise the risk of the release of odours and gases to surrounding areas including the contractor's compound and the wider community. Site operatives in the Site 3B area will be instructed to report all unusual, concentrated or significant odours on-site, so that measures may be taken to identify the source of the odour and eliminate same.

Gas monitoring techniques will be put in place by the contractor. For nuisance odours, automated odour control systems may need to be put in place, as necessary, to periodically release a fragrance to mask or neutralise unpleasant odour.

A wheel-washing facility shall be established for trucks leaving the site to minimise the transport of potentially odorous clay particles onto adjacent roads.

A no smoking policy will be strictly enforced onsite.

8.5.3 Climate Mitigation During Construction Phase

Mitigation measures to minimise GHG emissions from transport during the construction phase include the following:

- Local sourcing of construction materials such as the recycling of material won on excavations for reuse on site.
- Implementation of a Traffic Management Plan. This will outline measures to minimise congestion and queuing, reduce distances of deliveries and eliminate unnecessary loads.
- Reducing the idle times by providing an efficient material handling plan that minimises the waiting time for loads and unloads. Reducing idle times could save up to 10% of total emissions during construction phase.

- Turning off engines when not in use for more than five minutes. This restriction will be enforced strictly unless the idle function is necessary for security or functionality reasons.
- Regular maintenance of plant and equipment. Technical inspection of vehicles to ensure they will perform the most efficiently.

Materials with a reduced environmental impact may also be incorporated into the construction design through re-use of materials or incorporation of recycled materials in place of conventional building materials. The following materials should be considered for the construction phase:

- Ground Granulated Blast Furnace Slag (GGBS) & Pulverised Fuel Ash - Used as replacements for Portland cements to increase sustainability and carbon footprint of civil and structural works.
- Steel - The recovery rates associated with using recycled steel are high and research exists which shows that 99% of structural steel arising from demolition sites is recycled or re-used. The carbon emissions emitted during the production of virgin steel can be higher than some other structural materials on a tonne by tonne basis, and recycled steel should be used where possible.

As part of the Construction Environmental Management, the contractor is required to implement an Energy Management System for the duration of the works. This Energy Management system may include such measures as:

- The use of thermostatic controls on all space heating systems in site buildings to maintain optimum comfort at minimum energy use.
- The use of sensors on light fittings in all site buildings and low energy lighting systems.
- The use of adequately insulated temporary building structures for the construction compound fitted with suitable vents.
- The use of low energy equipment and ‘power saving’ functions on all PCs and monitors in the site offices.
- The use of low flow showers and tap fittings.
- The use of solar/thermal power to heat water for the on-site welfare facilities and contamination unit (sinks and showers).

8.5.4 Air Quality Mitigation During Operational Phase

The collection of EU Directives, known as the Auto Oil Programme, have outlined improved emission criteria which manufacturers are required to achieve from vehicles produced in the past and in future years. This is a trend, which has been in operation for many years and is destined to continue in future years for both cars and heavy-duty vehicles. The National Car Test (NCT) also helps to reduce transport emissions by ensuring that all vehicles on Irish roads over 4 years old undergo an emissions test and are suitably maintained.

No project specific mitigation measures have been identified but emissions of pollutants from road traffic can be controlled by either controlling the number of road users or by controlling the flow of traffic. For the majority of vehicle-generated pollutants, emissions rise as speed drops, although the opposite is true at very high speeds (i.e. speeds greater than 120 km/hr). Emissions also tend to be higher under stop-start conditions when compared with steady speed driving. The free flow of traffic on routes such as the N11 and the surround local roads will allow for the generation of lower concentrations of traffic related pollutants due to more steady speed driving. As outlined in the DMRB assessment, with the development operational, compliance with all the relevant limit values will be achieved at the nearest sensitive receptors. There is no proposed monitoring during the operation phase of the development.

8.5.5 Climate Mitigation During Operational Phase

Transport emissions, including greenhouse gases, from light and heavy-duty vehicles are continually being reduced through EU and national initiatives.

Currently, CO2 emissions from cars are regulated through EU legislation Regulation (EU) 2019/631 setting CO2 emission performance standards for new passenger cars and vans. It replaced and repealed the former Regulations (EC) 443/2009 (cars) and (EU) 510/2011. The Regulation sets EU fleet-wide CO2 emission targets applying from 2020, 2025 and 2030 and includes a mechanism to incentivise the uptake of zero- and low-emission vehicles. As the new target started applying in 2020, the average CO2 emissions from new

passenger cars registered in Europe have decreased by 12% (compared to the previous year (i.e. from 122.3 g CO2/km in 2019 to 107.8 g CO2/km in 2020) and the share of electric cars tripled.

The current legislation requires that new cars registered in the EU do not emit more than an average of 95 grams of CO2 per kilometre. The next binding target is for 2025 – 2030 period were a 15% percentage reduction from the 2021 starting points emission levels is required and a 37.5% reduction by 20304.

As such, transport mitigation of GHG emissions are primarily delivered by EU legislation to ensure an ongoing reduction in emissions per car. Other national initiatives to reduce emissions include fiscal measures to promote the use of electric vehicles and the biofuels obligation scheme.

8.6 Residual Impacts

8.6.1 Construction Phase

8.6.1.1 Dust Emissions

There are several residential/commercial properties located within 100 metres of the works particular along Berryfield Lane and Thornhill Road. These properties are likely to experience a 'temporary slight adverse' dust impact during construction in the absence of additional mitigation. With the specified additional mitigation, the potential impact of construction dust on these affected properties is a 'short-term, slight adverse' effect.

8.6.1.2 Greenhouse Gas Emissions

The construction phase of the potential development has the potential to generate a number of greenhouse gas emissions in the short term from embodied carbon in site materials, vehicles delivering this material to the construction site and site operations. The construction of the proposed development is considered to pose a 'permanent adverse' impact for climate.

8.6.1.3 Odour

The disturbance of the areas around the historic landfills may generate lateral or vertical pathways for the escape of landfill gas. There are a number of existing residential properties located to the south of the Landfill Site 2 where the proposed road alignment is planned. Similarly, the Enniskerry Football Club grounds are located adjacent (c. 500 metres southwest) to the area where the proposed road cuts through Landfill Site 3B. These properties are predicted to experience a 'temporary slight adverse' impact from landfill odours in the event that any landfill gas is released during the works. Other receptors in the area will likely experience negligible impacts.

8.6.2 Operational Phase

8.6.2.1 Road Traffic

The traffic-related air emissions may generate quantities of air pollutants such as nitrogen dioxide and particulate matter from any additional traffic associated with the residents of the proposed development. The site is accessed via Junction 6 off the N11 road then via the R918 or internals roads (Berryfield Lane, Thornhill Road). The changes presented for the development coupled with the proposed changes in traffic will result in local human and ecological receptors experiencing a 'negligible' air quality impact from road traffic.

[4] European Commission, CO_2 emission performance standards for cars and vans. Available at: https://ec.europa.eu/clima/eu-action/transport-emissions/road-transport-reducing-co2-emissions-vehicles/co2-emission-performance-standards-cars-and-vans_en (assessed Feb, 2022)

8.6.2.2 Greenhouse Gas Emissions

During the operational phase a scheme of this nature has the potential to generate greenhouse gases through increased vehicular traffic in the area as well as from the external lighting, space heating and energy use within the buildings.

These design measures are aligned with the Built Environment actions in the Climate Action Plan 2021, specifically the introduction of NZEB for new dwellings, the phasing out of fossil fuels as the heat source and the installation of heat pumps. In this regard, the built environment elements of the proposed development are fully aligned with climate policy.

In terms of climate adaption, the main potential risk to and from the development relates to fluvial flood risk from the rivers in the area. A flood risk assessment for the proposed development forms part of the SHD planning application and flood risk is also addressed in Chapter 7 - Water services, Hydrology and Flood Risk of this EIAR. In this regard, no specific climate adaption measures are proposed for the development outside of the SUDS drainage design.

8.6.2.3 Odour

The presence of the historic landfills on site acts as a potential source of odour as a result of trace gases such as H_2S. A Gas Management Strategy for manging this risk has been approved by Wicklow County Council and the EPA in 2019 through the Certificate of Approval consent process. This strategy includes for engineered barriers and vents to ensure the safe collection and venting of any gases. With these standard landfill design measures in place, the potential for fugitive losses of odour is significantly reduced. Any potential losses will be short term and temporary and will readily dilute and disperse with no significant impact for air quality for the area.

CHAPTER 9 – NOISE AND VIBRATION

Glossary

Term	Meaning
Background Noise Level	The A-weighted noise level exceeded for 90% of the measurement over a period of time, used to represent the sound level experienced in the absence of transient events.
Daytime	The daytime period is defined as 07:00 to 19:00 hrs
Decibel	A customary scale most commonly used (in various ways) for reporting levels of sound. The actual sound measurement is compared to a fixed reference level and the decibel value is defined to be 10 log10 (actual/reference), where (actual/reference) is a power or energy ratio. The standard reference for airborne sound is 20 micro-Pascals.
Evening	The evening time period is defined as 19:00 to 23:00 hrs
Night-time	The night-time period is defined as 23:00 to 07:00 hrs.
Noise Sensitive Receptor	Any location in which the inhabitants may be disturbed by noise from the Proposed Development. This includes a dwelling, house, hotel or hostel, health building (providing patient services), nursing/retirement home, educational establishment, place of worship or entertainment, or other facility which may justifiably require for its proper use the absence of noise at levels likely to cause significant impacts. – See **Table 9-8** regarding receptor sensitivity.
Vibration Sensitive Receptor	Any location in which the inhabitants may be disturbed by vibration from the Proposed Development. This includes a dwelling, house, hotel or hostel, or other locations which may justifiably require for its proper use the absence of vibration at levels likely to cause significant impacts. As technology advances, the number of facilities utilizing vibration sensitive equipment is continually increasing. Research laboratories, manufacturers of advanced technology devices such as semiconductors and hospitals all utilise processes and equipment that are sensitive to vibration. Wildlife refuges such as badger sets are also considered as vibration sensitive locations.

Acronyms

Term	Meaning
AADT	Average Annual Daily Traffic
CIA	Cumulative Impact Assessment
CRTN	Calculation of Road Traffic Noise
ProPG	Professional Practice Guidance on Planning & Noise
DMRB	Design Manual for Roads and Bridges
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
NML	Noise Monitoring Location
NSR	Noise Sensitive Receptor
PPV	Peak Particle Velocity
TII	Transport Infrastructure Ireland

Units

Unit	Description
dB	Decibel (unit used to measure the intensity of sound)
ha	Hectare (area)
Hz	Hertz
$L_{AMax,T}$	Is the maximum A-weighted sound level measured during a period of time (T)
$L_{AMin,T}$	Is the minimum A-weighted sound level measured during a period of time (T)
kph	Kilometres per hour (speed)
m/s	Metres per second (wind speed)
mm/s	Millimetres per second (vibration – peak particle velocity)
dB(A)	Noise measurements made with A-weighted scale; follows the frequency sensitivity of the human ear at low levels
$L_{A90,T}$	The A-weighted noise level exceeded for 90% of the measurement over a period of time (T). This is normally used to indicate background noise
$L_{Ar,T}$;	The Rated Noise Level, equal to the LAeq during a specified time interval (T), plus specified adjustments for tonal character and/or impulsiveness of the sound.
$L_{Aeq,T}$	The continuous equivalent A-weighted sound pressure level. This is an equivalent or '"average'" of the sound pressure level over a period of time (T)
$L_{A10,T}$	The noise level exceeded for 10% of the measurement over a period of time (T). This is normally used as a measure of road traffic noise

9 CHAPTER 9 – NOISE AND VIBRATION

9.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) identifies, describes and presents an assessment of the likely significant noise and vibration effects of the proposed Fassaroe Phase 1 strategic housing development. This involves the outward assessment of noise and vibration impacts on nearby noise sensitive locations during construction and operational phase of the proposed development. The inward impact on the proposed development is also considered.

The assessment presented is informed by the following EIAR chapters and Technical Appendices:

- Chapter 2: Description of Development;
- Chapter 12: Traffic and Transportation;
- Volume IV, Appendix 9A – 9C: Noise and Vibration Assessment – Supporting Information.

This noise and vibration assessment was completed by RPS (see Table 1.2, Chapter 1: Introduction for details on competent experts).

9.2 Methodology

The methodology adopted for this assessment is as follows:

- Review of appropriate guidance documents to identify suitable noise criteria;
- Characterisation of the receiving noise and vibration environment;
- Characterisation of the proposed development;
- Use prediction and measurement to determine the inward and outward impacts of the proposed development; and
- Specify mitigation measures where necessary.

9.2.1 Relevant Guidance and Legislation

The following reference documents have also been used/considered in the preparation of this chapter:

- BS4142:2014+A1:2019, Methods for rating and assessing industrial and commercial sound
- BS5228: 2009+A1:2014, Code of Practice of Noise and Vibration Control on Construction and Open Sites Part 1: Noise
- BS5228: 2009+A1:2014, Code of Practice of Noise and Vibration Control on Construction and Open Sites Part 2: Vibration
- BS8233:2014, Guidance on sound insulation and noise reduction for buildings
- Guidelines on the Information to be contained in Environmental Impact Assessment Reports, Environmental Protection Agency (2017)
- Design Manual for Roads and Bridges LA111 – Noise and Vibration Revision 2, UK Highways Agency (2020)
- ISO 1996-1:2016, Acoustics - Description, measurement and assessment of environmental noise - Part 1: Basic quantities and assessment procedures
- ISO 1996-2:2017, Acoustics - Description, measurement and assessment of environmental noise - Part 2: Determination of sound pressure levels
- ISO 9613-1:1993, Attenuation of sound during propagation outdoors - Part 1: Calculation of the absorption of sound by the atmosphere
- ISO 9613-2:1996, Attenuation of sound during propagation outdoors - Part 2: General method of calculation.
- ProPG: Planning & Noise Professional Practice Guidance on Planning & Noise

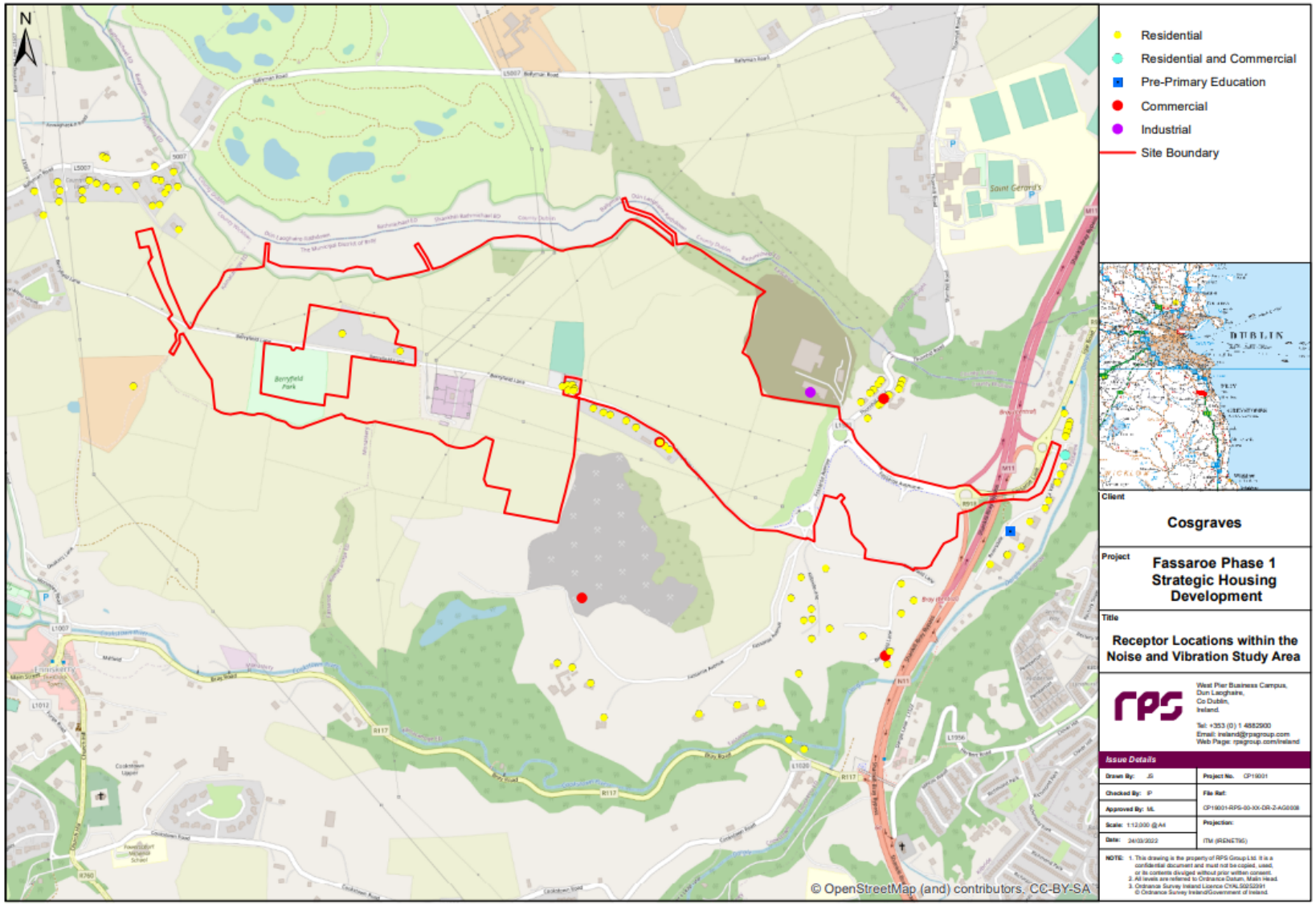
- Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes, Transport Infrastructure Ireland (2005)
- Guidelines for the Treatment of Noise and Vibration in National Road Schemes, Transport Infrastructure Ireland (2004)
- Wicklow County Council Development Plan 2016 – 2022

9.2.2 Study Area

The proposed application site forms part of a larger designated new development area identified as an "Action Area" under the Bray Municipal District Local Area Plan 2018 -2024 (LAP). The lands lie on the western side of Bray. The proposed development site extends to a large proportion of the northern half of the Action Area lands on the northern side of Berryfield Lane. The application site however also extends to the south of Berryfield Lane to provide active public open space, the main east-west link road and a small number of houses. The extent of the application site extends beyond the Action Area lands to the west to provide for the east west road connection to Ballyman Road and to the east to provide for a proposed pedestrian and cycle route (including bridge) connection across the N11 to Dargle Road. Further details on the site description are presented in Chapter 2: Description of Development.

The Noise and Vibration Study Area encompasses the site of the proposed development and the surrounding area within an approximate 500 m radius to include residential properties and commercial/industrial premises as shown in **Figure 9-1. Appendix 9A** presents the details on receptors. Note: the receptor identifiers (IDs) are not in sequential order.

Figure 9.1: Receptor Locations within the Noise and Vibration Study Area



9.2.3 Evaluation Criteria

This section outlines the evaluation criteria. Outward assessment of noise and vibration impacts on nearby noise sensitive locations during construction and operational phase of the proposed development are considered as well as the inward impact on the proposed development.

9.2.3.1 Construction Noise Criteria

There is no statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. In absence of specific noise limits, appropriate noise emission criteria relating to permissible construction noise levels for a development of this scale may be found in BS5228-1:2009+A1:2014 Code of Practice of Noise and Vibration Control on Construction and Open Sites Part 1: Noise.

The standard contains several methods for the assessment of the significance of noise effects. The ABC method outlined in section E3.2 has been used for the purposes of controlling noise. The approach adopted calls for the designation of a noise sensitive receptor into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded at this location, indicates a potential significant noise impact is associated with the construction activities. These thresholds apply to residential buildings.

Table 9.1**Table 9.1** outlines the applicable noise threshold of potential significant effect (TPSE) at the nearest noise sensitive locations. The determination of what category to apply is dependent on the existing ambient (L_{Aeq}) noise level (rounded to the nearest 5 dB) at the nearest noise sensitive property. For weekday daytime, if the ambient noise level is less than the Category A threshold limit, the Category A threshold limit (i.e. 65 dB) applies. If the ambient noise level is the same as the Category A threshold limit, the Category B threshold limit (i.e. 70 dB) applies. If the ambient noise level is more than the Category A threshold limit, the Category C threshold limit (i.e. 75 dB) applies.

Table 9.1: Threshold of Potential Significant Effect at Nearest Sensitive Receptors

Assessment Category and Threshold Value Period (L_{Aeq})	Noise Threshold Value, in decibels (dB)		
	Category A[A]	Category B[B]	Category C[C]
Night-time (23.00 – 07.00)	45	50	55
Evenings and weekends[D]	55	60	65
Daytime (07.00 – 19.00) and Saturdays (07.00 – 13.00)	65	70	75

NOTE 1 A potential significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.

NOTE 2 If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise.

NOTE 3 Applied to residential receptors only.

A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.

C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

D) 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

9.2.3.2 Construction Traffic Noise Criteria

There is currently no legislation that limits environmental noise levels from traffic to a limit value. Hence the impact of off-site traffic associated with construction phase of the development has been assessed with respect to the Highways Agency in the UK who published the Design Manual for Roads and Bridges LA111 – Noise and Vibration Revision 2, UK Highways Agency (2020). This document presents details on the classification of magnitude of noise impacts and noise level changes and associated magnitude of impact are presented in **Table 9.2**.

Table 9.2: Noise Level - Magnitude of Impact (Highway Agency, UK)

Magnitude of Impact	Increase in Baseline Noise Level of Closest Public Road Used for Construction Traffic
Major	Greater than or equal to 5.0
Moderate	Greater than or equal to 3.0 and less than 5.0
Minor	Greater than or equal to 1.0 and less than 3.0
Negligible	Less than 1.0

9.2.3.3 Construction Phase – Vibration Criteria

There is no statutory Irish guidance relating to the maximum permissible vibration level that may be generated during the construction phase of a project. In absence of specific vibration limits, appropriate vibration emission criteria relating to permissible construction vibration levels for a development of this scale may be found in BS5228-2:2009+A1:2014 Code of Practice of Noise and Vibration Control on Construction and Open Sites Part 2: Vibration.

Human beings are known to be very sensitive to vibration, the threshold of perception being typically in the Peak Particle Velocity (PPV) range of 0.14 mm/s to 0.3 mm/s. Vibrations above these values can disturb, startle, cause annoyance or interfere with work activities. At higher levels they can be described as unpleasant or even painful. In residential accommodation, vibrations can promote concerns about possible structural damage. Guidance of effects of vibration levels are illustrated in **Table 9.3** below.

Table 9.3: Guidance on Human Perception of Vibration Levels

Vibration Level	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mm/s	Vibration might be just perceptible in residential environments.
1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

Limits of transient vibration, above which cosmetic damage to property could occur, are given numerically in **Table 9.4** (Ref: BS5228-2:2009+A1:2014). Minor damage is possible at vibration magnitudes which are greater than twice those given in **Table 9.4** and major damage to a building structure can occur at values greater than four times the tabulated values.

Table 9.4: Transient Vibration Guide Values for Cosmetic Damage

Type of Building	Peak Particle Velocity (PPV) (mm/s) in Frequency Range of Predominant Pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures. Industrial and heavy commercial buildings.	50 mm/s at 4 Hz and above	50 mm/s at 4 Hz and above
Unreinforced or light framed structures. Residential or light commercial buildings.	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above.

9.2.3.4 Operational Phase – Noise Criteria – Outward Impacts

Once the development has been constructed, the main noise impact will arise from additional traffic on existing roads in the vicinity of the proposed development and the new road (Berryfield Avenue) linking Ballyman Road to the N11.

The TII Guidelines for the Treatment of Noise and Vibration in National Road Schemes is the recognised Irish guidance for the assessment of road traffic noise. It is primarily concerned with setting out the design criteria in relation to noise from the construction and operation of national road schemes in Ireland. However, the increase in traffic on local roads because of the proposed development and the new road proposed as local road linking Ballyman Road and the N11/M11 does not fall under the remit of TII guidelines. In absence of specific noise limit values from traffic, the traffic noise impact is assessed with respect to the Design Manual for Roads and Bridges LA111 – Noise and Vibration Revision 2, UK Highways Agency (2020). This document presents details on the classification of magnitude of noise impacts in the short term (e.g., when the project is opened) and long term (typically 15 years after project opening). A change in road traffic noise of 1 dB in the short term is the minimum that is considered perceptible. In the long term, a 3 dB change is considered perceptible. The significance that can be attached to changes in noise level (perceptible to human beings) applicable to traffic noise is shown in **Table 9.5**. However, the changes are subjective and will vary among individuals.

Table 9.5: Traffic Noise Level - Magnitude of Change

Magnitude of Change	Noise Change - $L_{A10,18hr}$ or L_{night}	
	Short Term	Long Term
Negligible	Less than 1.0	Less than 3.0
Minor	1.0 to 2.9	3.0 to 4.9
Moderate	3.0 to 4.9	5.0 to 9.9
Major	Greater than or equal to 5.0	Greater than or equal to 10.0

9.2.3.5 Operational Phase – Noise Criteria – Inward Impacts

The inward assessment examines the noise impact on the proposed residential scheme. The criteria here examines the inward impacts once the construction phase has been completed. The proposed residential scheme spans an area of 78.5 ha with areas of the development in proximity to N11/M11, Fassaroe substation and EPA licensed facilities in Roadstone Quarry and Starrus Eco Waste Transfer Facility.

Wicklow County Council Development Plan 2016 – 2022

Wicklow County Councill Development Plan 2016 – 2022 outlines several objectives in relation to noise. Chapter 9 – Infrastructure outlines several criteria. The requirement to plan for noise is highlighted by National Roads Objective TR22 which states…

> *"To ensure that all new developments in proximity to National Routes provide suitable protection against traffic noise in compliance with S.I No. 140 of 2006 Environmental Noise Regulations and any subsequent amendments to these regulations."*

In Section 9.3 Waste and Environmental Emissions, four noise pollution objectives (WE12, WE13, WE14 and WE15) have been set and include:

- ***WE12 -*** *To enforce, where applicable, the provisions of the Environmental Protection Agency (EPA) Acts 1992 and 2003, and EPA Noise Regulations 2006.*
- ***WE13*** *- To regulate and control activities likely to give rise to excessive noise (other than those activities which are regulation by the EPA).*
- ***WE14 -*** *To require proposals for new developments with the potential to create excessive noise to prepare a construction and/or operation management plans to control such emissions.*
- ***WE15*** *- To require activities likely to give rise to excessive noise to install noise mitigation measures to undertake noise monitoring and to provide an annual monitoring audit.*

In addition to the Wicklow County Council County Development Plan 2016-2022, the Bray Municipal District (including the settlements of Bray, Enniskerry and Kilmacanogue has adopted a Local Area Plan which is fundamentally similar to the County Development Plan in terms of objective in relation to noise in the planning context.

EPA Licensed Facilities

There are two EPA Licensed facilities in proximity to sections of the proposed residential development. Starrus Eco and Roadstone Quarry are operated under EPA waste licence W0053-03 and license W0269-01, respectively. Condition 4 of their licences state… *"Noise from the facility shall not give rise to sound pressure levels (Leq,T) measured at the boundary of the facility which exceed the limit value(s)."* Schedule B.4 Noise Emissions provides details on applicable limits and these are reproduced in **Table 9.6**.

Table 9.6: Noise Emission Criteria Extracted from EPA Licence W0053-03 and W0269-01

Daytime dB(A) L_{Aeq} (30 minutes)	Night-time dB(A) L_{Aeq} (30 minutes)
55 Note 1	45 Note 1
Note 1: There shall be no clearly audible tonal component or impulsive component in the noise emission from the activity at any noise sensitive location.	

The two EPA Licensed facilities are pre-existing and therefore, the noise impact for the residential dwellings forming part of the proposed development are assessed against the BS 8223:2014 noise guideline values (discussed in greater detail later in this section).

ProPG Assessment and BS 8223:2014

The Professional Practice Guidance on Planning & Noise (ProPG) was developed by a Working Group consisting of representatives of the Association of Noise Consultants (ANC), Institute of Acoustics (IOA) and Chartered Institute of Environmental Health (CIEH) in the UK. It does not constitute an official government code of practice and does not have a statutory basis in Ireland or the UK. ProPG is however based on the best professional knowledge available at the time of publication.

The primary goal of ProPG is to encourage better acoustic design for new residential development and aims to protect people from the harmful effects of noise. The scope of this ProPG is restricted to the consideration of new residential development that will be exposed predominantly to airborne noise from transport sources. Where industrial or commercial noise is present on the site, and considered to be dominant, ProPG recommends that… *"regard should be had to the guidance in BS4142:2014".*

If a ProPG type assessment is deemed appropriate, the two sequential stages of the overall approach are:

- Stage 1 – an initial noise risk assessment of the proposed development site; and
- Stage 2 – a systematic consideration of four key elements.

The four key elements to be undertaken in parallel during Stage 2 of the recommended approach are:

- Element 1 – demonstrating a "Good Acoustic Design Process";
- Element 2 – observing internal "Noise Level Guidelines";
- Element 3 – undertaking an "External Amenity Area Noise Assessment"; and
- Element 4 – consideration of "Other Relevant Issues".

Element 2 seeks to achieve recommended noise levels inside noise sensitive rooms in new residential development. Suitable guidance on internal noise levels can be found in BS8233:2014: Guidance on sound insulation and noise reduction for buildings. **Table 9.7** presents the BS8233 and ProPG internal noise level guidelines for dwellings. The guideline values apply to noise without a specific character such as tonal or impulsive noise.

Table 9.7: BS 8233 and ProPG Internal Noise Level Guidelines

Activity	Location	07:00 – 23:00 hrs	23:00 – 07:00 hrs
Resting	Living Room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$ 45 dB $L_{AMax,F}$ *

* Included in ProPG

The third element of Stage 2 is a noise assessment of external amenity areas. The term "assessment" is deliberately used because this element concerns more than just the level of noise outside. Again reference is made to criteria in BS8233:2014 which states that… *"the acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB $L_{Aeq,16hr}$".* The standard continues… *"These guideline values may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels in these external amenity spaces but should not be prohibited."*

BS8233:2014 states only noise without tonal character has been considered. In absence of appropriate criteria in BS 8233:2014, reference is made to the BS4142:2019+A1:2014 Methods for rating and assessing industrial and commercial sound.

Fassaroe 110 kV Substation is in proximity to the sections of the proposed development. There are no conditioned noise limits and there is potential for tonal noise to be audible at the nearest noise sensitive locations and a BS 4142 type assessment is undertaken on the proposed dwellings closest to the substation.

BS4142:2014+A1:2019 Assessment

British Standard BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound provides a method of assessing the impact of a source of industrial or commercial sound. BS 4142 uses a 'rating level', which is based on a comparison between the sound which is being assessed and the background sound which would exist without it. The rating level is then modified by any corrections for the character of the sound, be that tonal, impulsive, or intermittent.

BS 4142 states… *"The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound levels and the context in which the sound occurs."* BS 4142 goes on to state…

- *Typically, the greater the difference between the specific sound and background sound level, the greater the magnitude of the impact.*
- *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
- *A difference of around +5 dB is likely to be an indication of an adverse impact depending on the context.*
- *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this an indication of the specific sound having a low impact, depending on the context.*

9.2.3.6 Noise and Vibration Impact Assessment Criteria

In keeping with the typical scope of an EIA, the emphasis of this noise and vibration chapter is on the assessment of the potential effects of the proposed development upon the surrounding environment and the potential effect of the surrounding environment on the proposed residential units.

The following terminology and definitions are defined:

- Noise Impact - The difference in the acoustic environment before and after the implementation of the proposals (also known as the magnitude of change). This includes any change in noise level and in other characteristics/features, and the relationship of the resulting noise level to any standard benchmarks;
- Noise Effect - The consequence of the noise impact. This may be in the form of a change in the annoyance caused, a change in the degree of intrusion or disturbance caused by the acoustic environment, or the potential for the change to alter the character of an area such that there is a perceived change in quality of life. This will be dependent on the receptor and its sensitivity; and
- Significance of Effect -The evaluation of the noise effect and, particularly if the noise impact assessment is part of a formal EIA, deciding whether or not that impact is significant.

General Significance Criteria

The general significance criteria in the EPA Guidelines (2017) have been used for determining the level of impact associated with the proposed development. Different aspects of noise from the proposed development (e.g., construction, traffic, etc.) are assessed using the different methodologies as described in the relevant guidance documents. Where feasible, the significance criteria have been used in the various assessments included in this chapter having regard to the sensitivity of receptors.

Criteria to Define the Sensitivity of Receptors

There is currently no statutory guidance document on the sensitivity of receptors in Ireland. Sensitive receptors, in the context of noise and vibration, are typically residential premises but can also include schools, places of worship and other noise sensitive locations. Site and project specific considerations play a part in determining the sensitivity of a receptor.

The sensitivity of receptors to noise and vibration commonly used for noise impact assessments in Ireland is defined in **Table 9.8**.

Table 9.8: Criteria to Define Receptor Sensitivity

Sensitivity	Description	Examples of Receptors
High	Receptors where people or operations are particularly susceptible to noise	Residential, including private gardens where appropriate Hospitals/residential care homes Schools during the daytime Quiet outdoor areas used for recreation Places of worship
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance	Offices Bars/Cafes/Restaurants where external noise may be intrusive Community facilities and amenity areas Sports grounds when spectator noise is not a normal part of the event and where quiet conditions are necessary (e.g. ,tennis, fishing and golf) Wildlife refuges Recording studios and concert halls are also included in this category
Low	Receptors where distraction or disturbance from noise is low	Buildings not occupied during the daytime Sports grounds when spectator noise is a normal part of the event Night Clubs
Negligible	Receptors where distraction or disturbance from noise is negligible.	All other areas such as those used primarily for industrial or agricultural purposes.

The majority of receptors which have the potential to be affected by noise and vibration impacts arising from the proposed development are the residents of dwellings in the vicinity of the proposed development. Residents, due to the nature and use of residential receptors are deemed to have 'High' sensitivity. Commercial developments such as offices (including those co-located with warehouses) are considered 'Medium' sensitivity during daytime periods with the sensitivity reducing to 'Low' during evening for commercial developments. At night-time periods both community facilities and commercial developments are considered low sensitivity as the have reduced occupancy or are unoccupied.

Receptors with lower sensitivity to noise include commercial and industrial developments.

Magnitude of Impact / Level of Significance

Construction Noise

Section 9.2.3.1 outlined that the 'ABC' method in BS5228 is used to determine the construction noise impact. Using the baseline noise measurement data, it was determined that the appropriate construction noise threshold value for determining the potential significant effects for residential receptors in the vicinity of the proposed development is Category A (i.e. 65 dB L_{Aeq} during daytime periods). For assessing the significance of effect, reference is made to the EPA Guidelines (2017) and the DMRB which states…

> *Construction noise and construction traffic noise shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:*
>
> *1) 10 or more days or nights in any 15 consecutive days or nights;*
>
> *2) A total number of days exceeding 40 in any 6 consecutive months.*

Table 9.9 presents the construction noise significance rating.

Table 9.9: Construction Noise – Significance of the Impact

Noise Levels	DMRB Magnitude	EPA Magnitude of Impact	Significance Rating	Determination
≤ Baseline noise level	Negligible	Negligible	Imperceptible / Not Significant	Depends on BS 5228 threshold value, baseline noise levels, duration and frequency.
> Baseline noise level and ≤ BS 5228 threshold	Minor	Low	Slight/ Moderate	
> BS 5228 threshold to ≤BS 5228 threshold + 5 dB	Moderate	Medium	Moderate/ Significant	
> BS 5228 threshold +5 to + 10 dB	Major	High	Significant/ Very Significant	
> BS 5228 threshold + 10 dB			Very Significant / Profound	

Construction Traffic Noise

Section 9.2.3.2 outlined the DMRB magnitude of impact criteria used to determine the construction traffic noise impact. For assessing the significance of effect, reference is made to the EPA Guidelines (2017) and the DMRB with the same criteria used for construction noise and construction traffic noise. **Table 9.10** presents the construction traffic noise significance rating.

Table 9.10: Construction Noise – Significance of the Impact

Noise Level Increase	DMRB Magnitude	EPA Magnitude of Impact	Significance Rating	Determination
Less than 1.0	Negligible	Negligible	Impercetible/ Not Significant	Depends on baseline noise levels, duration, and frequency.
1.0 to 2.9	Minor	Low	Slight/ Moderate	
3.0 to 4.9	Moderate	Medium	Moderate/ Significant	
Greater than or equal to 5.0	Major	High	Significant/ Very Significant	
			Very Significant / Profound	

Construction Vibration

Section 9.2.3.3 outlined guidance on effects of vibration levels on humans and limits of transient vibration, above which cosmetic damage could occur. For assessing the significance of effect, reference is made to the EPA Guidelines (2017) and the DMRB which states…

> *Construction vibration shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:*
>
> *1) 10 or more days or nights in any 15 consecutive days or nights;*
>
> *2) a total number of days exceeding 40 in any 6 consecutive months.*

Table 9.11 presents the construction vibration significance rating.

Table 9.11: Construction Vibration – Significance of the Impact

Vibration Level	DMRB Magnitude	EPA Magnitude of Impact	Significance Rating	Determination
Less than 0.3 mm/s	Negligible	Negligible	Impercetible/ Not Significant	Depends on duration, occurrence, and frequency.
Greater than or equal to 0.3 mm/s and less than 1.0 mm/s	Minor	Low	Slight/ Moderate	
Greater than or equal to 1.0 mm/s and less than 10 mm/s	Moderate	Medium	Moderate/ Significant	
Greater than or equal to 10 mm/s	Major	High	Very Significant / Profound	

9.2.3.7 Operational Noise

As outlined in Section 9.2.3.5, BS 8233:2014 provides guideline values for internal noise levels within residential dwellings. The noise level criteria, associated magnitude of impact and significance rating is summarised in **Table 9.12**.

Table 9.12: Operational Noise Levels: Magnitude of Impact

Magnitude of Impact	Guideline Levels (Bedroom)	Guideline Levels (Daytime Resting)	Significance Rating	Determination
Negligible	< 30 dB	< 35 dB	Imperceptible	Depends on the baseline noise levels, duration, and frequency.
Low	30-35 dB	35-40 dB	Not Significant	
			Slight	
Low/Medium	35-40 dB	40-45 dB	Slight	
			Moderate	
Medium	40-45 dB	45-50 dB	Significant	
			Very Significant	
High	>45 dB	>50 dB	Profound	

9.3 Receiving Environment

The site is located on the western side of Bray. The overall Fassaroe Masterplan development area covers approximately 156 hectares to the west of the existing built-up area of Bray, and to the northeast of Enniskerry. The Fassaroe lands are bounded by the N11 to the east, Ballyman Glen and the County Brook Stream to the north, the Cookstown River to the south and by agricultural land to the west. The existing edge of the built-up area of Bray environs is located immediately to the east of the N11. Powerscourt Demesne is located c. 2km to the southwest. Dun Laoghaire Golf Club is located on elevated lands to the northwest of the site, accessed from Ballyman Road.

The surrounding noise environment comprises of traffic noise from the N11 national road, Berryfield Lane and Ballyman Road, Starrus Eco Waste Transfer Facility, Roadstone Quarry and Fassaroe 110 kV substation.

There are a small number of dwellings in the vicinity of the proposed development. These consist of one of dwellings along Berryfield Lane and Kilbride Lane with larger built-up areas at Monastery Grove and off Ballyman Road.

9.4 Baseline Noise Survey

The baseline noise survey provides quantification and an understanding of the acoustic environment adjacent to and in proximity to the Proposed Development. The purpose of the noise monitoring surveys was to:

- Determine the background and ambient noise levels at the nearest NSRs to the Proposed Development site;
- Evaluate the noise climate in the Noise and Vibration Study Area;
- Define the applicable construction noise threshold in accordance with British Standard BS5228-1, *Code of Practice of Noise Control on Construction and Open sites*;
- Determine $L_{Aeq,16hr}$ daytime and $L_{Aeq,8hr}$ night-time noise levels for assessment against ProPG and BS 8223:2014 noise criteria.

9.4.1 Baseline Noise Survey - Overview

A baseline noise survey was undertaken at 4 no. of monitoring locations. Unattended measurements were undertaken on the 9th – 11th November 2021. Additional attended spot measurements were undertaken on 3rd March 2022 at 6 no. of locations. All measurements were undertaken in accordance with ISO 1996 Acoustics – Description and Measurement of Environmental Noise, Part 1 (ISO 1996-1:2016) and Part 2 (ISO 1996-2:2017).

9.4.1.1 Monitoring Locations – Baseline Noise Survey

Four noise monitoring locations were identified for obtaining representative ambient and background noise levels near the proposed residential development. Details of the noise monitoring locations are provided in **Table 9.13** and locations are shown in **Figure 9.2**.

Table 9.13: Noise Monitoring Location Details

Monitoring Location	ITM Co-ordinates		Location	Photographs
	Easting	Northing		
NML1	724367	717986	Located on a parcel of land to east of the proposed development and to the south of dwelling on the Thornhill Road. The monitoring location is approximately 35m from the façade of the neighbouring dwelling. The monitoring location is approximately 360m from the N11 and approximately 45m from a roundabout on the R918 regional road used to access from the proposed development to the N11 national road. The monitoring location is also approximately 100m from the entrance to the Starrus Eco Waste Transfer Facility (WTF).	Plate 9.1
NML2	724080	718092	Located in a field to the southwest of WTF. The monitoring location is approximately 20m from the WTF boundary and this monitoring location is representative of the noise experienced by some of the nearest dwellings/apartments proposed.	Plate 9.2
NML3	723654	718085	Located in the rear garden of dwelling on the northern side of Berryfield Lane. The noise monitor is located approximately 4m from the façade. The dwelling is approximately 310m west of Fassaroe substation and approximately 150m north of Roadstone Fassaroe quarry site boundary.	Plate 9.3
NML4	722489	718572	Located on a parcel to rear of dwellings off the Ballyman Road and adjacent to the proposed western site access road. The monitoring location is approximately 50m east from the façade of the nearest dwelling.	

Plate 9.1: Noise Monitoring Location NML1

Plate 9.2: Noise Monitoring Location NML2

Plate 9.3: Noise Monitoring Location NML3

Plate 9.4: Noise Monitoring Location NML4

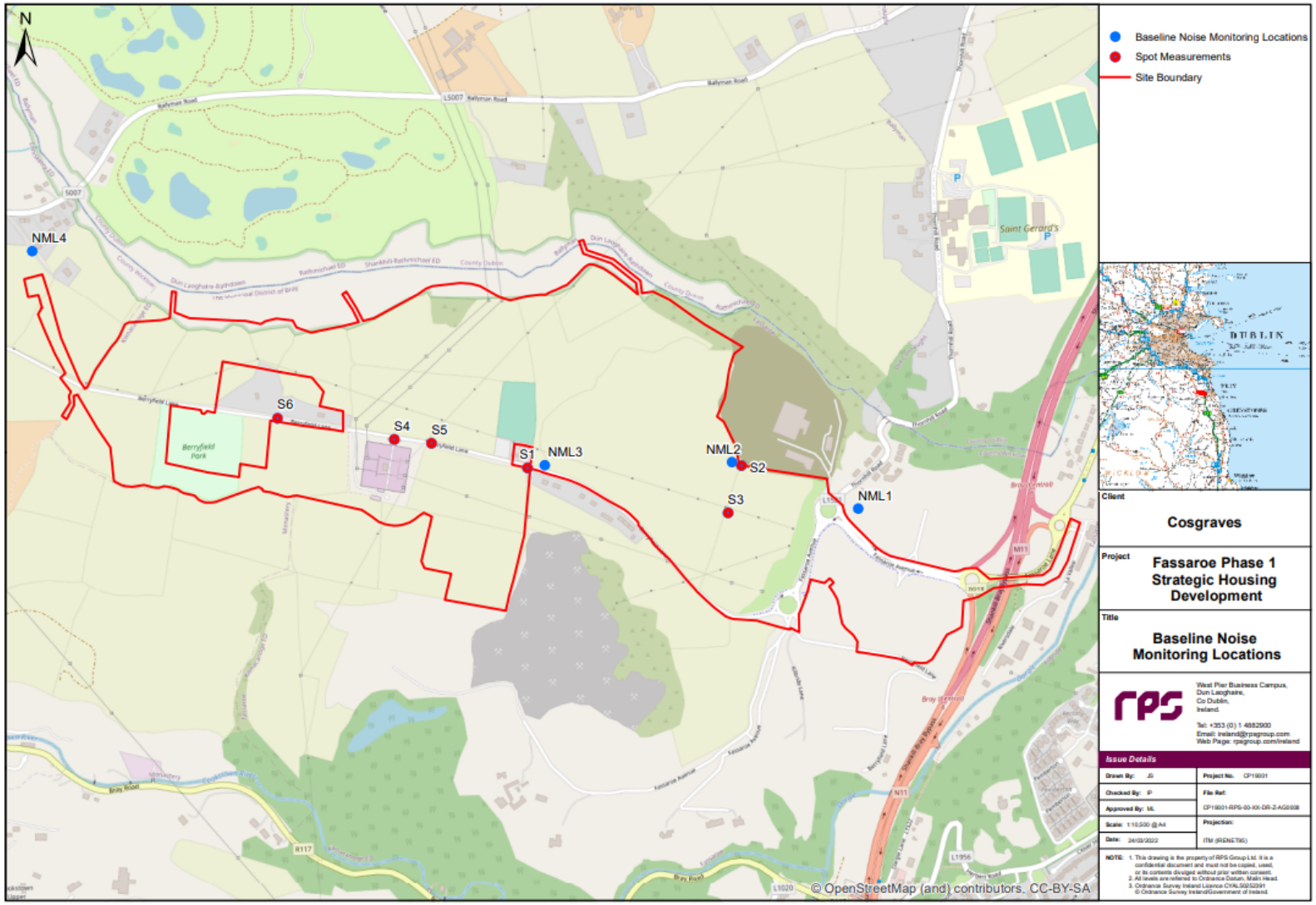
9.4.1.2 Monitoring Locations – Spot Measurements

Spot measurements were undertaken at 6 no. of locations to supplement the baseline measurements. Details of the noise monitoring locations are provided in **Table 9.14** and locations are shown in **Figure 9.2**.

Table 9.14: Spot Measurements - Noise Monitoring Location Details

Monitoring Location	ITM Co-ordinates		Location
	Easting	Northing	
S1	723615	718079	Located along Berryfield Lane in proximity to NSRs R27, R33 and R148. The purpose of this measurement was to determine if the noise from Roadstone Quarry was audible at this location.
S2	724101	718084	Located in a field to the south of Starrus Eco Waste Transfer Facility. The monitoring location is approximately 10m from the Starrus Eco Waste Transfer Facility (WTF) boundary. The purpose of this measurement was to quantify the total noise from WTF and traffic noise from the N11 national road.
S3	724071	717976	Located in a field to the south of Starrus Eco Waste Transfer Facility. The monitoring location is approximately 110m from the Starrus Eco Waste Transfer Facility (WTF) boundary. The purpose of this measurement was to quantify the traffic noise from the N11 national road.
S4	723313	718144	Located along Berryfield Lane at entrance to Fassaroe ESB Substation.
S5	723397	718135	Located along Berryfield Lane approximately 15m from the northeast corner of Fassaroe ESB Substation.
S6	723047	718192	Located along Berryfield Lane at entrance to NSR R102. The location is approximately 170m from the northwest corner of Fassaroe ESB Substation.

Figure 9.2: Baseline Noise Monitoring Locations



9.4.1.3 Monitoring Equipment and Procedure

The unattended noise measurements were undertaken using Bruel & Kjaer (B&K) 2250 Class 1 Sound Level Meters with associated outdoor microphone kit B&K UA-1404. The microphones were mounted at a height of 1.5m above ground level. Similarly, the attended measurements were undertaken using a Bruel & Kjaer (B&K) 2250 Class 1 Sound Level Meter with a UA-0237 Type wind shield. The meter was mounted on a tripod at a height of 1.5m. All measurements were free-field measurements positioned at least 3.5m from any reflecting façade. The sound level meters were calibrated before and after the survey using a B&K 4132 Class 1 Acoustic Calibrator and the drift in calibration was within acceptable range (as per criterion in BS 4142:2014+A1:2019). Laboratory calibration certificates for the sound level meters are included in Volume IV, Appendix 9B.

The following parameters were recorded during each monitoring period:

- **L_{Aeq}** The continuous equivalent A-weighted sound pressure level. This is an 'average' of the sound pressure level.
- **L_{Amax}** This is the maximum A-weighed sound level measured during the sample period.
- **L_{Amin}** This is the minimum A-weighted sound level measured during the sample period.
- **L_{A10}** This is the A-weighted sound level that is exceeded for noise for 10% of the sample period.
- **L_{A90}** This is the A-weighted sound level that is exceeded for 90% of the sample period.

The 'A' suffix for the noise parameters denotes the fact that the sound levels have been 'A-weighted' in order to account for the non-linear nature of human hearing. All sound levels in this report are expressed in terms of decibels (dB) relative to $2x10^{-5}$ Pa.

For the baseline noise survey a weather station was also deployed at monitoring location N2 which recorded wind speed, wind direction and rainfall in 15-minute measurements, for the same periods as the noise measurements. An NRG Symphonie Datalogger with NRG 40C Anemometer, NRG 200P Wind Vane wind vane and a rain gauge was employed during the unattended noise survey. A Photograph showing the meteorological weather station in situ at monitoring location N2 is presented in **Plate 9-2**.

9.4.2 Baseline Noise Survey – Results

9.4.2.1 Meteorological Conditions

The weather during the baseline survey was dry with temperatures range from 3.7 – 13.6 ^{O}C. The average wind speed ranged from 0.3 – 4.5 m/s with winds from a west north-westerly direction.

The weather during the spot measurements was dry with temperatures ranging from 5 – 8 ^{O}C. The average wind speed was less than 2 m/s and winds from a north-easterly direction.

9.4.2.2 Baseline Noise Results

The L_{Aeq} and L_{A90} noise data at each monitoring location is presented in Appendix 9C. The baseline noise data recorded at each monitoring location was analysed as follows:

- Data was divided into two data sets: daytime (07:00 – 23:00 hrs) and night-time (23:00- 07:00 hrs);
- No rainfall was recorded during the survey. (Best practice requires that measurements taken during rainfall be removed from each data set;
- Wind speeds were below 5 m/s during the survey. (Best practice requires that measurements taken during wind speeds greater than or equal to 5 m/s are removed from each data set; and
- Periods of measured noise data affected by extraneous irregular noise events were identified and removed. The period 03:30 to 05:15 hrs at location NML1 was omitted as the variation in noise level did not follow the diurnal trend.

Table 9.15 presents a summary of noise monitoring results.

Table 9.15: Noise Monitoring Results - $L_{Aeq,16hr}$ Daytime and $L_{Aeq,8hr}$ Night-time.

Noise Monitoring Location	Daytime $L_{Aeq,16hr}$	Night-time $L_{Aeq,8hr}$
NML 1	40 - 47	44 – 45*
NML 2	48 - 54	43 – 48
NML 3	46 - 49	41
NML 4	39 - 48	37 - 38
* Data for the period 03:30 to 05:15 hrs at location NML1 was removed		

These noise levels have been used to determine the current noise levels experienced at locations representative of the most exposed dwellings to noise sources within the proposed development as well as existing noise sources.

The ABC method outlined in section E3.2 of BS5228-1:2009+A1:2014 has been used for the assessment of construction noise. The measured ambient (L_{Aeq}) noise levels have been used determine the threshold of potential significant effect in keeping with the requirement set out in BS 5228. In all cases the daytime noise levels indicate that the appropriate category for determining the potential significant effects is Category A (i.e. 65 dB L_{Aeq} during daytime periods) for residential receptors.

The spot measurement results are discussed in detail when the inward impacts are considered in **Section 9.5.3**.

9.5 Potential Impacts

9.5.1 'Do Nothing' scenario

Annex IV of the EIA Directive sets out the information required to be included in an EIAR. This includes:

> "a description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without implementation of the project as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge".

In the event that the proposed development does not go forward, an assessment of the future baseline conditions has been carried out.

In the absence of the proposed development, no significant change to the future baseline scenario is anticipated other than that which may occur due to other developments and may include replacement/ additional equipment at the Fassaroe 110 kV substation and a negligible increase in road traffic noise due to population growth.

9.5.2 Construction Phase – Outward Impacts

The development is proposed to be implemented across several construction phases. The main works to be carried out include:

- Site development works
- Establishment of construction compound(s)
- Road Works
- Landfill remediation
- Overhead line rerouting
- Construction of residential and commercial buildings
- Landscape works
- Construction of pedestrian bridge

The construction phases of the proposed development will result in the creation of a large construction site which may have a potential negative impact on the immediate local environment and the amenity of existing residents within the Fassaroe area.

Construction noise predictions have been undertaken for the proposed construction activities at all noise sensitive receptors in the noise and vibration study Area using a three-dimensional noise model using Predictor LimA, Version 2021.1 noise modelling software. The method for calculating outdoor noise attenuation used by the Predictor LimA software is based on the international standards ISO 9613-2:1996 – Attenuation of sound during propagation outdoors - Part 2: General method of calculation. **Table 9.16** provides a summary of the construction noise model inputs.

Table 9.16: Summary of Operational Model Inputs

Item	Input
Noise Source	BS 5228-1:2009+A1:2014 Code of Practice of Noise and Vibration Control on Construction and Open Sites Part 1: Noise.
	Traffic flows (as outlined in Chapter 12: Traffic and Transportation)
Noise Receptor	Noise receptor locations (see Figure 9.2)
	Receiver Heights of 1.5 m and 4 m except for apartments blocks where 6.5 m, 9 m and 10.5 m were also assessed.
Model Parameters	Relative Humidity 70% (ISO 9613)
	Temperature 10°C (ISO 9613)
	Ground absorption 0 for acoustically hard surfaces and 0.5 for all other acoustically soft surfaces.
	1 m contour data
	ISO 9613-2 downwind propagation noise model

Construction plant is assumed to be operational at closest point to receptors. Predictions are based on the construction plant operating simultaneously. The duty cycle plant or number of loads is outlined depending on the item of plant. The predicted construction noise levels have been compared to the derived threshold noise values using the ABC Method from British Standard BS5228 as set out in **Table 9.2**.

Section 9.2.3.6 sets out the sensitivity of the receptor, the predicted impact in dB(A) and the magnitude of the construction phase noise effect. The significance of the impact is then quantified according to the scale in **Table 9.9**.

9.5.2.1 Site Development Works and Establishment of Site Compounds

Construction of the proposed development will require considerable amounts of cut and fill across the site. This is to achieve suitable site development levels on a site with variations in height. The proposed east-west road through the site will require significant amounts of cut while the landfill remediation capping works will require significant amounts of fill / cover.

A contractor's site compound will be established at the site and the working area fenced off to provide a secure site. Due to the scale of development and the phased approach to development the location of the compound(s) will vary depending on the phasing of the works and the location of the different elements associated with the overall scheme (road, commercial buildings, house building, and retail development). Outside of the main construction compound locations, there may be several smaller local work compounds throughout the site which may be used by the contractor for staff welfare facilities, to store materials for short term use and for plant to park overnight. **Table 9.17** includes a list of the most significant plant/equipment likely to be used during the site development works and establishment of site compounds.

Table 9.17: Typical Construction Plant for Site Development Works and Establishment of Site Compounds

Activity	Plant	Reference from Annex C & D BS5228	Sound Power Level dB(A)	Duty Cycle / Number of Loads
Site Development Works	Tracked excavator	C.4.63	105	75%
	Road lorry (full)*	C.6.21	109	4.5 loads per hour
	Dozer *	C2.1	103	50
Site Compound Setup	Tracked excavator	C.2.5	104	50
	Road lorry (full)*	C.6.21	109	4.5 loads per hour
	Dump truck (tipping fill)	C2.30	107	10
	Dozer	C.5.12	105	50
	Vibratory roller	C.5.28	104	50
	Lorry with lifting boom	C.4.53	105	50

The predicted noise levels at the nearest dwellings to the site development works and establishment of site compound are presented in **Table 9.18**. The predicted noise levels are below the daytime noise limit of 65 dB L_{Aeq} at the nearest noise sensitive location. The site development works will have a not significant/ slight effect at the closest receptors, and this reduces to not significant at more distant locations. The effect of the site compound setup is not significant at the nearest receptors.

Table 9.18: Predicted Noise Levels at Nearest NSRs for Site Development Works and Establishment of Site Compounds

Receptor ID	Predicted L_{Aeq} Noise Levels for	
	Site Development Works	Establishment of Site Compounds
R33	64	
R148	62	
R187	50	
R158		50
R81		49
R124		48

9.5.2.2 Road Works and Landfill Remediation Works

Commence construction of the proposed new main access road from the eastern side of the site to western side of the development areas, as far as the ESB substation, including provision for rerouted 38 kV lines, and all associated roadside landscaping, drainage and utilities. The roadworks and landfill remediation works will be in tandem, which will allow a good materials balance within the site, as excess soils material generated as part of the road construction can be recycled as landfill cap material and / or fill in areas of the site where localised land reprofiling is required. **Table 9.19** presents a list of the most significant plant/ equipment likely to be used during the construction of the new main access road.

Table 9.19: Typical Construction Plant for Main Access Road Works

Activity	Plant	Reference from Annex C & D BS5228	Sound Power Level dB(A)	Duty Cycle / Number of Loads
Earthworks	Tracked excavator	C.4.63	105	75
	Tracked excavator	C.4.63	105	75
	Articulated dump truck *	C.2.33	109	4.5 loads per hour
	Vibratory roller	C.5.25	103	25
	Dozer *	C.2.1	103	50
Road Formation	Continuous flight auger piling**	C.3.22	108	75
	Dozer	C.5.12	105	50
	Road lorry (full)*	C.6.21	109	4.5 loads per hour
	Grader *	C.6.31	115	50
	Tracked excavator	C.5.35	103	50
	Road roller*	C.5.19	108	50
	Articulated dump truck *	C.2.33	109	4.5 loads per hour
	Asphalt paver (+ tipper lorry)*	C.5.32	112	30
	Vibratory roller (not vibrating)*	C.5.23	111	30
	Wheeled excavator	C.5.11	101	30
	Road sweeper	C.4.90	104	25

Note: ** - Piling required for road embankment which traverses the southern point of Landfill Site 2.

The predicted noise levels at the nearest dwellings to the construction of the new main access road are presented in **Table 9.20**. The predicted noise levels are below the daytime noise limit of 65 dB L_{Aeq}. These construction activities will result in a not significant/slight effect at the nearest receptors, and this will reduce to not significant at more distant receptors.

Table 9.20: Predicted Noise Levels at nearest NSRs for Road Works

Receptor ID	Predicted L_{Aeq} Noise Levels for	
	Earthworks	Road Formation
R148	55	61
R33	55	61
R27	51	57

9.5.2.3 Landfill Remediation Works and Gas Compound Infrastructure

The proposed landfill capping remedial measures have been designed to meet the requirements of the Certificates of Authorisation issued by the EPA and to accommodate the construction of the Phase 1 proposed development. The remediation measures include:

- A Landfill Capping System
- Landfill Gas Management
- Leachate Interception
- Surface Water Drainage
- Excavation and Disposal (in localised areas)

At Landfill Site 3B, in order to accommodate the access road which will be constructed in cut through the site, it is proposed that all of the waste beneath the pavement layers will be excavated down to clean material. Small areas of Sites 1 and 2 also require some excavation. Piling is proposed for the road embankment which traverses the southern point of Site 2. Piling has been considered as part of the road construction in **Section 9.5.2.2.** The closest NSR to the landfill remediation works is R102 which c. 75m from Site 3C. The next nearest dwellings are NSR R148 and R33 c. 95m from Site 2. The noise predictions consider the closest landfill for each of the most exposed NSRs.

As part of the landfill remediation, landfill gas management is required, and a landfill gas compound will be constructed, and associated infrastructure will be installed. **Table 9.21** presents a list of the most significant plant/equipment likely to be used during the landfill remediation works and construction of the gas compound.

Table 9.21: Typical Construction Plant for Landfill Works and Gas Compound Construction

Activity	Plant	Reference from Annex C & D BS5228	Sound Power Level dB(A)	Duty Cycle / Number of Loads
Landfill Capping / Drainage / Installation of Virtual Gas Curtain	Articulated dump truck (tipping fill)	C.2.32	102	10
	Dozer	C.8.7	103	75
	Tracked excavator	C.8.12	102	50
	Articulated dump truck *	C.2.33	109	4.5 loads per hour
	Vibratory roller*	C.5.21	108	30
	Vibratory piling rig	C.3.8	116	25
Gas Compound – Site Preparation	Tracked excavator	C.2.3	106	75
	Articulated dump truck *	C.2.33	109	4.5 loads per hour
	Dozer	C.2.12	109	50
Gas Compound – Preparation of Hardstanding's	Tracked excavator	C.2.19	105	75
	Articulated dump truck (tipping fill)	C.2.32	102	10
	Dozer	C.5.12	105	50
	Vibratory roller*	C.5.21	108	50
Gas Compound – Concrete Pours	Concrete mixer truck (discharging) & concrete	C.4.28	103	75
	Poker vibrator	C.4.33	106	25
	Road lorry (full)*	C.6.21	109	4.5 loads per hour
Gas Compound – Installation of Plant	Mobile telescopic crane	C.4.39	105	75
	Telescopic handler	C.4.54	107	50
	Angle grinder (grinding steel)	C.4.93	109	25
	Lifting platform	C.4.57	95	75
	Road lorry (full)*	C.6.21	109	4.5 loads per hour

The predicted noise levels at the nearest dwellings to the landfill remediation works and the gas compound works are presented in **Table 9.22**. The predicted noise levels are below the daytime noise limit of 5 dB L_{Aeq}. The landfill remediation construction activities will result in a slight effect at the nearest receptors, and this will reduce to not significant at more distant receptors. The effect of the gas compound works is not significant at the nearest receptors.

Table 9.22: Predicted Noise Levels at Nearest NSRs for Landfill Remediation Works and Gas Compound Works

Receptor ID	Predicted L_{Aeq} Noise Levels for	
	Landfill Remediation	Gas Compound
R102	64	50
R148	60	43
R173	56	50
R33	59	43
R223	46	50

9.5.2.4 Overhead Line Rerouting, Undergrounding and Tower Construction

There are a number of electricity lines which cross the lands and these are to be diverted and undergrounded in order to accommodate the proposed development. These relate to an existing twin 110 kV overhead line and 2 No. existing 38 kV overhead lines, all of which run to the existing Fassaroe 110 kV substation. During the construction of the new main access road, provision for the rerouted 38 kV lines will be made. Two new steel lattice towers are required on the southern side of the Ballyman Glen at a location where the proposed 110 kV cable that has been undergrounded from the Fassaroe substation will emerge from a trench. One new steel lattice tower / terminal tower is required at the edge of the proposed District Park (just to the south of the Ballyman Glen) at a location where the proposed 38 kV cable that has been undergrounded from the Fassaroe substation will emerge from a trench.

The undergrounding works are carried out in parallel with the road works and these works have been considered as part of the road works in **Section 9.5.2.2.** The noise impact from the removal of existing towers and the construction and installation of new towers has been modelled separately. **Table 9.234** presents a list of the most significant plant/equipment likely to be used during removal of existing towers and construction of new towers.

Table 9.23: Typical Construction Plant for Overhead Line Structures

Activity	Plant	Reference from Annex C & D BS5228	Sound Power Level dB(A)	Duty Cycle / Number of Loads
Removal of Existing Towers	Excavator mounted rock breaker	C.9.12	113	50
	Wheeled mobile crane	C.5.37	104	75
	Dumper*	C.4.4	104	5 loads an hour
	Tracked excavator	C.2.3	106	75
Construction and Installation of New Towers	Tracked excavator	C.2.3	106	75
	Wheeled mobile crane	C.5.37	104	75
	Dumper*	C.4.4	104	5 loads an hour
	Poker vibrator	C.4.33	106	25
	Angle grinder (grinding steel)	C.4.93	109	25
	Diesel generator	C.4.78	94	50

The predicted noise levels at the nearest dwellings to the removal of existing towers and the construction and installation of new towers are presented in **Table 9.24**. The predicted noise levels are below the daytime noise limit of 65 dB L_{Aeq}. The effect of the construction of the overhead line structures is not significant at the nearest receptors.

Table 9.24: Predicted Noise Levels at nearest NSRs for Overhead Line Structures

Receptor ID	Predicted L_{Aeq} Noise Levels for Overhead Line Structures	
	Demolition and Removal	Construction and Installation
R148	47	45
R33	46	45
R84	46	46

9.5.2.5 Construction of Residential and Commercial Buildings

Phase 1 proposes the construction of 650 no. residential units comprising 241 no. houses and 409 no. apartments. Four blocks of apartments are proposed, and these will be located within character area 1 and one block in the neighbourhood centre. The houses will be located within character areas 2, 4 and 5. The crèche will be located in character area 2. The potential impact from the construction of residential and commercial buildings will depend on the proximity of the works to NSRs. The greatest impact on the nearest existing residential dwellings to the proposed development will occur when works are focused in character areas 2 and 5. Several scenarios were considered and the scenarios with the greatest potential impact were modelled. **Table 9.25** presents a list of the most significant plant/equipment likely to be used during construction of buildings.

Table 9.25: Typical Construction Plant for Construction of Buildings

Activity	Plant	Reference from Annex C & D BS5228	Sound Power Level dB(A)	Duty Cycle / Number of Loads
Site Preparation	Tracked excavator	C.2.3	106	75
	Articulated dump truck *	C.2.33	109	4.5 loads per hour
	Dozer	C.2.12	109	50
Preparation of Hardstanding's	Tracked excavator	C.2.19	105	75
	Articulated dump truck (tipping fill)	C.2.32	102	10
	Dozer	C.5.12	105	50
	Vibratory roller*	C.5.21	108	50
Concrete Pours	Concrete mixer truck (discharging) & concrete	C.4.28	104	5.5 loads per hour
	Poker vibrator	C.4.33	103	100
	Road lorry (full)*	C.6.21	106	25
General Works	Tower cranes (x2)	C.4.48	104	100
	Telescopic handler (x2)	C.4.54	107	50
	Angle grinder (grinding steel)	C.4.93	109	25
	Dumper*	C.4.4	104	50
	Dumper (idling)	C.4.5	91	50
	Diesel generator	C.4.78	94	100
	Lifting platform	C.4.57	95	75
	Mini tracked excavator	C.4.67	102	50

The predicted noise levels at the nearest dwellings to the building construction works are presented in **Table 9.26**Table 9.26. In general, the predicted noise levels are below the noise guidance thresholds at all noise sensitive locations. However, there is potential for exceedances at locations R33 and R148 during the construction of some of the nearest houses in character area 5. This will result in a medium impact at these

two receptors when construction activities are in concentrated in proximity to the receptors. However, the duration will not exceed the duration criteria in the DMRB[1] and the effect will not be significant.

Table 9.26: Predicted Noise Levels at Nearest NSRs for Construction of Buildings

Receptor ID	Predicted L_{Aeq} Noise Levels
R33	70
R148	67
R27	63
R159	62
R187	62

In practice the actual noise levels are expected to be lower as noise model assumes that the plant is concentrated in proximity to the dwelling. Where in practice, plant will be spread out and will not be concentrated at the closest location to the NSRs. Nonetheless, mitigation measures will be proposed adjacent to this dwelling, and these are discussed in **Section 9.6.1**. With appropriate mitigation measures, the predicted noise impact is below the 65 dB L_{Aeq} noise limit and this construction activity will result in a slight effect at the nearest receptors, and this will reduce to not significant at more distant receptors.

9.5.2.6 Landscaping Works

A district park and local parks form part of the proposed development. The district park will provide the principal green open space for the Fassaroe development comprising a total of 15.3ha. Three no. pocket park areas comprising a total of 0.43ha are also proposed.

The potential impact from landscaping works will depend on the location of the works. The greatest impact on the nearest existing residential dwellings to the proposed development will occur when works are focused to east of character area 5 and southwest of character area 2 and the this has been assessed. There is an existing single storey dwelling on the northern side of Berryfield Lane which will be demolished to accommodate the district park and to enhance the connectivity between the passive and active parts of the park. The demolition of the existing single storey dwelling on the northern side of Berryfield Lane is also assessed. **Table 9.27** presents a list of the most significant plant/equipment likely to be used during construction landscaping works and the demolition works.

Table 9.27: Typical Construction Plant for Landscaping and Demolition Works

Activity	Plant	Reference from Annex C & D BS5228	Sound Power Level dB(A)	Duty Cycle / Number of Loads
Landscaping	Tractor (towing equipment)	C.4.74	108	40
	Tractor (towing equipment)	C.4.74	108	30
	Tracked excavator	C.5.35	103	30
	Articulated dump truck *	C.2.33	109	4.5 loads per hour
	Articulated dump truck (tipping fill)	C.2.30	107	10
Demolition	Pulveriser mounted on excavator	C.1.4	104	75
	Wheeled excavator	C.5.11	101	75
	Road lorry (full)*	C.6.21	109	1 load per hour
	Backhoe mounted hydraulic breaker	C.5.1	117	25

[1] *Construction noise and construction traffic noise shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:*
1) 10 or more days or nights in any 15 consecutive days or nights;
2) a total number of days exceeding 40 in any 6 consecutive months.

The predicted noise levels at the nearest dwellings to the landscaping works and demolition works are presented in **Table 9.28**. The predicted noise levels from the landscaping works are below the daytime noise limit of 65 dB L_{Aeq} and this construction activity will result in a slight effect at the nearest receptors, and this will reduce to not significant at more distant receptors.

Table 9.28: Predicted Noise Levels at Nearest NSRs for Landscaping Works and Demolition Works

Receptor ID	Predicted L_{Aeq} Noise Levels	
	Landscaping	Demolition
R148	62	67
R33	62	62
R27	54	67
R159	53	62
R187	52	61

The predicted noise levels from the demolition works are below the daytime noise limit except for NSRNSRs R27 and R148. The main sources of noise are the pulveriser mounted on the excavator and backhoe mounted rock breaker. In practice, not all plant will operate simultaneously, and the actual noise levels will be lower. This phase of works is expected to last several days and is below the duration criteria in the DMRB[1] and this will not be significant. Nonetheless, to mitigate the noise impact, it is recommended that a temporary noise barrier is installed. Further details are discussed in **Section 9.6.1**. With the installation of the noise barrier, the noise levels are predicted to be below the noise limit. However, there may be periods where the noise level is elevated for brief periods with the overall effect described as slight to moderate at the nearest receptor. The effect will reduce to slight at more distant receptors.

9.5.2.7 Pedestrian Bridge

A pedestrian / cycle route including bridge across the N11 to Dargle Road Upper is proposed as part of the proposed development. The bridge construction will be undertaken by the applicant in consultation with Wicklow County Council and Transport Infrastructure Ireland. The bridge will be completed and open for use in advance of the occupation of dwellings in Phase 1. **Table 9.29** presents a list of the most significant plant/equipment likely to be used during construction pedestrian bridge.

Table 9.29: Typical Construction Plant for Pedestrian Bridge Construction

Activity	Plant	Reference from Annex C & D BS5228	Sound Power Level dB(A)	Duty Cycle / Number of Loads
Bridge Construction	Tracked excavator	C.5.35	103	50
	Dump truck (tipping fill)	C2.30	107	10
	Vibratory roller*	C.5.21	108	25
	Wheeled mobile crane	C.5.37	104	75
	Poker vibrator	C.4.33	106	25
	Vibratory plate (petrol)	C.2.41	108	25
	Truck mounted concrete pump + boom arm	C.4.30	107	75

The predicted noise levels at the nearest dwellings to the pedestrian bridge construction works are presented in **Table 9.30**. The predicted noise levels are below the noise guidance thresholds at all noise sensitive locations and this construction activity will result in a slight effect at the nearest receptors.

Table 9.30: Predicted Noise Levels at nearest NSRs for Pedestrian Bridge Construction

Receptor ID	Predicted L_{Aeq} Noise Levels
R125	62
R139	61
R142	59

9.5.2.8 Construction Traffic

It is anticipated that all construction vehicles accessing the site will come from the N11. Access to and from the main carriageway is available in both directions and able to cater for all vehicle types. Access is also available from the Ballyman Road but use of this access will be discouraged during construction. Initially, vehicles will access the site via the Berryfield Lane arm of the Roadstone roundabout. During later phases of construction, the Roadstone roundabout will be removed, with alternative access being provided both to the site and for existing residents on Berryfield Lane.

The level of construction traffic directly associated with the development of Phase 1 will vary over the course of the construction project. The predicted noise impact from construction traffic is based on the anticipated peak construction traffic movements presented in Chapter 12 Traffic and Transportation. Traffic flows at both the western and eastern junction 6 interchange are shown in **Table 9.31**.

Table 9.31: Construction Traffic Impact Fassaroe Interchange

Road Link	Period	Existing Traffic Volumes PCU	Construction Traffic PCU	% Impact
Eastern Fassaroe Interchange	AM	1079	34	3%
	PM	1224	24	2%
Western Fassaroe Interchange	AM	896	60	7%
	PM	840	50	6%

The predicted change in noise from construction traffic was calculated using Calculation of Road Traffic Noise (CRTN), Department of Transport Welsh Office, HMSO 1988. When the additional traffic flow from the construction activity is added to the existing traffic flow, there is a negligible increase in predicted traffic noise levels and this is not significant in EIA terms.

9.5.2.9 Construction Vibration

Some construction phase activities associated with the proposed development have the potential to result in vibration effects at sensitive receptors. Activities included in the proposed construction phase that have the potential to result in vibration effects include piling and to a lesser extent demolition activity. Piling is proposed for the road embankment which traverses the southern point of landfill site 2. This represents the most intense activity with sensitive receptors approximately 95m away.

Chapter 5 - Biodiversity indicates that there may be some presence of badgers on the site. While no badger setts were identified during recent site surveys there is a possibility that some could be identified prior to the commencement of development. In the event that this arose, it would be necessary to protect badgers from potential vibration impacts. The most significant potential vibration impact would be from piling activity. To a lesser extent vibration from the operation of construction machinery may cause an impact. The standard mitigation measures to protect badgers from potential vibration impacts involve exclusion zones from specific activities and are outlined in **Section 9.6.1**.

Annex E of British Standard BS5228-2:2009+A1:2014 provides empirical formulae to calculate a Peak Particle Velocity (PPV) for piling. Of the various methods of piling, driving precast concrete piles has a higher potential for vibration impacts, and has been evaluated in this assessment. A typical piling rig for driving concrete piles is a Junttan PM20 with a maximum energy of 74 kJ.

The nearest sensitive locations (R33 / R48) are located approximately 95m away. Assuming the piles are driven to refusal at the nearest location to each receptor the calculated PPV levels are less than 0.1 mm/s which is not significant in EIA terms. Higher vibration levels will only arise when piling close to the receptors. Other receptors will be located at a greater distance to the piling activity will experience lower PPV levels and will result in an imperceptible significance.

9.5.3 Operational Phase

During the operational phase there are several inward and outward impacts on the proposed development, and existing dwellings in the vicinity of the proposed development.

The potential impact on residences in the proposed development vary across the extent of the development, some residential units are in proximity to N11 national road, Fassaroe 110 kV substation, EPA licensed facilities Roadstone Quarry and Starrus Eco Waste Transfer Facility and a gas flare as part of the gas management system for remediation of the historic landfills within the wider site boundary.

The impacts on existing residents as a result of the proposed development are from the gas flare as part of the gas management system for remediation of the historic landfills within the wider site boundary and additional traffic volumes on roads in the vicinity of the site.

9.5.3.1 Starrus Eco Waste Transfer Facility

Starrus Eco Waste Transfer Facility (WTF) is located adjacent to northeast eastern part of the proposed development and is operated under EPA waste license W0053-03. This licence is for the operation of an integrated waste management facility including bulking of municipal solid waste prior to transfer off site for disposal, composting, wood shredding, processing/storage of dry recyclables, recovery of construction and demolition waste, acceptance of waste at a civic waste facility to include acceptance of hazardous waste such as bonded asbestos waste, WEEE and chlorofluorocarbons. Several technical amendments have been made to the licence and Amendment B is the only one of interest from a noise perspective which states…

> *"The facility shall be operated only between the hours of 07:30 and 21:00 Monday to Saturday inclusive, except for the processing of dry mixed recyclable waste in the Phase 1 building which may be operated on a 24-hour day and 7-day week".* The technical amendment goes on to state… *"After 21:00 and where dry mixed recyclable waste is being processed: outdoor vehicle movements shall be solely for the purpose of servicing the overnight processing of mixed dry recyclable waste; reversing sirens or warning signals on outdoor vehicles shall be of a flat spectrum (white noise) type; and the three fans on the outside of the Phase 1 building shall be turned off."*

Irrespective of the activities on site, the site is licenced and Condition 4 of the licence states… *"Noise from the facility shall not give rise to sound pressure levels (Leq,T) measured at the boundary of the facility which exceed the limit value(s)."* Schedule B.4 Noise Emissions provides details on applicable limits and these are reproduced in **Table 9.6** in Section 9.2.3.5.

The waste transfer facility is north of apartment blocks 01, 02 and 03 in character area 1 and east/southeast of dwellings located on Street 04 and 06 in character area 2. Unattended monitoring was undertaken over a 48-hour period at location NML2 to quantify the noise levels at this location. The average daytime and night-time L_{Aeq} noise levels are presented in Section 9.4.2.2.

The average noise levels during the daytime hours noise levels ranged from 48 – 54 dB $L_{Aeq,16hr}$. The average noise levels during the night-time ranged from 44 – 45 dB $L_{Aeq,8hr}$. The noise environment at this location comprises of noise from the Starrus Eco Waste Transfer Facility and traffic on the N11/M11.

One-third octave band data from the unattended noise survey was reviewed and in general the noise character was broadband in nature. However, there were 7 no. instances where tonal noise was measured at one-third octave band frequencies of 5 kHz and 8 kHz. The source of the tonal noise is not apparent.

The unattended 48-hour measurements were supplemented with two 30-minute attended measurements on 03/03/2022. One of the locations was c. 10m from the Starrus Eco Waste Transfer Facility (S2) and the other measurement (S3) was setback a further 100m from the site boundary. The purpose of these measurement was twofold, 1) measure the total noise at location S2 and observe the character of the noise and 2) determine the contribution from N11 national road using measurement S3.

During the noise measurements, there were other noise sources and to determine the specific noise from the WTF, periods where noise from other noise sources such as aircraft overhead or other extraneous noise sources were omitted. Analysis of data during periods where influence from extraneous sources was minimised was undertaken. **Figure 9.3** presents the time history measurements at location S2 and S3 near Starrus Eco Waste Transfer Facility.

Figure 9.3: Time History of Noise Measurements at Location S2 and S3 near Starrus Eco Waste Transfer Facility

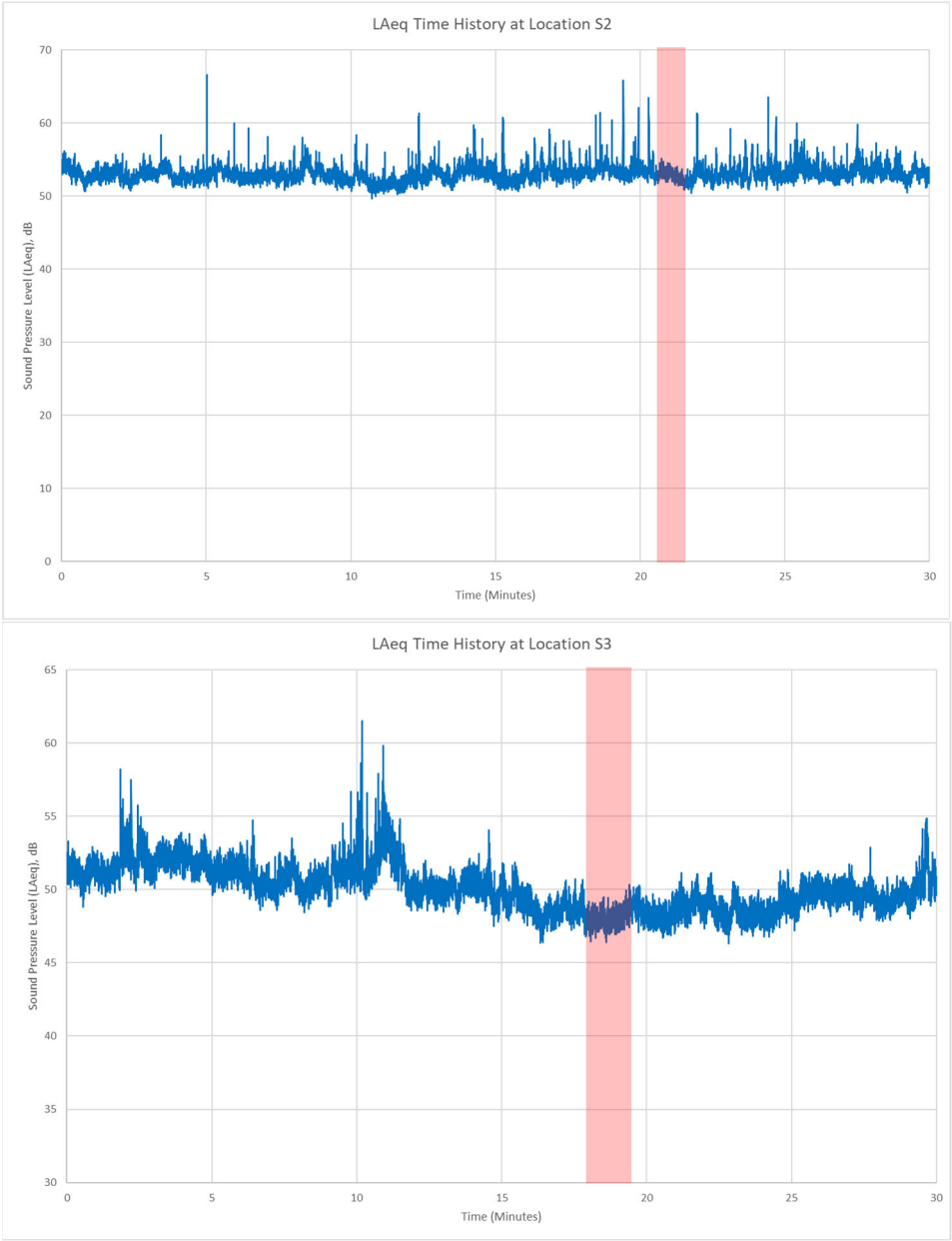


Table 9.32 presents the L_{Aeq} noise levels for the segments where other noise sources were minimised.

Table 9.32: L_{Aeq} Noise Levels at Location S2 and S3

Monitoring Location	Noise Levels, L_{Aeq} (dB)	Comments
S2	52.8	Noise from WTF dominates. Noise is broadband in character. Traffic noise audible at a significant level.
S3	48.0	Traffic noise dominates. Noise from WTF audible at a lower level.
Difference between S2 and S3	51.1	Specific noise for WTF. Traffic noise contribution removed from S2.

No tonal noise was audible during the survey. However, the noise data from the unattended noise survey from 9th – 11th November 2021 shows elevated noise levels during night-time periods which is likely to be from both the WTF and traffic noise which has a significant contribution. Suitable guidance on internal noise levels is outlined in **Section 9.2.3** (see **Table 9.7**)

Noise surveys were undertaken at external locations, and the guideline values refer to internal noise levels. The sound insulation of the building envelope needs to be considered to calculate the internal noise levels. However, the acoustic performance of the building envelope will be reduced in the event windows are opened for ventilation or cooling purposes, with the insulation reduced to approximately 15 dB(A). Most residents value the ability to open windows at will, and for the purpose of this assessment, windows are opened an attenuation of 15 dB between external and internal noise levels has been assumed. **Table 9.33** presents the average internal noise levels during daytime (07:00 – 23:00 hrs) and night-time periods (23:00 – 07:00 hrs).

Table 9.33: Average Noise Levels at Location NML2 and BS 8233 Guideline Values

Start Time	Average L_{Aeq}	BS 8233 Guideline Values
09/11/2021 15:15 - 09/11/2021 23:00*	33	35 dB $L_{Aeq,16hr}$ (Resting) 40 dB $L_{Aeq,16hr}$ (Dining)
09/11/2021 23:00 - 10/11/2021 07:00	28	30 dB $L_{Aeq,8hr}$ (Resting)
10/11/2021 07:00 - 10/11/2021 23:00	34	35 dB $L_{Aeq,16hr}$ (Resting) 40 dB $L_{Aeq,16hr}$ (Dining)
10/11/2021 23:00 - 11/11/2021 07:00	33	30 dB $L_{Aeq,8hr}$ (Resting)
11/11/2021 07:00 - 11/11/2021 15:00*	39	35 dB $L_{Aeq,16hr}$ (Resting) 40 dB $L_{Aeq,16hr}$ (Dining)

*Full 16-hour period not measured

In some instances, the internal noise levels are above the guideline values in **Table 9.7**. BS 8233 states… *"Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved".* With the internal guidelines relaxed by up to 5 dB, the average internal noise levels are below the relaxed guidelines. The significance of impact from Starrus Eco Waste Transfer Facility will range from not significant to slight at the nearest receptors. If the windows were closed, the guidelines would be met by a greater margin. Measures to reduce the noise impact are discussed in **Section 9.6.2**.

With respect to external amenity areas, BS8233:2014 states that *"it is desirable that external noise level does not exceed 50 dB $L_{Aeq,T}$ with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments.* The $L_{Aeq,16hr}$ noise levels measured at a height of 1.5m (ground floor level) ranged from 48 dB – 54 dB $L_{Aeq,16hr}$ which is below the upper range in BS 8223:2014. The Starrus Eco Waste Transfer Facility is approximately 7m below the ground level of the proposed development (and existing ground level where the measurements were undertaken). Hence, noise levels at higher floor levels are likely to be higher as the attenuation due to topography will be reduced at higher floors and direct line of sight may occur. BS 8223:2014 also states… *"These guideline values may not be achievable in all circumstances where development might be desirable".* The standard goes on to say, *"In such a situation, development should be*

designed to achieve the lowest practicable noise levels in these external amenity spaces but should not be prohibited." Where significant adverse noise impacts remain on any private external amenity space, ProPG states…

> *"impact may be partially off-set if the residents are provided, through the design of the development or the planning process, with access to:*
>
> - *a relatively quiet facade (containing openable windows to habitable rooms) or a relatively quiet externally ventilated space (i.e. an enclosed balcony) as part of their dwelling; and/or*
> - *a relatively quiet alternative or additional external amenity space for sole use by a household, (e.g. a garden, roof garden or large open balcony in a different, protected, location); and/or*
> - *a relatively quiet, protected, nearby, external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings; and/or*
> - *a relatively quiet, protected, publicly accessible, external amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance). The local planning authority could link such provision to the definition and management of Quiet Areas under the Environmental Noise Regulations."*

The proposed development includes 15.3 ha district park publicly accessible amenity space and this can be used to partially off-set of higher amenity noise levels. Further details on measures to reduce the noise impact are discussed in Section 9.6.2.

9.5.3.2 Roadstone Quarry

Roadstone Quarry is to the south of the proposed development and is operated under EPA waste license W0269-01. This waste licence relates to the operation of an inert waste recovery facility. Licensed activities comprise (i) the continued restoration of a former sand and gravel quarry using soil and stones; and (ii) the continued operation of an existing construction and demolition waste recycling operation. A closure audit application and accompanying report was submitted to the EPA in November 2020. This relates to the removal of lands from the licensed area. The lands to be removed are located on the eastern and north-eastern side of the existing licensed site and comprise the lands within and around the footprint of the former sand and gravel pit at Fassaroe. These lands were backfilled under licence using imported surplus soil and stone from construction and development projects between mid-2011 and the early months of 2015.

The following key areas/activities are operational as outlined in the report accompanying the closure audit application:

- Concrete Production Area
- Retail Shop (During a site visit on 9th November 2021, the shop was boarded up.)
- C&D Waste Recovery

Irrespective of the activities on site, the site is licenced and Condition 4 of the licence states… "Noise from the facility shall not give rise to sound pressure levels (Leq,T) measured at the boundary of the facility which exceed the limit value(s)." Schedule B.4 Noise Emissions provides details on applicable limits and these are reproduced in Table 9.6 in Section 9.2.3.5.

Noise emissions are monitored on a quarterly basis at 5 locations across the Fassaroe facility (designated N1 to N5), all of which are located at, or close to, the licensed site boundary. Location N3 is north of the quarry and approximately 80m from nearest dwelling.

The nearest dwellings as part of the proposed residential development are approximately 270m away from the quarry boundary.

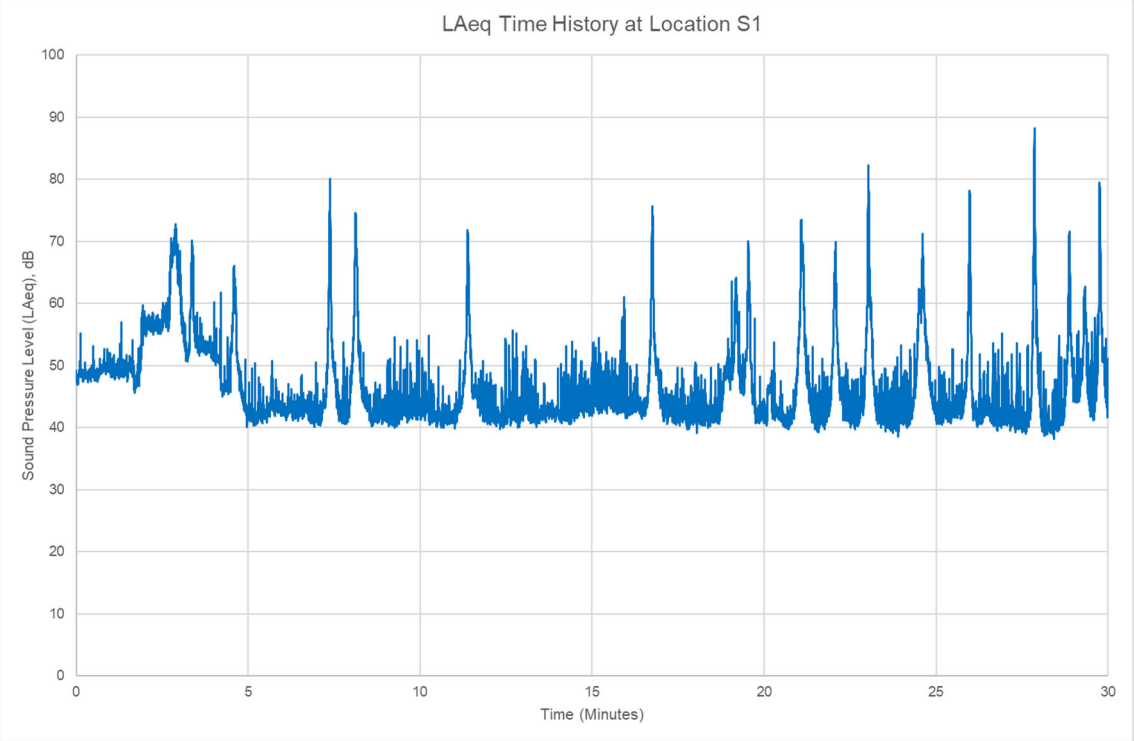
Annual Environmental Reports (AERs) including years 2015 - 2020 are available on the EPA portal. A review of the AERs indicate that the site complies with the noise limits at location N3. However, there is limited information on the actual noise levels that where measured.

Baseline noise measurements were undertaken at Location NML3 which is approximately 135m north of the Roadstone quarry site boundary. The noise levels at this location comprises a range of noise sources including distant traffic noise from the N11, noise from passing traffic, farm activity, activity from nearby equipment servicing premises and activity at the residence. During the equipment installation a reverse alarm was audible at a low level from the direction of Roadstone quarry. No other activity from the quarry was observed.

The average noise levels during the daytime hours noise levels ranged from 46 – 49 dB $L_{Aeq,16hr}$. The average noise level during the night-time was 41 dB $L_{Aeq,8hr}$.

The unattended 48-hour baseline measurements were supplemented with two 15-minute attended measurements on 03/03/2022. **Figure 9.4** presents the L_{Aeq} noise level time history at location S1.

Figure 9.4: L_{Aeq} Time History from Attended Noise Measurement at Location S1



During the attended noise survey, noise from Roadstone Quarry was not audible. The background noise level was dominated by distant traffic from the N11 national road. Activity at nearby residences, passing traffic, bird song, activity at equipment servicing premises including noise from a forklift truck moving and idling dominated the ambient noise environment. The first 5-minutes of the measurement were attributed to forklift truck idling, moving past the measurement location. The peaks in the noise levels are due to passing vehicles on Berryfield Lane. When noise from these sources subsided, distant traffic noise with audible at a steady noise level with occasional bird song. The ambient noise levels during the periods when distant traffic noise and bird song occurred ranged between 38 – 43 dB L_{Aeq}. The overall background noise level ranged between 41.1 – 41.6 dB L_{A90}. A summary of the measurements is presented in **Table 9.34**.

Table 9.34: Noise Monitoring Results Adjacent to Roadstone Quarry

Noise Monitoring Location	Start Date and Time	Measured Noise Levels, dB				Comments
		L_{Aeq}	L_{AFMax}	L_{AF90}	L_{AF10}	
S1	03/03/2022 15:24	56.5	79.8	41.6	56.5	Quarry was not audible. Distant traffic noise dominates background noise levels. Peaks in noise levels due to passing traffic on Berryfield Lane and activity at nearby equipment services premises.
S1	03/03/2022 15:39	60.4	87.8	41.1	55.0	

Roadstone Quarry was not audible during the survey. Hence, the noise emissions from Roadstone Quarry are lower than the noise levels measured when all, but distant traffic noise subsided. Furthermore, the measurement location was approximately 125m from Roadstone Quarry boundary and nearest property from the proposed development will be setback further at least 270m from the Roadstone Quarry so noise levels will be attenuated further due to the larger propagation distance.

The average noise levels were assessed against the guideline values on internal noise levels in BS8233:2014. **Table 9.33** presents the average internal noise levels during daytime (07:00 – 23:00 hrs) and night-time periods (23:00 – 07:00 hrs) at NML3. The average internal noise levels are below the BS 8233 guideline values.

Table 9.35: Average Noise Levels at Location NML3 and BS 8233 Guideline Values

Start Time	Average L_{Aeq}	BS 8233 Guideline Values
09/11/2021 15:15 - 09/11/2021 23:00*	31	35 dB $L_{Aeq,16hr}$ (Resting) 40 dB $L_{Aeq,16hr}$ (Dining)
09/11/2021 23:00 - 10/11/2021 07:00	26	30 dB $L_{Aeq,8hr}$ (Resting)
10/11/2021 07:00 - 10/11/2021 23:00	31	35 dB $L_{Aeq,16hr}$ (Resting) 40 dB $L_{Aeq,16hr}$ (Dining)
10/11/2021 23:00 - 11/11/2021 07:00	26	30 dB $L_{Aeq,8hr}$ (Resting)
11/11/2021 07:00 - 11/11/2021 15:00*	34	35 dB $L_{Aeq,16hr}$ (Resting) 40 dB $L_{Aeq,16hr}$ (Dining)

*Full 16-hour period not measured

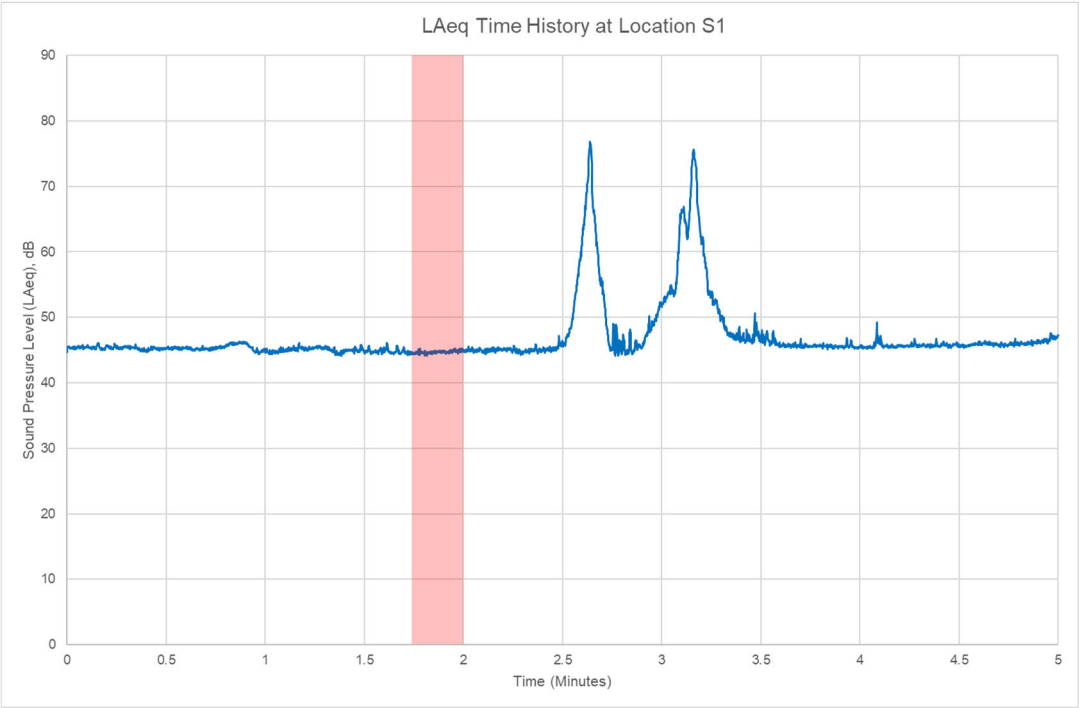
With respect to external amenity areas, BS8233:2014 states that *"it is desirable that external noise level does not exceed 50 dB $L_{Aeq,T}$ with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments.* The $L_{Aeq,16hr}$ noise levels measured ranged from 46 dB – 49 dB $L_{Aeq,16hr}$ which is below the lower range in BS 8223:2014. Roadstone Quarry will have an imperceptible effect at the nearest receptors.

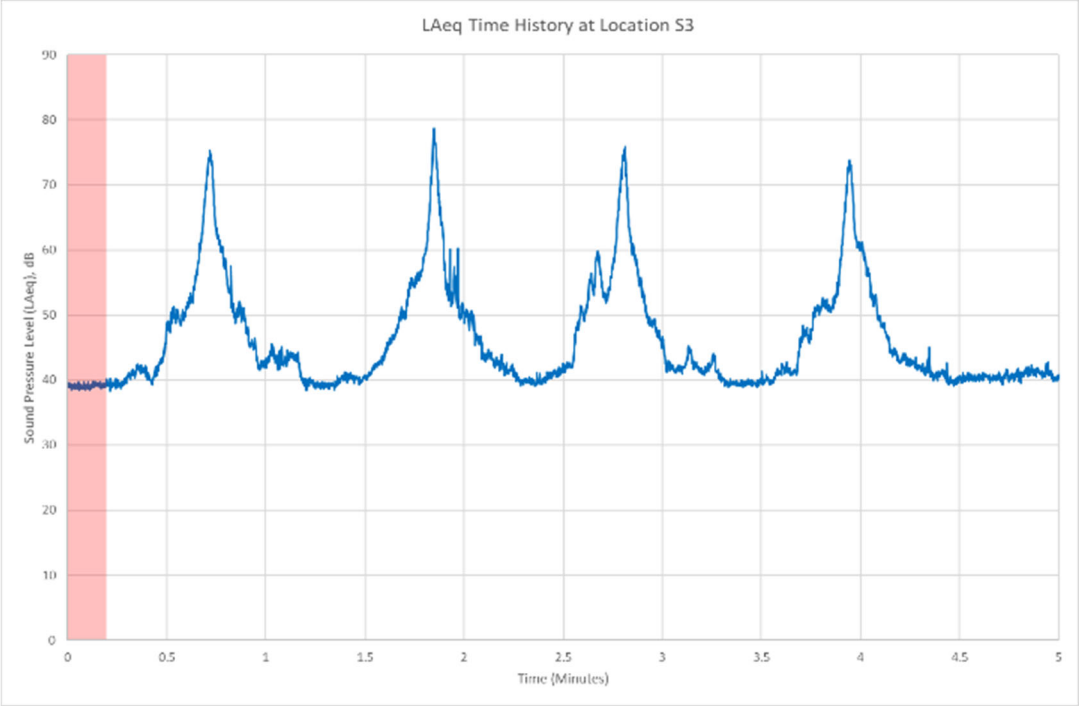
9.5.3.3 Fassaroe 110 kV Substation

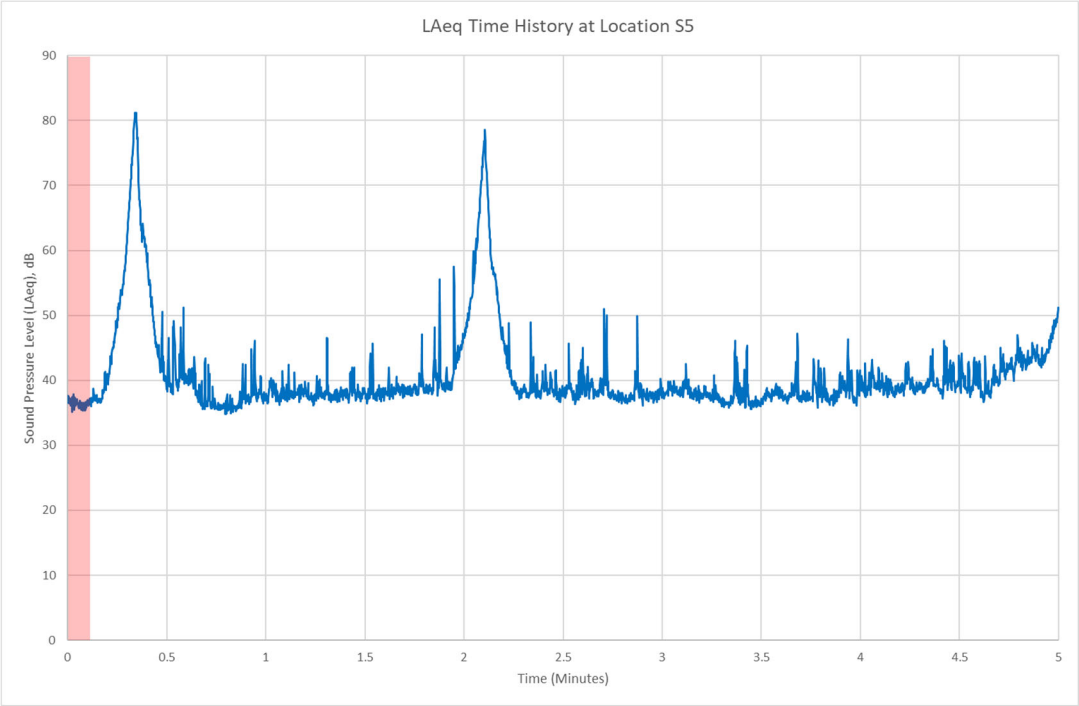
Fassaroe 110 kV substation is located off the Berryfield Lane and we are unaware of noise conditions attached to the substation planning permission. Several dwellings which form part of the proposed housing development are in proximity to the substation and there are potential inward noise impacts from the substation. To assess the potential noise impact several noise measurements on site were undertaken. Measurements were undertaken at the substation entrance on Berryfield Lane, at the location of the proposed nearest dwelling (Area 4 of the proposed development) in proximity to the substation. A measurement was also undertaken at a location on Berryfield Lane approximately 170m from the northwest corner of Fassaroe ESB Substation where no noise from the substation was audible during the spot measurements.

Figure 9.5 presents the time history at measurements at the three measurement locations to assess the noise impact of Fassaroe substation on the proposed development. During the noise measurements, there were other noise sources and to assess the impact of the substation, periods where noise from other noise sources such as vehicle passing the measurement location were omitted. Analysis of data during periods where influence from extraneous sources was minimised was undertaken. The segments analysed are shaded in **Figure 9.5**.

Figure 9.5: Time History at Measurements to Assess the Impact of Fassaroe Substation







The L_{Aeq} noise levels are presented in **Table 9.36**. The noise from the substation was audible at locations S4 (adjacent to substation) and S5 (in proximity to proposed dwellings in character area 4). The noise levels at location S5 are 2.6 dB above the baseline ambient noise levels at location S6 (approximately 170m from substation boundary).

Table 9.36: Noise Monitoring Results Adjacent Fassaroe 110 kV Substation

Noise Monitoring Location	Measured Noise Levels (L_{Aeq}), dB
S4	44.7
S5	39.2
S6	36.6

Noise from the substation is tonal close to the source. Tones were identified at 100 Hz and 315 Hz one-third octave bands. However, as the noise propagates, the tonal at 315 Hz was masked by the other background and ambient noise sources. At location S5 (in proximity to character area 4 of the proposed development), 100 Hz tonal noise was audible, but it was less pronounced. At location S6 noise from the substation was not audible during the noise survey. However, there is potential that the substation may be audible during periods when the background noise level is lower, for example during night-time periods.

Suitable guidance on internal noise levels can be found in “BS8233:2014: Guidance on sound insulation and noise reduction for buildings”. BS8233:2014 states only noise without tonal character has been considered. In absence of appropriate criteria in BS 8233:2014, reference is made to the BS4142:2019+A1:2014 Methods for rating and assessing industrial and commercial sound. BS4142 describes methods for rating and assessing sound of an industrial and/or commercial nature.

Table 9.37 presents an assessment of the likelihood of significant adverse impacts at measurement location S5. Location NML 3 has been used as a proxy location for obtaining background noise levels in absence of the specific source (i.e., the substation). The background noise levels were obtained from a statical analysis of the baseline L_{A90} noise levels measured during the daytime, evening and night-time periods.

Table 9.37: BS 4142 Assessment - Location adjacent to Fassaroe 110 kV Substation

Noise Monitoring Location	Comment	Noise Levels, dB
Ambient Noise Level	-	-
Residual Noise Level	Obtained from Location NML3	44(D) / 35(E) / 34(N)
Background Noise	Obtained from Location NML3	32 / 30 / 28
Specific Noise	Obtained from Location S2	39
Acoustic Feature Correction	+4 dB as tone was clearly perceptible	4
Rating Level		43
Assessment indicates likelihood of significant adverse impact		11(D) / 13(E) / 15(N)

Note: D, E and N denote periods. D - Daytime; E – Evening; and N – Night-time

The noise from the substation will have a significant adverse impact during all periods and at the current noise levels is likely to result in complaints. It is recommended that mitigation measures are implemented for these dwellings. Further details are discussed in Section 9.6.2. With appropriate mitigation measures the significance of impact from Fassaroe 110 kV Substation will result in effects ranging from not significant to slight at the nearest receptors.

9.5.3.4 Landfill Gas Management Infrastructure

There are five no. historic landfill sites which were previously operated by Wicklow County Council within the Fassaroe area. Remediation measures were approved by the EPA for four of these sites in 2019. As the residential development is in proximity to these sites, the current proposed application seeks planning approval for the remediation of the sites in accordance with the remediation details approved by the EPA for four sites and adopting the same remediation approach for the fifth site. Following remediation, the areas of the landfill sites will form part of open space areas and part of a road. The remediation measures include:

- Landfill capping systems
- Landfill gas management systems
- Leachate interceptions
- Surface water drainage
- Excavation and disposal (in localised areas to address existing slope slippage works and to accommodate a road proposal in one area).

At all five sites waste is currently generating a residual amount of landfill gas and will continue to do so for some years. Landfill gas migrates along the path of least resistance. At present, the gas simply migrates towards the surface of the landfills. The capping of the landfills is proposed as part of the Phase 1 development. With the installation of a low permeability capping layer the gas will be prevented from venting through surface of the landfill and will therefore build up in pressure and eventually migrate laterally beneath the edges of the sites, potentially towards residential units. To prevent this occurring a gas management system must be incorporated into the rehabilitation measures.

The main gas management strategy comprises of a Virtual Gas Curtain (VGC). The Virtual Gas Curtain is a fully enclosed barrier that is proposed around the perimeter of each of the landfill sites. The concept of the VGC is to form a low pressure or low gas concentration area relative to the surrounding gassing ground, to encourage gas to flow towards the barrier, and allow subsequent venting to atmosphere. Additionally, Automatic Flare Systems Limited Report (July 2020) recommends the installation of gas wells to depths just above the water table connected into a common gas main that leads to a small 100m^3/hr Lo-Cal flare for sites 2 and 3A. The Lo-Cal flare will be located approximately 150m from receptor R102 off Berryfield Lane.

As the 100m^3/hr Lo-Cal Flare will be a new source, the noise levels at the nearest dwellings from the 100m^3/hr Lo-Cal Flare were predicted using a using a three-dimensional model using Predictor LimA, Version 2021.1 noise modelling software. The method for calculating outdoor noise attenuation used by the Predictor LimA software is based on the international standards ISO 9613-2:1996 – Attenuation of sound during propagation outdoors - Part 2: General method of calculation. **Table 9.38** provides a summary of the operational noise model inputs.

Table 9.38: Summary of Operational Noise Model Inputs

Item	Input
Noise Source	Manufacturers Data supplemented with data from Source DB+ database
Noise Receptor	Receptor locations (see Figure 9.2)
	Receiver Heights of 1.5 m and 4 m except for apartments blocks where 6.5 m, 9 m and 10.5 m were also assessed.
Model Parameters	Relative Humidity 70% (ISO 9613)
	Temperature 10°C (ISO 9613)
	Ground absorption 0 for acoustically hard surfaces and 0.5 for all other acoustically soft surfaces.
	1 m contour data
	ISO 9613-2 downwind propagation noise model

Measurement readings provided by the manufacturer (insert manufacturers details) indicated that a typical 100m^3/hr Lo-Cal flare has a noise level of 60 dB(A) at distance of 10m. The noise emissions can be reduced by installing the booster inside an acoustic enclosure. With the acoustic enclosure in place the noise level is 55 dB(A) at a distance of 10m. Using the manufacturers data, a source sound power level was calculated assuming spherical propagation from the source. The frequency characteristics of the flare was sourced from Source DB+ which is a noise source database which forms part of the noise modelling software. The A-weighted octave band sound power levels and overall sound power level for the 100m^3/hr Lo-Cal flare are presented in **Table 9.39.**

Table 9.39: 100m^3/hr Lo-Cal Flare, Octave Band Sound Power Levels - L_{wA} dB(A)

	A-weighted Octave Band Frequency (Hz)									LwA
Frequency	**31.5**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	
Sound Power Level, dB(A)	61.2	66.2	71.2	73.2	74.2	75.2	74.2	75.2	76.2	**83.0**

The predicted noise levels at the nearest dwellings existing dwellings and proposed dwellings are presented in **Table 9.40**.

Table 9.40: 100m3/hr Lo-Cal Flare – Operational Noise Levels, dB(A)

Receptor ID	Predicted Noise Level, dB(A)	
	Ground Floor	First Floor
R102	21.9	27.1
R173	21.2	22.1
Character Area 4	18.0	18.6

The predicted noise levels are low and are below the existing mode background and ambient noise levels measured on site. The noise emissions from the flare are broadband in natural and it is expected that tonal noise will not be an issue. However, it is likely that this source will be audible at some receptor locations.

NML 3 and NML 4 are the two monitoring locations which are most representative of existing ambient and background noise in proximity to the proposed lo-cal flare. The average external noise levels with (in-combination) the lo-cal flare and without the lo-cal flare (existing level) are presented in **Table 9.4 Table 9.41.**

Table 9.41: Noise Results – With and Without Lo-Cal Flare - $L_{Aeq,16hr}$ Daytime and $L_{Aeq,8hr}$ Night-time

Noise Monitoring Location	Existing Level		In-Combination Level	
	Daytime $L_{Aeq,16hr}$	Night-time $L_{Aeq,8hr}$	Daytime $L_{Aeq,16hr}$	Night-time $L_{Aeq,8hr}$
NML 3	46 - 49	41	46 - 49	41
NML 4	39 - 48	37 - 38	39 - 48	37 - 38

The average internal noise levels are below the BS 8233:2014 guideline values. The $L_{Aeq,16hr}$ external noise levels measured ranged from 46 dB – 49 dB $L_{Aeq,16hr}$ at NML 3 and 39 – 48 dB $L_{Aeq,1hr}$ at NML 4 which is below the lower range in BS 8223:2014. The 100m^3/hr Lo-Cal Flare will result in a negligible magnitude of impact at the nearest existing dwellings and dwellings as part of Phase 1 of the proposed development and the flare will have an imperceptible effect at the nearest receptors. To ensure that the Lo-Cal flare has the lowest noise emissions, it is recommended that the flare booster should be installed inside an acoustic enclosure.

9.5.3.5 Traffic Noise Impacts – Existing Noise Sensitive Receptors

Phase 1 of the Fassaroe development lands will consist of the following units:

- 650 Residential units, of which 241 are houses and 409 are apartments
- 1,143 sq.m of Retail Space (incl. 108 sq.m in district park)
- 360 sq.m café
- 733 sq.m creche with approximately 138 no. childcare spaces.

The above units will generate different types and numbers of trips. The proposed development will result in an increase in traffic volumes along the N11, R918, L1521, Ballyman Road and Berryfield Lane. **Table 9.42** presents the AADTs and percentage Heavy Goods Vehicles (%HGV) without the proposed development (Do-minimum) and with the proposed development (Do-something) on these roads. Traffic figures are presented the opening year (baseline +4) and opening year +5 (baseline +9).

Table 9.42: Traffic Volumes on Roads Surrounding Proposed Development

Scenario	N11		R918		L1521		Ballyman Road		Berryfield Lane	
	AADT	%HGV	AADT	%HGV	AADT	%HGV	AADT	%HGV	AADT	%HGV
Do-Minimum +4	74773	3.82%	14746	6.7%	5977	20.6%	1674	6.6%	525	11.2%
Do-Something +4	76439	3.73%	15657	6.3%	7700	16.0%	1708	6.5%	559	10.6%
Do-Minimum +9	80602	4.07%	15799	6.4%	6359	19.8%	1788	7.1%	561	11.8%
Do-Something +9	82491	3.97%	16710	6.0%	8082	15.5%	1839	6.9%	612	10.8%

An internal road (Berryfield Avenue) forms part of the proposed scheme, this ensures limited traffic use Berryfield Lane. However, the new internal road has potential to impact the noise impact on existing dwellings on Berryfield Lane and adjacent to the western extent of Berryfield Avenue adjoining Ballyman Road.

The changes in traffic volumes with and without the proposed development are summarised **Table 9.43**. The largest change in traffic volume is on the L1521 connecting the proposed development with N11 national road and R918 regional road. Phase 1 of development in Fassaroe is identified as incorporating approximately 650 residential units. In order to also assess the impact of a potential further build out at Fassaroe in the +9 year a sensitivity analysis was included to account for a second phase of development (Phase 2) up to a combined total of 1,200 units on this site.

Table 9.43: Changes in Traffic Volumes with Proposed Development

Road Link	Percentage Increase Traffic Volumes because of the Proposed Development	
	Opening Year	Opening Year +5
N11	2.2%	2.3%
R918	5.8%	5.5%
L1521	22.4%	21.3%
Ballyman Road	2.0%	2.8%
Berryfield Lane	6.1%	8.3%

The predicted change in noise from road traffic was calculated using Calculation of Road Traffic Noise (CRTN), Department of Transport Welsh Office, HMSO 1988. The magnitude of noise effects was assessed using the criteria in the UKs DMRB LA 111 - Noise and vibration, Revision 2 (2020) which distinguishes between short-term and long-term impacts on the basis that receptors habituate to road traffic noise and annoyance/sleep disturbance effects reduces over time.

When the predicted additional traffic flow from the proposed development is added to the existing traffic flow, the do-something scenario noise level shows a negligible increase (< 1dB in short term and long-term) in predicted traffic noise levels from the N11, R918, L1521, Ballyman Road and Berryfield Lane, and this is not significant in EIA terms.

9.5.3.6 Traffic Noise Impacts on Proposed Residential Units

The proposed development is located approximately 475m from the N11 national road with an AADT of 58,308 in 2021 (AADT maximum recorded was 70,199 in 2019) and this is projected to grow to 85,233 when the second phase of development (Phase 2) up to a combined total of 1,200 units on this site is included. Traffic noise impacts on the proposed residential units was assessed using the BS8223:2014 criteria.

Baseline noise levels at location NML1 are dominated by traffic noise from the N11. This location is approximately 100m closer to the N11 compared to the nearest dwellings in Block 01 in Area 1. Hence, the noise from the N11 will be lower at Block 01 in Area 1 compared to the levels at NML 1.

Table 9.44 presents the average internal noise levels (assuming a 15 dB façade attenuation for an open window) during daytime (07:00 – 23:00 hrs) and night-time periods (23:00 – 07:00 hrs) at NML3. The average internal noise levels do not exceed the BS 8233 guideline values.

Table 9.44: Average Noise Levels at Locations NML1 and BS 8233 Guideline Values

Start Time	Average L_{Aeq}	BS 8233 Guideline Values
09/11/2021 15:15 - 09/11/2021 23:00*	25	35 dB $L_{Aeq,16hr}$ (Resting) 40 dB $L_{Aeq,16hr}$ (Dining)
09/11/2021 23:00 - 10/11/2021 07:00	29	30 dB $L_{Aeq,8hr}$ (Resting)
10/11/2021 07:00 - 10/11/2021 23:00	31	35 dB $L_{Aeq,16hr}$ (Resting) 40 dB $L_{Aeq,16hr}$ (Dining)
10/11/2021 23:00 - 11/11/2021 07:00	30	30 dB $L_{Aeq,8hr}$ (Resting)
11/11/2021 07:00 - 11/11/2021 15:00*	32	35 dB $L_{Aeq,16hr}$ (Resting) 40 dB $L_{Aeq,16hr}$ (Dining)

*Full 16-hour period not measured

With respect to external amenity areas, the average noise levels are lower below the lower guideline value of 50 dB $L_{Aeq,T}$. The traffic noise impacts on the proposed development are not significant in EIA terms. However, there is expected traffic growth with and without the proposed development (see **Table 9.42**Table 9.42) with traffic growth resulting in up to a 2 dB increase in noise level from the N11 national road. The traffic noise impacts including future growth on the proposed development are not significant in EIA terms.

9.6 Mitigation Measures

9.6.1 Construction Phase

Construction works will be temporary and limited in duration. The timing of construction activities, working hours and the rate of progress of construction works are a balance between efficiency of construction and minimising the impact on the local community and road users. Constraints will be specified in the contract documents, generally restricting working hours on the proposed development.

Section 9.5.2 predicted noise from construction activities which may give rise to potentially significant impacts if not carefully managed. This is the case when noisy activities need to be completed in close proximity to sensitive receptors. Construction scheduling will be planned to minimise any overlap and carefully control activities when being carried out close to sensitive receptors.

Construction working hours ('normal hours') adjacent to residential areas or sensitive noise receptors will be limited to:

- 7am - 7pm, Monday to Friday; and
- 7am - 2 pm, Saturday
- Sunday – no working
- Bank and Public Holidays – no working

The proposed apartment buildings and the Neighbourhood Centre are remote from existing residences. Given the nature of the proposed apartment buildings and the Neighbourhood Centre, their construction will require a number of large concrete pours which for technical reasons require significantly longer working days. It is not unusual that such activities would require construction time-blocks of approximately 15 hours. Given the nature of construction and a range of influencing factors it is not possible to predict or programme far in advance the exact dates on which extended construction hours will be necessary. It is proposed that the developer however will provide notification to the Planning Authority a week in advance of these occurrences.

The noise predictions are based on activities being carried out close to receptors where such activities will be temporary in duration, localised and will be further mitigated by noise control measures implemented by the contractor on site.

BS5228:2009+A1:2014 – Noise and vibration control on construction and open sites outlines a range of measures which have now become standard good practice measures that can be used to reduce the impact of construction phase noise and vibration on the nearest noise sensitive locations. These measures will be applied by the contractor where appropriate during the construction phase of the proposed development.

Construction Noise Control

The contractor will engage a competent professional to monitor and provide regular reports on construction noise. The monitoring results will be reviewed and any control measures necessary to deliver on the commitments in this EIAR adopted over the course of the works.

The contractor can exercise considerable control over noise levels by careful scheduling of works. The contractor will draft a construction method statement, prior to the commencement of works, outlining the measures to be taken during construction to avoid and mitigate construction noise.

BS 5228 outlines several issues associated with noise effects that influence the community reaction to the noise. The duration of site operations, the hours in which specific activities are carried out, the attitude of the public to the site operator and the use of effective mitigation measures are all important considerations in managing construction noise.

Construction noise has been modelled based on all the sources are operating simultaneously and close to the noise sensitive locations. In practical terms, the sources will be distributed throughout the construction site and in operation on a cyclical basis, depending on specific tasks.

The contractor will implement a programme of noise management measures that will include; engagement with the community on the activities that need to be carried out, the timing and duration of such activities, commitment to specific hours of work and the use of quiet work methods such as the selection of low-noise plant and operating methods. Wicklow County Council and potentially affected residents will be kept informed of the works to be carried out and of any proposals for any work outside normal hours.

The contractor will provide contact details on a site notice board and through contact with residents of the proposed scheduling of noisy activities, the control and monitoring measures to be taken and contact details of a responsible person to whom noise complaints can be addressed.

Two construction activities (Construction of buildings in area 5 and demolition of a single dwelling on Berryfield Lane) were identified with the potential to have noise levels in excess of the noise guidance thresholds. It is proposed that a 3.6m high double skinned solid site hoarding is located along the site boundary adjacent to receptors R33 and R148. It is also proposed that existing walls will be retained along the Berryfield Lane and raised to a height of 3.6 metres using double skinned solid plywood site hoarding. Where no walls are present a 3.6 m high double skinned solid plywood barrier will be erected adjacent to receptors on Berryfield Lane in proximity to construction works. This mitigation measure can offer up to 5 – 10 dB reduction on construction noise levels.

During the demolition works, it is proposed that a temporary noise barrier is installed adjacent to construction works.

Specific construction good practice measures from BS5228 will be implemented by the contractor as listed below:

- Ensuring that mechanical plant and equipment used for the purpose of the works are fitted with effective exhaust silencers and are maintained in good working order;
- Selection of quiet plant and machinery to undertake the required work where available;
- All major compressors will be ‘sound reduced’ models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use;
- Any ancillary pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers;
- Machines in intermittent use will be shut down in the intervening periods between work;
- Ancillary plant such as generators, compressors and pumps will be placed behind existing physical barriers, and the direction of noise emissions from plant including exhausts or engines will be placed away from sensitive locations, in order to cause minimum noise disturbance. Where possible, in potentially sensitive areas, temporary construction barriers or enclosures will be utilised around noisy plant and equipment;
- Use of temporary localised screening for specific activities as required;

- Handling of all materials will take place in a manner which minimises noise emissions; and
- Audible warning systems will be switched to the minimum setting required by the Health & Safety Authority.

Further controls will be implemented during the demolition activity including:

- Programming of works to avoid simultaneous noisy activities, (e.g., piling in two locations);
- Retaining outer walls as barriers for as long as possible before demolition;
- Switching off plant when not in use; and
- Temporary acoustic barriers will be used where warranted for specific activities close to sensitive receptors to minimise noise breakout.

Construction Vibration Control

As outlined in **Section 9.5.2.9** construction vibration impacts will not be significant. There may however be a risk of vibration impacts on badgers close to construction activities. In order to protect badgers from potential impacts a survey of the proposed site will be carried out within 10 months of the start of construction to identify any badger setts within 150 m of the proposed working area. If any badger setts are found the procedures set out in the TII Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes will be followed.

Consultation and Communication

Mitigation in the form of timely and effective stakeholder consultation is outlined in Sections 0 and 0. This will ensure that residents are kept informed of on-going and future operations. For example, local residents would be informed by letter drop of proposed works, particularly where these are due to occur outside standard working hours. The letter would include details of proposed cause, start dates and duration of works to be carried out.

9.6.2 Operational Phase

The proposed development scheme spans an area of 78.5 ha with 650 residential units in 5 no. of character areas across the development site. Given the extent of the development, some residential units are in proximity to N11 national road, Fassaroe 110 kV substation and EPA licensed facilities Roadstone Quarry and Starrus Eco Waste Transfer Facility and a gas flare as part of the gas management system for remediation of the historic landfills within the wider site boundary.

Starrus Eco Waste Transfer Facility

The waste transfer facility is north of apartment blocks 01, 02 and 03 in character area 1 and east/southeast of dwellings located on Street 04 and 06 in character area 2. In some instances the In some instances, the internal noise levels are above the BS8233:2014 guideline values. However, BS 8233 states… *"Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved".* With the internal guidelines relaxed by up to 5 dB, the average internal noise levels are below the relaxed guidelines. With respect to external amenity areas, the $L_{Aeq,16hr}$ noise levels measured were below the upper range (55 dB $L_{Aeq,16hr}$) in BS 8223:2014. However, the is potential that the average noise levels may be higher at upper floors in the proposed apartment blocks in area 1.

To mitigate the noise impact for receptors facing the Starrus Eco Waste Transfer Facility, it is recommended that a noise barrier is installed along the boundary with the WTF. The barrier can be blended into the surrounding with the planting of mature trees. With this mitigation the amenity noise levels will be reduced.

It is also recommended that dwellings nearest the WTF be acoustically treated with enhanced glazing, acoustic vents and enhanced roof insulation. The exact details and dwelling numbers will be determined at detailed design stage. The façade of the nearest dwellings to the WTF site boundary will act as a barrier for other dwellings in character areas 1 and 2.

The exact height of the noise barrier will be determined in conjunction with the detail of the acoustic treatment within the dwellings to ensure the noise levels will be below the BS8233:2014 internal guidelines values and the noise impact will not be significant in EIA terms. It is possible that the barrier may be up to a maximum requirement of 4m to ensure compliance with the guidelines.

Fassaroe 110 kV Substation

Fassaroe 110 kV substation is located off the Berryfield Lane. A BS4142 assessment was undertaken for receptors in close proximity to the substation. The noise from the substation will have a significant adverse impact during all periods and at the current noise levels is likely to result in complaints. To mitigate the noise impact at the nearest receptors several mitigation measures are proposed.

It is recommended that a noise barrier adjoining the substation boundary is installed. The noise barrier should block direct line of sight with the nearest dwellings. To further mitigate the noise, it is recommended that a 2m stone wall be installed along the boundary of dwelling nos. 7 – 11, 18 – 20, 21 – 30 and 31 in character area 5. The wall could be softened with planting. The façade of the dwellings above will act as a barrier for other dwellings in character area 5. With this mitigation, the amenity noise levels will be reduced.

It is also recommended that dwellings nearest the substation will be acoustically treated with enhanced glazing, acoustic vents and enhanced roof insulation. The exact details will be determined at detailed design stage. With the mitigation measures in place the noise impact will not be significant in EIA terms.

9.7 Residual Effects

9.7.1 Construction Phase

Pre-mitigation, the predicted construction noise impacts are anticipated to result in effects ranging from not significant to significant at some noise sensitive receptors. With mitigation the significance rating will reduce to moderate, and this is expected to result in brief effects.

Construction vibration impacts range from imperceptible to not significant significance rating.

No significant residual effects will arise.

9.7.2 Operational Phase

There are no significant vibration impacts in the operational phase.

With mitigation measures, no significant residual effects are predicted for existing residents and residents as part of the proposed development.

9.8 Cumulative Impact Assessment

There are no other notable developments currently proposed within the Fassaroe area. The main potential for cumulative impact in the immediate vicinity arises from the future development of the remainder of the Action Area lands which allow for considerable amounts of future mixed-use high-density development.

While this EIAR relates to the current Phase 1 application proposal, regard to the potential future nature of cumulative impacts that may arise due to the future development of the entire Action Area lands has been considered.

A notable permitted development in the slightly wider area is the Irish Water reservoirs at Ballyman which have been granted permission and which will ultimately serve much of the new development lands of the southern part of Dun Laoghaire Rathdown County Council and northern Wicklow, including the Fassaroe lands themselves.

Also, in the Ballyman area, is a current proposal by Dún Laoghaire Golf Club for an additional nine golf course holes as an extension to its existing golf course at Ballyman. This application (Dún Laoghaire Rathdown County Council Reference No. D21A/0103) is currently being considered by Dún Laoghaire Rathdown County Council.

9.9 Monitoring

Other than the monitoring specific for construction stage no further ongoing monitoring is considered necessary.

10 LANDSCAPE AND VISUAL IMPACT ASSESSMENT

10.1 Introduction

This chapter assesses the potential effects of the proposed development on the landscape and visual amenity in the receiving environment.

The chapter was prepared by Richard Butler (B LArch , MSc Sp Planning, MILI, MIPI) of Model Works Ltd. Richard has degrees in landscape architecture and planning and is a member of the Irish Landscape Institute and the Irish Planning Institute. He has over 20 years' experience in development and environmental planning, specialising in Landscape/Townscape and Visual Impact Assessment (LVIA).

10.2 Methodology

The chapter was prepared with reference to the Landscape Institute's *Guidelines for Landscape and Visual Impact Assessment*, 2013 (GLVIA) and Technical Information Note *Townscape Character Assessment,* and the EPA draft *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*, 2017.

10.2.1 Key Principles of the 'Guidelines for Landscape and Visual Impact Assessment' GLVIA

10.2.1.1 Use of the Term 'Effect' vs 'Impact'

The GLVIA requires that the terms 'impact' and 'effect' be clearly distinguished and consistently used. 'Impact' is defined as the action being taken, e.g. the introduction to the landscape of buildings, infrastructure or landscaping. 'Effect' is defined as the change resulting from those actions, e.g. change in townscape character or the visual amenity experienced at a vantage point.

10.2.1.2 Assessment of Both 'Landscape/Townscape' and 'Visual' Effects

The GLVIA requires that effects on views and visual amenity be assessed separately from the effects on landscape, although the two topics are inherently linked.

'Landscape' results from the interplay between the physical, natural and cultural components of our surroundings. Different combinations and spatial distribution of these elements create variations in landscape character (or 'townscape' in urban areas). Landscape impact assessment identifies the changes to this character which would result from the proposed development, and assesses the significance of those effects on the landscape as a resource.

Visual impact assessment is concerned with changes that arise in the composition of available views, the response of people to these changes and the overall effects on the area's visual amenity.

10.2.2 Methodology for Assessment of Landscape Effects

Assessment of potential landscape effects involves (a) classifying the sensitivity of the landscape resource, and (b) describing and classifying the magnitude of landscape change which would result from the development. These factors are then combined to arrive at a classification of significance of the effects.

10.2.2.1 Landscape Sensitivity

Five categories are used to classify landscape sensitivity (**Table 10.1**).

Table 10.1: Categories of Landscape Sensitivity

Sensitivity	Description
Very High	Areas where the landscape exhibits very strong, positive character with valued elements, features and characteristics that combine to give an experience of unity, richness and harmony. The landscape character is such that its capacity to accommodate change is very low. These attributes are recognised in policy or designations as being of national or international value and the principle management objective for the area is protection of the existing character from change.
High	Areas where the landscape exhibits strong, positive character with valued elements, features and characteristics. The landscape character is such that it has limited/low capacity to accommodate change. These attributes are recognised in policy or designations as being of national, regional or county value and the principle management objective for the area is the conservation of existing character.
Medium	Areas where the landscape has certain valued elements, features or characteristics but where the character is mixed or not particularly strong, or has evidence of alteration, degradation or erosion of elements and characteristics. The landscape character is such that there is some capacity for change. These areas may be recognised in policy at local or county level and the principle management objective may be to consolidate landscape character or facilitate appropriate, necessary change.
Low	Areas where the landscape has few valued elements, features or characteristics and the character is weak. The character is such that it has capacity for change; where development would make no significant change or would make a positive change. Such landscapes are generally unrecognised in policy and the principle management objective may be to facilitate change through development, repair, restoration or enhancement.
Negligible	Areas where the landscape exhibits negative character, with no valued elements, features or characteristics. The character is such that its capacity to accommodate change is high; where development would make no significant change or would make a positive change. Such landscapes include derelict industrial lands, as well as sites or areas that are designated for a particular type of development. The principle management objective for the area is to facilitate change in the landscape through development, repair or restoration.

Note on Definitions Used in this Assessment

The definitions of the classifications in **Table 10.1** (Landscape Sensitivity), **Table 10.2** (Magnitude of Landscape Change), **Table 10.5** (Viewpoint Sensitivity) and **Table 10.6** (Magnitude of Visual Change) are not taken from either the GLVIA or the EPA Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, 2017.

Both of these guidance documents require that classifications of sensitivity and magnitude of change (such as high, medium, low, etc.) be used in the assessment process (see EPA Draft Guidelines Figure 3.5 and GLVIA Box 3.1, Paragraph 3.26 and Figure 3.5), but neither guidance document provides definitions for such classifications.

The GLVIA specifically avoids being prescriptive in this regard (GLVIA paragraph 1.20): *"The guidance concentrates on principles while also seeking to steer specific approaches where there is a general consensus on methods and techniques. It is not intended to be prescriptive, in that it does not provide a detailed 'recipe' that can be followed in every situation. It is always the primary responsibility of any landscape professional carrying out an assessment to ensure that the approach and methodology adopted are appropriate to the particular circumstances."* (emphasis added)

The EPA's Draft Guidelines state (Section 3, p.49): *"While guidelines and standards help ensure consistency, the professional judgement of competent experts plays a role in the determination of significance. These experts may place different emphases on the factors involved. As this can lead to differences of opinion, the EIAR sets out the basis of these judgements so that the varying degrees of significance attributed to different factors can be understood."* (emphasis added)

The GLVIA and EPA Draft Guidelines thus require that the factors used in arriving at significance conclusions (i.e. sensitivity and magnitude) should be explained in the EIAR, but the guidelines do not provide the explanations themselves.

It is for this reason that the definitions in **Tables 10.1, 10.2, 10.5** and **10.6** are provided. These definitions have been developed and refined by various LVIA practitioners in Ireland, including the chapter author, over decades of practice. They are not standard, i.e., the classifications/definitions used in this assessment may differ from those used by other practitioners. However, the author considers these definitions to be reasonable and appropriate for the purpose of classifying the significance of landscape/ townscape and visual impacts. The same definitions have been used in many previous LVIA reports/ chapters prepared by the author and accepted by planning authorities.

10.2.2.2 Magnitude of Landscape Change

Magnitude of change is a factor of the scale, extent and degree of change imposed on the landscape by a development, with reference to its key elements, characteristics or character areas (also known as 'landscape receptors'). Five categories are used to classify magnitude of change (refer to 'Note on definitions used in this assessment' in section 10.2.2.1 above).

Table 10.2: Categories of Magnitude of Landscape Change

Magnitude of Change	Description
Very High	Change that is large in extent, resulting in the loss of or major alteration to key elements, features or characteristics of the landscape, and/or introduction of large elements considered totally uncharacteristic in the context. Such development results in fundamental change in the character of the landscape.
High	Change that is moderate to large in extent, resulting in major alteration to key elements, features or characteristics of the landscape, and/or introduction of large elements considered uncharacteristic in the context. Such development results in change to the character of the landscape.
Medium	Change that is moderate in extent, resulting in partial loss or alteration to key elements, features or characteristics of the landscape, and/or introduction of elements that may be prominent but not necessarily substantially uncharacteristic in the context. Such development results in change to the character of the landscape.
Low	Change that is moderate or limited in scale, resulting in minor alteration to key elements, features or characteristics of the landscape, and/or introduction of elements that are not uncharacteristic in the context. Such development results in minor change to the character of the landscape.
Negligible	Change that is limited in scale, resulting in no alteration to key elements features or characteristics of the landscape, and/or introduction of elements that are characteristic of the context. Such development results in no change to the landscape character.

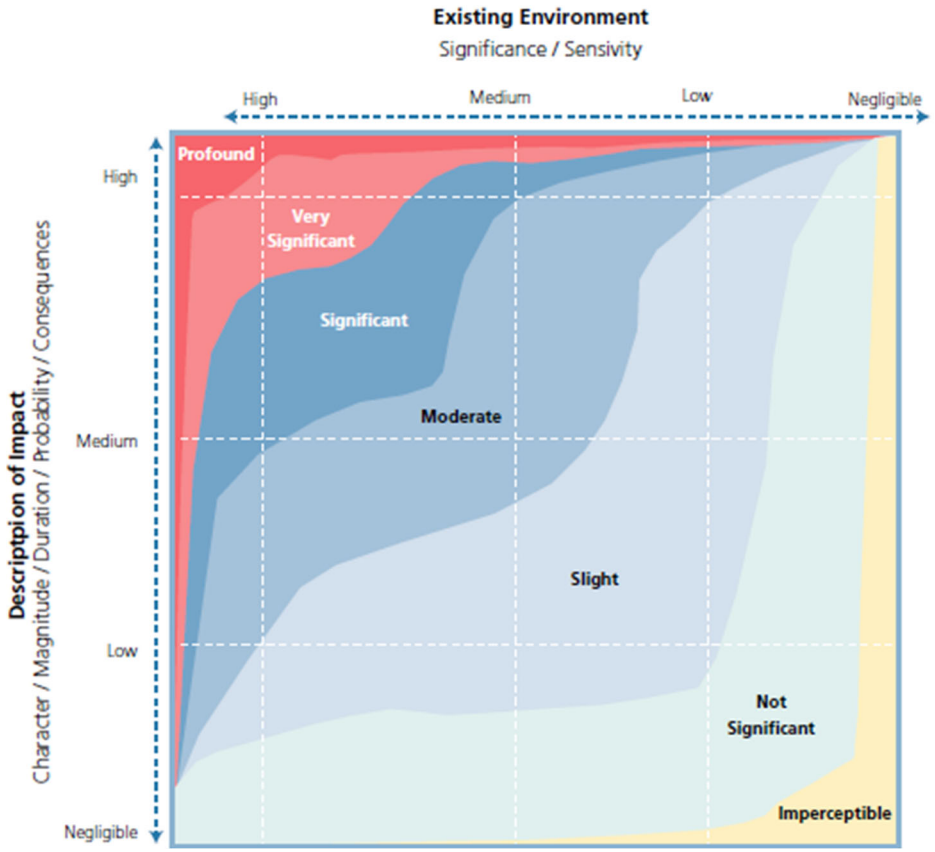
10.2.2.3 Significance of Effects

To classify the significance of effects the magnitude of change is measured against the sensitivity of the landscape using **Table 10.3** and **Figure 10.1** as a guide. The significance classification matrix (**Table 10.3**) is derived from the EPA's Draft *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*, 2017 (specifically Figure 3.5 of the Guidelines – see **Figure 10.1** below).

Table 10.3: Guide to Classification of Significance of Landscape and Visual Effects

		Sensitivity of the Landscape/View				
		Very High	**High**	**Medium**	**Low**	**Negligible**
Magnitude of Change to the Landscape/View	**Very High**	*Profound*	*Profound to Very Significant*	*Very Significant to Significant*	*Moderate*	*Slight*
	High	*Profound to Very Significant*	*Very Significant*	*Significant*	*Moderate to Slight*	*Slight to Not Significant*
	Med-ium	*Very Significant to Significant*	*Significant*	*Moderate*	*Slight*	*Not Significant*
	Low	*Moderate*	*Moderate to Slight*	*Slight*	*Not significant*	*Imperceptible*
	Neg-ligible	*Slight*	*Slight to Not Significant*	*Not significant*	*Imperceptible*	*Imperceptible*

Figure 10.1: 'Chart showing typical classifications of the significance of impacts' (Source: Figure 3.5 of the EPA's Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, 2017)



The matrix and the EPA's chart (**Figure 10.1**) are only a guide to the classification of significance. The assessor also uses professional judgement informed by their expertise, experience and common sense to arrive at a classification that is reasonable and justifiable. In the EPA guidelines the chart (**Figure 10.1**) is accompanied by a footnote that states: *"The depiction of significance classifications is indicative and should not be relied on as being definitive. It is provided for general guidance purposes"* (EPA Draft Guidelines Section 3, page 53. Emphasis added).

The impact significance classifications are taken from the EPA Draft Guidelines, which define the classifications as follows (**Table 10.4**):

Table 10.4: Impact Significance Classifications

Significance	Description
Imperceptible	An effect capable of measurement but without significant consequences.
Not significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
Significant	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
Profound	An effect which obliterates sensitive characteristics.

10.2.3 Methodology for Assessment of Visual Effects

Assessment of visual effects involves identifying a number of key/representative viewpoints in the site's receiving environment, and for each one of these: (a) classifying the viewpoint sensitivity, and (b) classifying the magnitude of change which would result from the proposed development. These factors are combined to arrive at a classification of significance of the effects on each viewpoint.

10.2.3.1 Sensitivity of the Viewpoint/Visual Receptor

Viewpoint sensitivity is a function of two main considerations:

- Susceptibility of the visual receptor to change. This depends on the occupation or activity of the people experiencing the view, and the extent to which their attention is focussed on the views or visual amenity they experience at that location. Visual receptors most susceptible to change include residents at home, people engaged in outdoor recreation focused on the landscape (e.g., trail users), and visitors to heritage sites or other places where the setting contributes to the experience. Receptors less sensitive to change include road, rail and other transport users (unless on recognised scenic routes), people engaged in outdoor recreation or sports where the setting does not influence the experience, and people in their place of work or shopping.
- Value attached to the view. This depends to a large extent on the subjective opinion of the visual receptor but also on factors such as policy and designations (e.g., scenic routes, protected views), or the view or setting being associated with a heritage asset, visitor attraction or having some other cultural status (e.g., by appearing in arts).

Five categories are used to classify a viewpoint's sensitivity (refer to 'Note on definitions used in this assessment' in section 10.2.2.1 above).

Table 10.5: Categories of Viewpoint Sensitivity

Sensitivity	Description
Very High	Iconic viewpoints (views towards or from a landscape feature or area) that are recognised in policy or otherwise designated as being of national value. The composition, character and quality of the view are such that its capacity for change is very low. The principle management objective for the view is its protection from change.
High	Viewpoints that are recognised in policy or otherwise designated as being of value, or viewpoints that are highly valued by people that experience them regularly (such as views from houses or outdoor recreation features focused on the landscape). The composition, character and quality of the view may be such that its capacity for accommodating change may or may not be low. The principle management objective for the view is its protection from change that reduces visual amenity.
Medium	Views that may not have features or characteristics that are of particular value, but have no major detracting elements, and which thus provide some visual amenity. These views may have capacity for appropriate change and the principle management objective is to facilitate change to the composition that does not detract from visual amenity, or which enhances it.
Low	Views that have no valued feature or characteristic, and where the composition and character are such that there is capacity for change. This category also includes views experienced by people involved in activities with no particular focus on the landscape. For such views the principle management objective is to facilitate change that does not detract from visual amenity or enhances it.
Negligible	Views that have no valued feature or characteristic, or in which the composition may be unsightly (e.g. in derelict landscapes). For such views the principle management objective is to facilitate change that repairs, restores or enhances visual amenity.

10.2.3.2 Magnitude of Change to the View

Classification of the magnitude of change takes into account the size or scale of the intrusion of development into the view (relative to the other elements and features in the composition, i.e., its relative visual dominance), the degree to which it contrasts or integrates with the other elements and the general character of the view, and the way in which the change will be experienced (e.g., in full view, partial or peripheral view, or in glimpses). It also takes into account the geographical extent of the change, as well as the duration and reversibility of the visual effects.

Five categories are used to classify magnitude of change to a view (refer to 'Note on definitions used in this assessment' in section 10.2.2.1 above):

Table 10.6: Categories of Magnitude of Visual Change

Magnitude of Change	Description
Very High	Full or extensive intrusion of the development in the view, or partial intrusion that obstructs valued features or characteristics, or introduction of elements that are completely out of character in the context, to the extent that the development becomes dominant in the composition and defines the character of the view and the visual amenity.
High	Extensive intrusion of the development in the view, or partial intrusion that obstructs valued features, or introduction of elements that may be considered uncharacteristic in the context, to the extent that the development becomes co-dominant with other elements in the composition and affects the character of the view and the visual amenity.
Medium	Partial intrusion of the development in the view, or introduction of elements that may be prominent but not necessarily uncharacteristic in the context, resulting in change to the composition but not necessarily the character of the view or the visual amenity.

Magnitude of Change	Description
Low	Minor intrusion of the development into the view, or introduction of elements that are not uncharacteristic in the context, resulting in minor alteration to the composition and character of the view but no change to visual amenity.
Negligible	Barely discernible intrusion of the development into the view, or introduction of elements that are characteristic in the context, resulting in slight change to the composition of the view and no change in visual amenity.

10.2.3.3 Significance of Visual Effects

As with landscape effects, to classify the significance of visual effects, the magnitude of change to the view is measured against the sensitivity of the viewpoint, using the guides in **Table 10.3** and **Figure 10.1** above.

10.2.4 Quality of Effects

In addition to predicting the significance of the effects, EIA methodology [draft EPA guidelines Table 3.3, p.50] requires that the quality of the effects be classified as positive/beneficial, neutral, or negative/adverse.

For landscape to an extent, but particularly for visual effects, this is an inherently subjective exercise. This is because landscape and visual amenity are *perceived* by people and are therefore subject to variations in the attitude and values – including aesthetic preferences - of the receptor. One person's attitude to a development may differ from another person's, and thus their response to the effects of a development on a landscape or view may vary. Additionally, in certain situations there might be policy encouraging a particular development in an area, in which case the policy is effectively prescribing landscape change. If a development achieves the objective of the policy the resulting effect might be considered positive, even if the landscape character is profoundly changed. The classification of quality of landscape and visual effects should seek to take these variables into account and provide a reasonable and robust assessment.

10.2.5 Photomontage Methodology

The verified photomontages were produced by Model Works Ltd. The photomontage methodology is based on the Landscape Institute advice note 01/11 *Photography and Photomontage in Landscape and Visual Impact Assessment*. The method has five main steps:

- Photography
- Survey
- 3D Modelling and Camera Matching
- Rendering and Finishing of Photomontages
- Presentation

10.2.5.1 Photography

Date, Time and Conditions: The photography is timed so that the scene conditions, weather conditions and sun position allow - as far as possible - for a clear and representative baseline photograph to be captured. The date and time of each photograph are recorded so that the sun position can be accurately portrayed in the photomontage.

Camera: The photographs are taken using a Canon EOS5D Mark II camera with a 21 mega pixel sensor and image resolution of 5616 x 3744 pixels. At each viewpoint the camera was positioned on a tripod with the lens 1.65m above ground level (the level of the average adult's eyes), directed at the site and levelled in the horizontal and vertical axes.

Lenses: Prime lenses (fixed focal length with no zoom function) are used as this ensures that the image parameters for every photograph are the same and that all photographs taken with the same lens are comparable. For close-up to middle distant views a 24mm prime lens is normally usually used. This lens captures a field of view of 73 degrees. This relatively wide field of view is preferred for the purpose of Landscape and Visual Impact Assessment as it shows more of the context landscape surrounding a site. For distant viewpoints a 50mm prime lens may be used, capturing a 39 degree horizontal field of view.

10.2.5.2 Survey

The coordinates of each viewpoint/camera position, including the elevation, are recorded using a survey grade GPS receiver, the Trimble Geo7X, which is accurate to within 1cm. For each viewpoint, the coordinates of several static objects in the view are also surveyed (e.g. lamp posts, bollards, corners of buildings, etc.). The coordinates of these 'markers' are used as reference points later in the process, to ensure that the direction of view of the cameras in the 3D model matches the direction of view of the photographs.

10.2.5.3 3D Model and Camera Matching

Creation of 3D Model: Using the information contained in the design team's drawings, a 3D model of the proposed development is built in the software package Autodesk 3DS Max. The 3D model is georeferenced to a survey drawing of the site and receiving environment.

3D Camera Positions: The surveyed camera positions and the markers for each view are inserted into the 3D model, with information on the focal length of the lens attributed to each camera. For each camera/view, the date and time is set to match those of the original photograph. This ensures that the direction of sunlight and shadows in the 3D model match those of the photographs.

Camera Matching: The photographs are then inserted as backdrops to the views of each camera in the 3D model. The direction of view of the cameras in the 3D model are matched with the direction of view of the photographs using the surveyed markers. This ensures that the camera positions, the direction of the views and the focal length of the cameras in the 3D model are accurate, so that the proposed development appears in the correct position and scale when montaged into the photographs.

10.2.5.4 Rendering of 3D Model and Finishing of Photomontages

For each view a render of the development is generated. This is the process of creating a photo-realistic image of the 3D model, as seen from each camera position, with sunlight and shadow applied to the model. The render of the development is then inserted into the photograph to create the photomontage. This involves masking (or cutting out) those parts of the render that are obscured by objects in the foreground of the photograph, and masking distant objects behind the render – so that the render fits seamlessly into the photograph.

10.2.5.5 Presentation

The individual photomontages are presented on A3 pages in landscape format in **Appendix 10A** of Volume 4 of this EIAR). For each photomontage, the viewpoint number, location description, and the date and time of photography are provided on the page.

10.3 Receiving Environment

10.3.1 Overview

The Fassaroe lands are located to the west of Bray and the N11. The area is mostly greenfield but the landscape can be described as peri-urban in character, in that the farmland is interspersed with a mix of urban-generated development typical of areas surrounding an urban centre (e.g., the houses on Berryfield Lane, the quarry, waste processing plant, soccer club and substation).

The Fassaroe lands have been identified for the expansion of the Bray urban area since the 1990s. Bray is identified as a Metropolitan Consolidation Town in the Regional Planning Guidelines for the Greater Dublin Area (2010-2022), with Fassaroe specifically mentioned (p.73): *"Fassaroe is considered a suitable location to facilitate long term and large scale economic growth and should be developed in tandem with consolidation of Bray town…"*.

The lands were zoned for development in the 1999, 2004, 2010 and 2016 (current) Wicklow County Development Plans, and the Bray Environs Local Area Plan (LAP) 2009. The current plan for the area is the Bray Municipal District Local Area Plan 2018-2024 (the 'Bray MD LAP 2018'), in which Fassaroe is identified as Action Area Plan 1 (AAP1) regarding which the LAP states (p.58): *"Fassaroe is identified as the location of major development in Bray; the growth of the settlement in accordance with regional plan targets is contingent on the delivery of the major residential and community services development at this location, there being no other suitable lands in the environs of Bray for such large scale development"*. (emphasis added)

The area has thus long been designated for transformation from peri-urban to urban in character. This landscape change has been deemed acceptable in principle through the process of Strategic Environmental Assessment (SEA). The SEA Environmental Report for the Bray MD LAP 2018 states: *"The potential impacts on landscape and visual amenity are predominantly neutral with some positive impacts likely to occur. Development would generally be consolidated within Bray town centre, undertaken on appropriately zoned lands in Fassaroe and generally avoid impacts on landscape and visual amenity."*

10.3.2 The Fassaroe Lands

10.3.2.1 Topography

Fassaroe occupies a domed area of land between two parallel tributaries of the Dargle River, namely County Brook (Fassaroe Stream) to the north and the Cookstown River to the south.

The central western part of the area is relatively elevated and flat, and the land falls towards the north, south and east (into the valleys of County Brook, Cookstown River and the Dargle River respectively). The slope above County Brook to the north is particularly steep (as shown by the graded shading in the map below).

Figure 10.2: Topography of the Fassaroe lands (extract from the Fassaroe Masterplan 2010 (no longer applicable under Bray MD LAP 2018 but baseline topographical information shown, remains valid))

There has been disturbance of the natural topography in several areas. Most notable among these is the extensive quarry south of Berryfield Avenue, where the landscape is characterised by large excavations, flat hard standings, dams, stockpiled material and screening mounds. Towards the north east there is a dry waste treatment facility, also located in a large excavation and enclosed by screening mounds. In the eastern part of the area there have been extensive earthworks alongside the N11 and both sides of the access road to Fassaroe, resulting in tall, steep embankments above the roads.

10.3.2.2 Land Use and Landcover

The majority of the Fassaroe area is in agricultural use, with relatively large, irregularly shaped fields variously divided by hedgerows or fences. The other land uses include the quarry, the waste treatment facility, sports club and three clusters of residential and commercial use:

- One of these, comprising several houses and two business premises, is located in the north east of the lands along Thornhill Road near the waste facility.
- The second is a row of houses and a business premises along Berryfield Lane at the centre of Fassaroe. The landscape has a suburban character in this area.
- To the south east, off Kilbride Lane which leads to the quarry, there are several large houses on extensive properties.

There is an electrical substation in the western part of the Fassaroe lands along Berryfield Lane, and the Fassaroe lands are traversed by several power lines on both steel lattice and timber pylons.

Figure 10.3: Aerial photograph showing the majority of the Fassaroe lands in agricultural use, the quarry and waste facility and the wooded river valleys to the north and south

Figure 10.4: A view from Berryfield Lane across the sloping lands of Fassaroe towards Bray and the coastline to the east

Vegetation

There are trees in some of the hedgerows but overall there are few trees or tree groups of landscape-scale significance. The exceptions to this include (a) a shelter belt of trees around Berryfield House, (b) a belt of screening vegetation on the embankments surrounding the waste facility, (c) belts of screening vegetation on the embankments either side of the Fassaroe access road, and (d) the woodland in the river valleys.

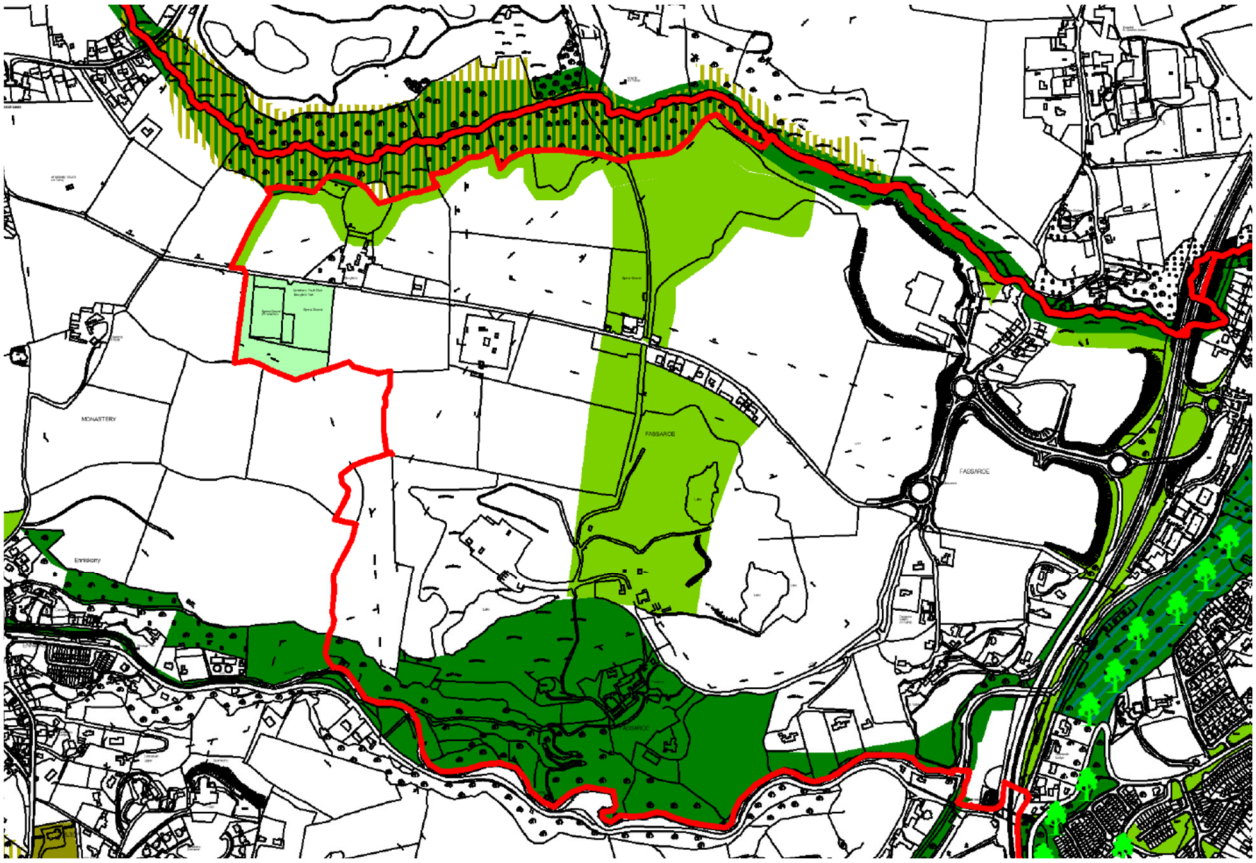
There are several small conifer plantations in the vicinity of the quarry in the southern part of the lands, and extensive scrub in and around the quarry itself.

Designated Areas

There are broad belts of woodland in the valleys of County Brook to the north and the Cookstown River to the south. Part of the wooded valley to the north (known as Ballyman Glen) is designated a Special Area of Conservation (SAC) and proposed Natural Heritage Area (pNHA).

The southern woodland belt is somewhat eroded by the residential properties in the area (the houses along Kilbride Lane), which are effectively carved out of the woodland. This vegetation – the woodland belts as collective features, and numerous individual specimens - are the most valuable landscape assets of the Fassaroe area.

Figure 10.5: Excerpt from Bray MD LAP 2018 Green Infrastructure map showing the wooded valleys to north and south of Fassaroe, including the SAC designation of Ballyman Glen



10.3.3 The Wider Landscape Surrounding Fassaroe

The topography of the Bray environs is complex. Behind the sloping coastal plain on which Bray is built the landscape is characterised by deep, steeply incised river valleys and steep-sided conical mountains. In this context the Fassaroe lands are relatively flat and at middling elevation; neither particularly elevated (therefore not exposed) nor sunken (therefore not hidden) in the landscape.

The Dargle River passes in a deep valley to the east of Fassaroe. The M11 follows the valley as it passes the lands. The valley sides and motorway embankments are heavily vegetated and in combination they form a broad corridor which separates Fassaroe from Bray both physically and visually. Beyond the Dargle River the land rises steeply then flattens and falls towards the coastline. This area is occupied by the Bray urban area. The urban grain is largely determined by the topography. The town orientates east towards the coast. Only a small proportion of the urban area - and few buildings and open spaces – are visually exposed to Fassaroe to the west.

Bray Head and Little Sugar Loaf stand prominently to the south of the town, both tall enough to afford views over the town towards the Fassaroe lands inland to the west.

Figure 10.6: A view from Bray Head over the urban landscape towards Fassaroe to the west

To the north of Fassaroe – beyond Ballyman Glen – is the Ballyman area. This is a largely rural landscape traversed by Ballyman Road, which provides access to several farm houses, rural business premises and Dun Laoghaire Golf Club up the hillside towards Carrickgollogan. Due to the elevation and aspect of the Ballyman area, the road users, the occupants of the roadside houses and the golf club are potential receptors of landscape/visual change.

Further to the west along Ballyman Road the concentration of housing increases as the road approaches Enniskerry. However, this stretch of the road is less elevated, as it dips into the upper reaches of Ballyman Glen.

To the west and south west of Fassaroe the land falls steeply into the valley of the Cookstown River. The village of Enniskerry is located in the valley, with several suburban estates on the slope above the valley to the west. Beyond that the land rises steadily into the Wicklow Mountains.

To the south of Fassaroe there is a low-lying area of particularly complex topography formed by the Cookstown and Dargle River Valleys. The Powerscourt Estate falls into this area and there is a relatively dense scattering of houses along the network of local roads. The valley topography and widespread mature woodland generate a high degree of visual enclosure in this area.

The land rises steeply to the south of these valleys, to Carrigoona Commons, the elevated Rocky Valley, and beyond that the Great Sugar Loaf - one of the defining features of the local and regional landscape, lying some 4km to the south of the site. This is a largely rural and sparsely populated landscape apart from a fairly continuous row of houses along Rocky Valley Drive.

Figure 10.7: A view from Ballyman Road across Fassaroe towards the Sugar Loaf to the south

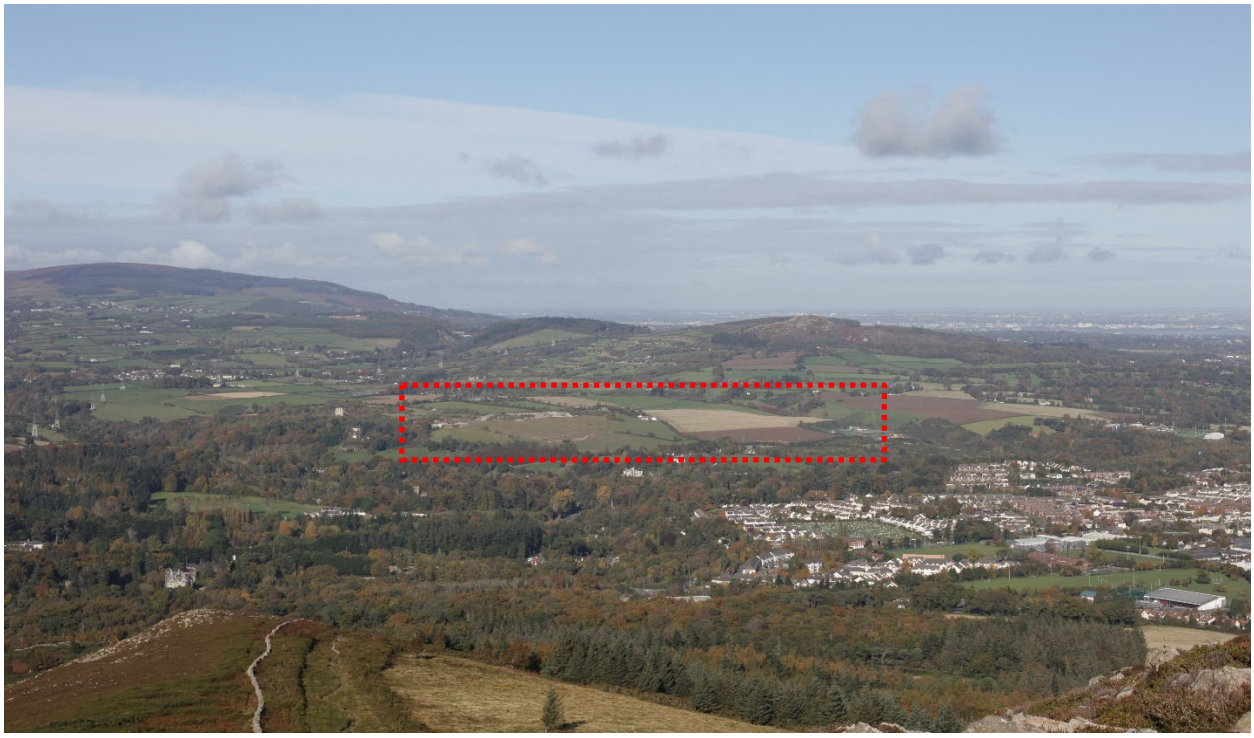


Figure 10.8: A view from the Little Sugarloaf showing Fassaroe to the west of the Bray urban area

10.3.4 Relevant Policy

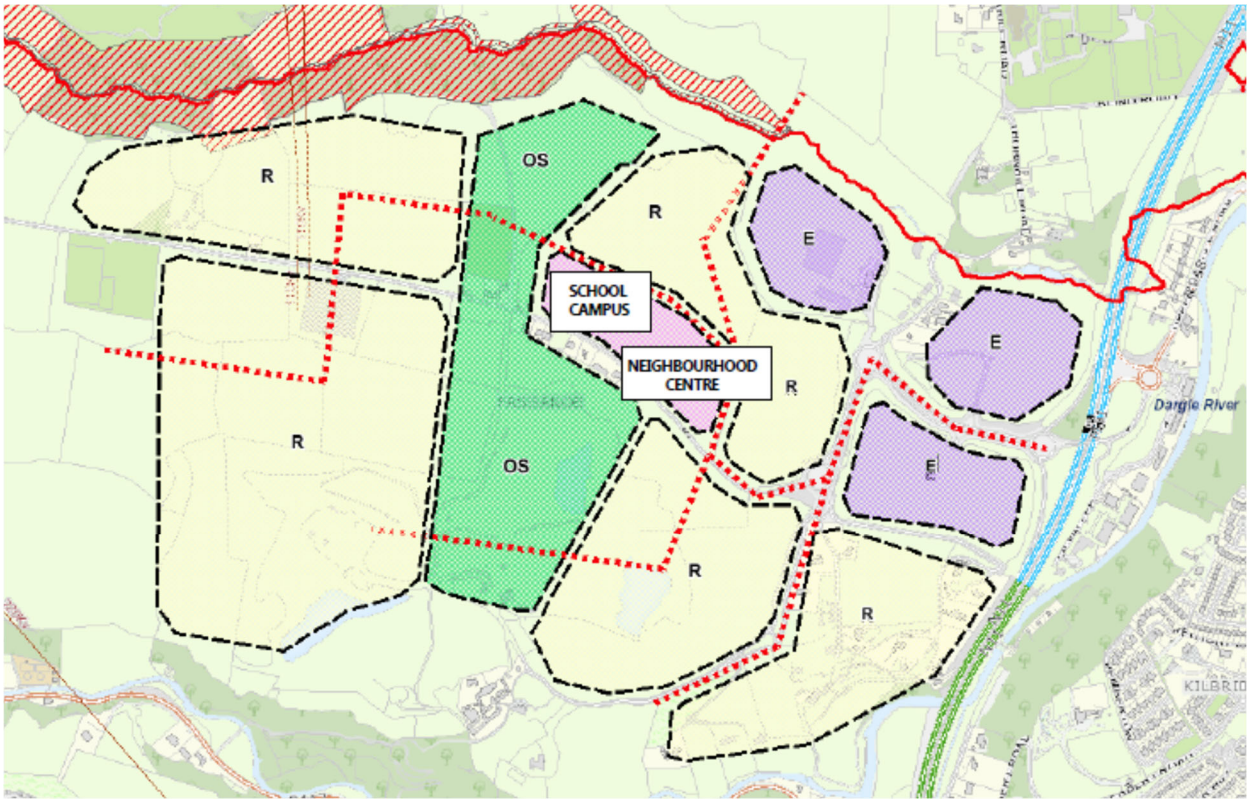
The Fassaroe lands are designated for urban development (see section 10.3.1 above) and the related landscape change has been deemed acceptable in principle through the process of Strategic Environmental Assessment (SEA). Therefore, the focus of this assessment is primarily on the quality of the landscape change/ effects (i.e. whether the proposed development would achieve the stated vision or objectives for Fassaroe, or would comply with recognised urban design principles) rather than the nature of the change (i.e. from a peri-urban landscape to an urban landscape).

10.3.4.1 Bray Municipal District Local Area Plan 2018

Fassaroe is identified as Action Area Plan 1 (AAP1), i.e. the 'location of major development in Bray in accordance with regional plan targets, there being no other suitable lands in the environs of Bray for such large scale development'.

The LAP includes a 'concept plan' for the area, which identifies a number of residential neighbourhoods arranged around a neighbourhood centre and school campus alongside Berryfield Lane. Also of note is the broad belt of open space crossing the lands north to south, linking Ballyman Glen to the north and the Cookstown River valley to the south. Towards the east near the M11 and either side of the Fassaroe access road, areas of employment land are identified.

Figure 10.9: Bray LAP 2018 'concept plan' for Action Area Plan 1: Fassaroe



The landscape-related objectives stated in the LAP include:

2. *"The development of this area shall include the provision of an access road from the N11 to Ballyman Road; the scale of such a route shall reflect its primary function as a service road for a new neighbourhood, rather than that of a 'by-pass'; the design and location of this route shall not affect the functionality of the major open space as a single park and an innovative design solution where park crossing is necessary will be required."*

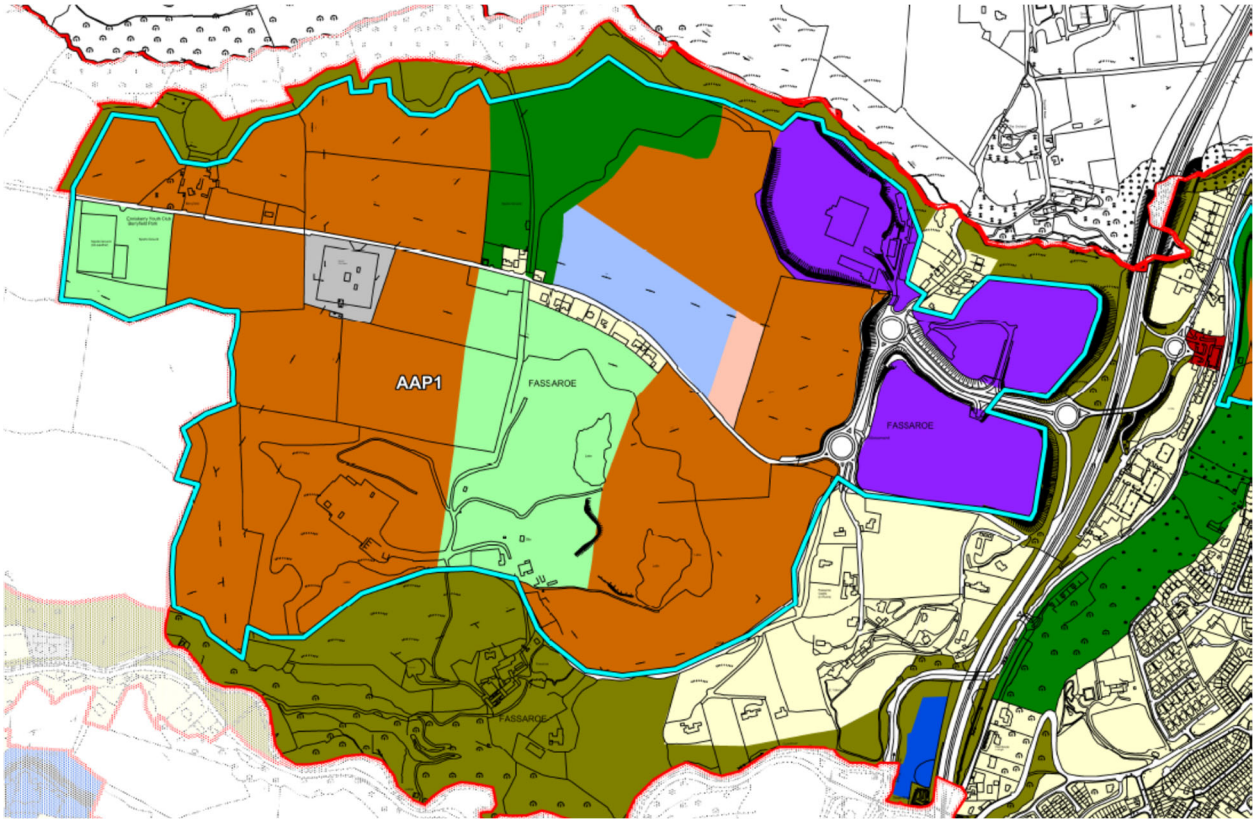
6. "*The scale of the neighbourhood centre shall be in accordance with the retail floorspace objectives of the County Retail Strategy; as well as shopping this centre shall include a range of retail and commercial services as well as community facilities, in order to create a vibrant heart of this new community; all uses shall be serviced by wide pedestrian streets and squares (to allow for outdoor uses), and while the new distributor road through the site should provide access to the village centre,*

neither the road nor significant car parking areas shall dominate the centre or be located directly along the frontage of buildings. The area to be dedicated to retail, retail services, commercial / community use shall not be expected to exceed 1ha; residential development will be expected to be interspersed through this area, particularly on upper floors, of the order of 75 units. Single storey supermarkets will not be permitted; retail uses shall be integrated into a larger overall mixed use development.

Green Infrastructure

The LAP concept plan (**Figure 10.9** above) and Green Infrastructure map (**Figure 10.5**) both show a belt of open space connecting Ballyman Glen and the Cookstown River valley across the Fassaroe development area. The Land Use Zoning Map identifies the southern portion of this open space, south of Berryfield Lane, as 'AOS Active Open Space'. The northern portions is 'OS1', i.e. parks and play areas (as opposed to formal sports grounds). The river valleys to the north and south are 'OS2', i.e. natural areas/green corridors.

Figure 10.10: Excerpt from Bray LAP 2018 Land Use Zoning Map



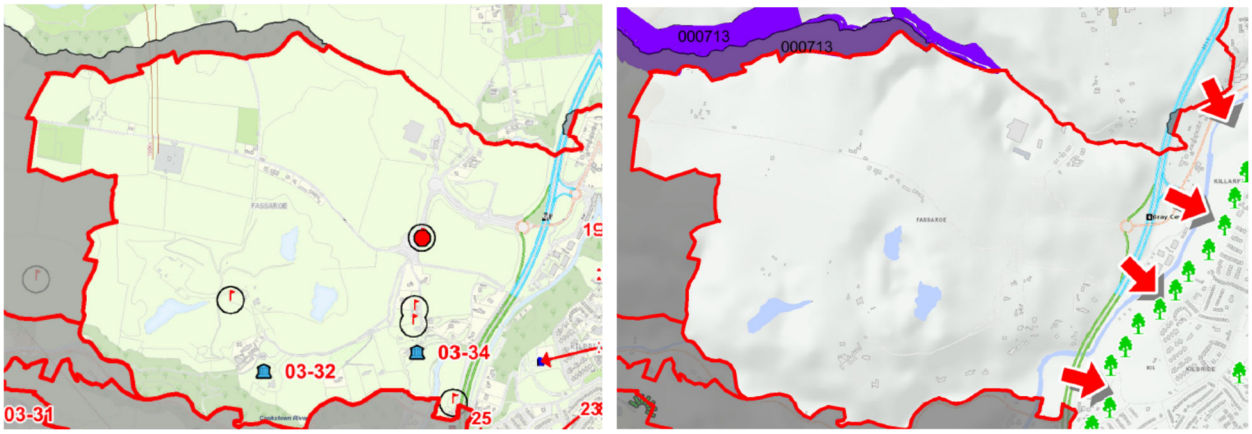
Heritage

The LAP Heritage Objectives Map identifies two protected structures and three national monuments in the southern part of Fassaroe just outside the Cookstown River valley.

There are no protected trees or woodland identified on the Heritage Objectives map (outside of the Ballyman Glen SAC area).

There are no views and prospects identified in the LAP on or over the Fassaroe lands.

Figure 10.11: Excerpts from Bray MD LAP 2018 Heritage Objectives Maps



Bray MD LAP 2018 Strategic Environmental Assessment Objectives

The 'targets' for Landscape and Visual Amenity stated in the Bray MD LAP SEA are as follows:

- *"Improve protection for landscapes of recognised quality.*
- *Maintain clear urban/rural distinctions.*
- *Enhance provision of, and access to, green space in urban areas."*

10.3.4.2 Wicklow County Development Plan 2016-2022

Landscape Character

The Wicklow County Development Plan 2016-2022 ('Wicklow CDP') includes a Landscape Assessment in Appendix 2. In this document and accompanying maps Fassaroe is classified as an urban area.

Regarding urban areas the Landscape Assessment states: *"All locations designated as 'settlements' in the County settlement hierarchy (i.e. areas falling within Levels 1-6) are considered 'urban' areas for the purpose of landscape classification. In terms of landscape classification, these settlements have already been deemed suitable for development (of the type allowed by the settlement strategy and the development standards of this plan) and the impacts on the wider landscape of such development has already been deemed acceptable. Therefore it will not be necessary for developments in urban areas to have regard to the surrounding landscape classification or to carry out landscape or visual impact assessment."*

Development Design Standards

Appendix 1 of the Wicklow CDP is the statement of Development and Design Standards (DDS), which *'sets out the principal factors that should be considered in the design of any new development'*. Many of these factors relate to - and will to some extent determine - the landscape and visual effects of a development.

The DDS identifies the following 'Key Principles of Good Design':

1. *Context: How does the development respond to its surroundings?*
2. *Connections: How well is the new development / site / neighbourhood connected?*
3. *Inclusivity: How easily can people use and access the development?*
4. *Variety: How does the development promote a good mix of activities?*
5. *Efficiency: How does the development make appropriate use of resources, including land?*
6. *Distinctiveness: How do the proposals create a sense of place?*
7. *Layout: How does the proposal create people-friendly streets and spaces?*
8. *Public Realm: How safe, secure and enjoyable are the public areas?*
9. *Adaptability: How will the buildings cope with change?*
10. *Privacy / Amenity: How do the buildings provide a high quality amenity?*

11. *Parking: How will the parking be secure and attractive?*
12. *Detailed Design: How well thought through is the building and landscape design?*

The DDS cites a number of 'key documents' which should be considered in the design and assessment of new developments. Most relevant among these is the *Best Practice Urban Design Manual*. (The DDS Key Principles of Good Design are taken from the *Urban Design Manual*.)

The DDS states: *"New developments on greenfield sites may need to establish their own identity, as some may be of such a scale and distance from the core town centre area as to render analysis of existing 'context' meaningless"*. For large scale expansion areas (such as Fassaroe) the following guidance is provided:

- *"at the outset, a vision for the area shall be established and agreed with the Planning Authority. This shall set out the 'type' of place that is envisaged, the design ethos and the influences on form and design emerging;*
- *an evaluation of the existing surroundings of the site, as well as future proposals / zoning for lands in proximity, shall be carried out to determine how the new development will integrate with the area and allow for maximum connectivity and permeability;*
- *the development shall include distinctive and / or landmark type buildings and a series of new spaces that allow for the development of a sense of place and identity;*
- *new roads / streets shall be laid out in a legible hierarchy from distributor to local roads;*
- *the retail, employment and community needs of the new area shall be met at a scale appropriate to the development, having regard to the availability of such facilities in the settlement and their proximity to the site in question."*

Other relevant policies include the following:

- Building design:
  - *"Good modern architecture with a building language that is varied and forward-looking rather than repetitive and retrospective will be required; however, reference and 'clues' must be drawn from surroundings, particularly in traditional or protected town centre areas;*
  - *"Variation in external materials will be expected, again subject to 'fit' with surrounding buildings. Care shall be taken in excessive use of contrasting materials and generally no more than two contrasting materials shall be utilised on any façade…*
  - *"Where a development takes the form of more than one structure (i.e. a number of apartment blocks or a multitude of individual houses), adequate variety in form, height, materials etc shall be employed, within an overall unified theme, to provide for visual diversity."*

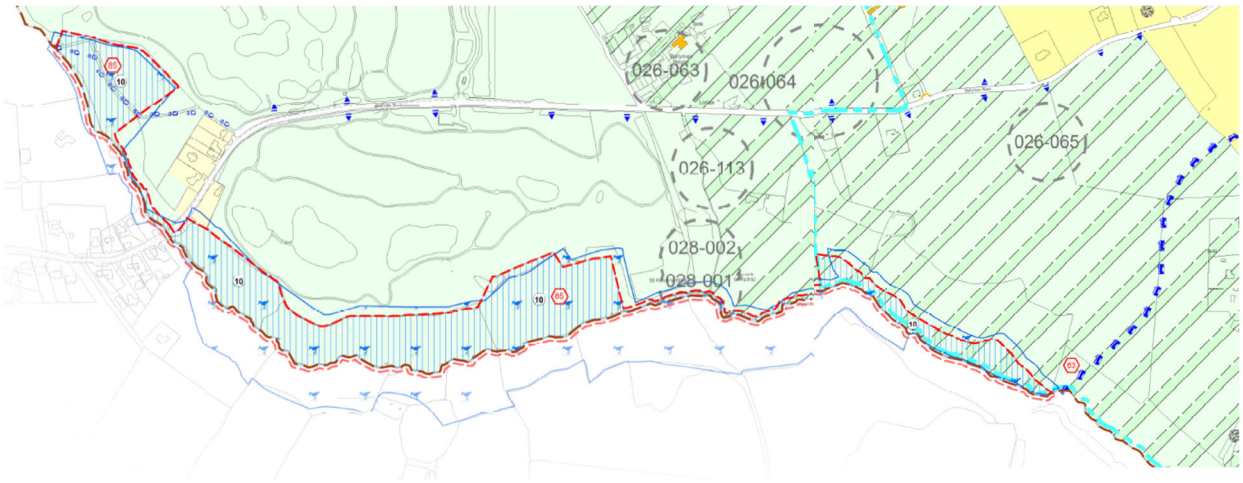
10.3.4.3 Dún Laoghaire Rathdown County Development Plan 2016-2022

The stream in the Ballyman Glen forms the boundary between County Wicklow and County Dublin. The Ballyman area to the north of the valley, which overlooks Fassaroe, falls into the jurisdiction of Dún Laoghaire Rathdown County Council and is subject to the Dún Laoghaire Rathdown County Development Plan 2016-2022 (DLR CDP).

The DLR CDP includes an objective to preserve views from Ballyman Road (see **Figure 10.12** below).

These view compositions typically include wide agricultural fields in the foreground sloping down into the Ballyman Glen, beyond which the Fassaroe lands can be seen against a dramatic backdrop of the Wicklow Mountains, with the Sugarloaf most prominent (see **Figure 10.7**).

Figure 10.12: Excerpt from DLR CDP 2016-2022 Use Zoning Objectives Maps 13 & 14



It can be assumed that:

- The DLR CDP – including the objective to preserve views from Ballyman Road - was prepared and adopted over several six year development plan cycles with cognisance of Wicklow County Council's zoning of Fassaroe for urban development (the Fassaroe lands have been zoned since the 1990s).
- It is not, therefore, the intention of DLR County Council to entirely restrict change/development in the panoramic views from Ballyman Road, which cover a vast area including Fassaroe. It is rather the intention of the 'preserve views' objective to (a) prevent change in the foreground which would block the views, and/or (b) prevent unsightly development from taking place, or to ensure that the urban development of Fassaroe responds appropriately to the existing landscape – principally the topography which is its defining characteristic.

10.4 Potential Impacts - Landscape

10.4.1 Construction Phase

The general sequencing / phasing of the proposed works is as follows (with the overall construction phasing shown on **Figure 2.11** of **Chapter 2** of this EIAR).

- Secure site boundaries with temporary fencing.
- Establish contractors compound(s).
- Commence construction of proposed new main access road from eastern side of site to western side of development areas, as far as ESB substation (including provision for rerouted 38kV ESB lines) – including all associated roadside landscaping, drainage and utilities.
- Commence construction of new tower structures and underground route for rerouted twin 110kV lines, and for rerouted 38kV line.
- Commence land fill remediation works at Landfill Sites Nos. 1 & 2 (including provision for rerouted 38kV ESB lines).
- Commence construction of Phase 1a residential zone
- Continue construction of western end of distributor road to Ballyman Road (including works to and remediation of landfill Site Nos. 3A, 3B and 3C).
- Complete remediation of Landfill Site Nos. 1 and 2 and set out as District Park.
- Construct Kiosk and Creche
- Complete ESB diversion works and decommission existing.
- Complete remediation of Landfill Site Nos. 3A, 3B and 3C and Link Road
- Continue / complete Phase 1a development

- Commence Phase 1b including construction of Creche
- Continue / complete Phase 1b including Neighbourhood Centre

While at a macro-level the landscape sensitivity to the proposed development can be classified low (due to the site's zoning for urban development; see 10.4.2.1 below), at the local level there are pockets of sensitivity to landscape change. These include:

- Areas of existing residential use:
  (1) The row of houses and farms along Berryfield Lane.
  (2) The houses along Thornhill Road to the north east.
  (3) The houses and farms along the eastern stretch of Ballyman Road to the north.
  (4) The houses along Kilbride Lane to the south east. While these houses are relatively close to the Fassaroe lands (indeed the area is included in the Bray LAP 2018 'concept plan' for Action Area Plan 1 – see **Figure 10.9** above), due to (a) the subject site being located in the northern part of Fassaroe, with Kilbride Lane to the south, and (b) the local topography and vegetation along Kilbride Lane, the houses have very limited potential to experience direct landscape or visual impacts arising from the site's development.
- The two river valleys, i.e., Ballyman Glen (SAC and pNHA) to the north and the Cookstown River valley to the south. While Ballyman Glen is principally protected (by its ecological designations) for its contribution to biodiversity, both Ballyman Glen and the Cookstown River valley are also valuable (and sensitive) as elements/features of the landscape. Their landscape value derives from their topography, tree cover and a relative absence of built elements, which contribute to the diversity, visual interest and beauty of the landscape.

The landscape change experienced by these receptors would be high close to the site, reducing in magnitude with distance from the site. The sensitive receptors most affected would be the row of houses along Berryfield Lane (where construction would take place at various distances to the east, north, west and south west of the houses) and Ballyman Glen.

The sensitive receptors least effected by landscape change would be the Thornhill Road and Kilbride Lane areas. The main effects on the residents of these areas would be indirect, in that views from their houses would not be significantly changed but they would experience the change in character of the landscape as they travel to and from their homes through Fassaroe.

Measuring the magnitude of change against the sensitivity of the receiving environment, **at the local level the potential construction phase effects on landscape character would be 'significant' and negative (construction activity is inherently disturbing of the landscape, and unsightly), although temporary**. Such effects (significant negative on landscape character) would be experienced only in the immediate environs of the site, i.e. Berryfield Lane and the southern edge of Ballyman Glen, with effects of lesser significance occurring along Thornhill Road, Kilbride Lane, Ballyman Road and the Cookstown River valley.

There are few options for effective mitigation of the negative landscape and visual effects of construction. The most effective measures are (a) the erection and maintenance of site hoarding and (b) best practice site management. Such measures are included in the *Construction Environmental Management Plan* by Atkins provided at **Appendix 2B** in Volume 4 of this EIAR.

At the wider scale, i.e. the areas from which the site/proposed works would be viewed from a distance, the magnitude of landscape change experienced would be low. In most such views the construction activity would be seen in the wider context, therefore visibly an extension of the existing Bray urban area. Change and expansion of urban areas is not unusual or unexpected, and it is also relevant that the affected lands are zoned for such change. **In summary, the macro level effects on landscape character during the construction phase would be negative but of slight significance, and temporary**.

10.4.2 Operational Phase

10.4.2.1 Landscape Character and Sensitivity to Change

The *Guidelines for Landscape and Visual Impact Assessment* notes that landscape sensitivity should be classified with consideration of 'the particular project or development that is being proposed and the location in question'. Sensitivity of the landscape is determined by two factors:

(1) **Susceptibility to change**: *"This means the ability of the landscape receptor (whether it be the overall character or quality/condition of a particular landscape type or area, or an individual element and/or feature…) to accommodate the proposed development without undue consequences for the maintenance of the baseline situation and/or the achievement of landscape policies or strategies"*.

(2) **Value of the landscape/townscape receptor**: This can be indicated by designations or, where there are no designations, by judgments based on criteria that can be used to establish landscape value.

Overall, the sensitivity of the receiving environment to landscape change of the type proposed can be classified 'medium' (definition[1]: *Areas where the landscape has certain valued elements, features or characteristics but where the character is mixed or not particularly strong, or has evidence of alteration, degradation or erosion of elements and characteristics. The landscape character is such that there is some capacity for change. These areas may be recognised in landscape policy at local or county level and the principle management objective may be to consolidate landscape character or facilitate appropriate, necessary change*).

This sensitivity classification is based on the following factors:

- The Fassaroe lands have been zoned for urban development since the 1990s when the area was identified as the only option for the necessary large scale expansion of the Bray urban area. The lands are zoned for urban development in both the Wicklow CDP and the Bray MD LAP. Both plans were subject to Strategic Environmental Assessment and the SEA report for the LAP states: *"The potential impacts on landscape and visual amenity are predominantly neutral with some positive impacts likely to occur. Development would generally be consolidated within Bray town centre, undertaken on appropriately zoned lands in Fassaroe and generally avoid impacts on landscape and visual amenity."*
- The Fassaroe lands are already classified as 'urban' in the Landscape Assessment contained in the Wicklow CDP. The Landscape Assessment states: *"In terms of landscape classification, these [areas] have already been deemed suitable for development (of the type allowed by the settlement strategy and the development standards of this plan) and the impacts on the wider landscape of such development has already been deemed acceptable".*
- There are relatively few cultural heritage sensitivities in and around the Fassaroe area, and no protected views identified in the area in the Bray MD LAP or the Wicklow CDP. The 'preserve views' objective of the DLR CDP for Ballyman Road to the north can be assumed to allow for the planned urban development of Fassaroe.
- Due to its intensive agricultural use there is relatively little vegetation of 'landscape value' in the Fassaroe area. The exceptions to this include (a) a shelter belt of trees around Berryfield House, (b) a belt of screening vegetation on the embankments surrounding the waste facility, (c) belts of screening vegetation on the embankments either side of the Fassaroe access road, and (d) the woodland in the river valleys.
- The main areas of landscape sensitivity in the Fassaroe area are:
  - The Cookstown River valley to the south and the Ballyman Glen to the north – due to their valley topography, woodland/trees and other habitats. Ballyman Glen is particularly sensitive due to its SAC and pNHA designations.
  - The pockets of residential use in the area including (1) the row of houses and farms along Berryfield Lane, (2) the houses along Thornhill Road to the north east, (3) the houses along Kilbride Lane to the south east, and (4) the houses and farms along the eastern stretch of Ballyman Road to the north.

10.4.2.2 Magnitude of Landscape Change

The proposed development is described in detail in Chapter 2 of the EIAR and in the design statements and drawings submitted with the planning application.

[1] Refer to 'Note on definitions used in this assessment' in Section 10.2.2.1.

Briefly, the proposed development comprises construction Phases 1A and 1B of the masterplan for the CPG owned lands at Fassaroe (refer to **Figure 2.11** of **Chapter 2 of this EIAR**). The combined site area for Phases 1A and 1B is approx.. 80.16 ha. The elements of the proposed development include:

- Road link (2.4km) connecting N11 to Ballyman Road (with westerly connection to Ballyman Road already in place)
- Pedestrian / cycle route including bridge across the N11 to Dargle Road Upper
- 18.4ha of District Park / Active Open Space
- 650 no. residential units comprising 241 no. houses and 409 no. apartments
- 3 No. pocket park areas comprising a total of 0.65ha.
- 733sq.m approx. crèche with capacity for approx. 138 no. childcare spaces
- Retail unit / kiosk (108sq.m.) in district park
- Neighbourhood Centre Phase 1 (1,875sq.m. retail, café and community concierge uses plus residential use)
- Demolition of an existing dwelling at Berryfield Lane
- Rerouting and undergrounding of overhead ESB lines (110kV and 38kV lines) across site and into existing ESB Substation
- Site development / ground works on future development areas to ensure sustainable cut and fill balances across the lands
- Water supply, foul and surface water drainage proposals
- Provisions for public bus services within the proposed layout
- Remediation of 5 no. historic landfill sites in line with Certificates of Authorisation issued to Wicklow County Council by the EPA in 2019

Taking account of the scale (80.16ha) and the nature of the proposed development (the various urban elements identified above), the magnitude of landscape change which would result from the development would be 'high' (definition[2]: *Change that is moderate to large in extent, resulting in major alteration to key elements, features or characteristics of the landscape, and/or introduction of large elements considered uncharacteristic in the context. Such development results in change to the character of the landscape*).

10.4.2.3 10.4.2.3 Significance of Landscape Effects

Measuring the magnitude of change (see 10.4.2.2) against the sensitivity of the receiving environment (10.4.2.1), **the potential operational phase effects on the landscape would be 'significant'**.

The development would initiate and realise a substantial part of the planned urban expansion of Bray into the Fassaroe area, delivering several key elements including (a) the east-west road link between the N11 and Ballyman Road, (b) the neighbourhood centre, (c), the district park and active open space and (d) extensive, diverse residential neighbourhoods. The overall effect, i.e. the shift in the landscape character of Fassaroe from peri-urban towards a contemporary urban condition, would be permanent.

In order to determine whether the landscape effects can be classified positive, neutral or negative, the proposal is considered (in **Table 10.7** below) against the relevant 'Key Principles of Good Design' as stated in the Development and Design Standards of the Wicklow CDP. These principles are derived from the 'Urban Design Criteria and Indicators' provided in the *Urban Design Manual - A Best Practice Guide* (2009) published by the Department of Housing, Local Government and Heritage.

[2] Refer to 'Note on definitions used in this assessment' in Section 10.2.2.1.

Table 10.7: Assessment of Proposed Development Against Relevant *Urban Design Manual – A Best Practice Guide* criteria and indicators

Urban Design Criteria and Indicators (*Urban Design Manual - A Best Practice Guide*)		Yes/ No	Comment
01 Context - How does the development respond to its surroundings?			
01a	The development seems to have evolved naturally as part of its surroundings	Yes & No	The proposed development is a new mixed use, mixed density urban expansion of Bray into a currently peri-urban landscape predominantly in agricultural use. It cannot (and should not) appear to have evolved from the peri-urban and rural surroundings to the north, west and south. This is recognised in the Bray MD LAP SEA which includes as one of the 'targets' for Landscape and Visual Amenity to *"Maintain clear urban/rural distinctions".* It is also noted in the Wicklow CDP Development and Design Standards that *"New developments on greenfield sites may need to establish their own identity, as some may be of such a scale and distance from the core town centre area as to render analysis of existing 'context' meaningless"*. Overall, the layout of the proposed development takes its cue principally from the topography, which is the defining characteristic of the Fassaroe lands, and to some extent from the alignment of Berryfield Lane, the one existing road traversing the area. The urban grain, the building heights, and the location and design of the open space (particularly the District Park and the active open space) respond appreciably to the landform, the presence of Ballyman Glen and the Cookstown River valley to the north and south respectively, and the alignment of Berryfield Lane. In this sense, although profoundly changing the character of the landscape, the new urban area has 'evolved' to an extent from the existing Fassaroe landscape and the surroundings.
01b	Appropriate increases in density respect the form of buildings and landscape around the site's edges and the amenity enjoyed by neighbouring users	Yes	High density residential development typologies are proposed in Character Area 1, in a part of Character Area 2 and in the Neighbourhood Centre: - Character Area 1 (including proposed Apartment Blocks 1, 2 and 3) is in the lower-lying eastern part of the area, fronting/above the existing Fassaroe access road. These two conditions, i.e. (a) the proximity to and visibility from the main 'road gateway' into Fassaroe, and (b) the lower elevation (towards the Dargle River valley) make Character Area 1 suitable for increased density. - The proposed apartment Building 4 is located in Character Area 2 on the east side of the District Park. Its location, enclosed on two sides by the very large open space, makes it suitable for higher density. The apartment building can also contribute to the definition/enclosure of the open space, and provide a visual reference point and contribute to a desirable diversity in built form. - The Neighbourhood Centre includes two apartment blocks co-located with the centre's retail, cafe and community concierge/gym uses. The high density residential use in the central village/urban core, fronting the new Link Road, would contribute to the establishment of an urban identity/character and a high level of activity in the centre's public realm. The proposed increases in density thus take account of aspects of the existing and future landscape (e.g. the topography, the location of roads/public transport routes, open space and the neighbourhood centre). Although they would be visible in the evolved urban context, none of the apartment buildings is close enough, nor so tall that they would cause harm to the amenities of existing residential areas (e.g. the houses on Berryfield Lane, Thornhill Road, Kilbride Lane or Ballyman Road.

Urban Design Criteria and Indicators (*Urban Design Manual - A Best Practice Guide*)		Yes/ No	Comment
01c & d	Form, architecture and landscaping have been informed by the development's place and time The development positively contributes to the character and identity of the neighbourhood	Yes	Several key elements and aspects of the proposed development reflect a distinctly contemporary design approach and response to place. These include: - The new urban structure incorporating a hierarchy of streets and home zones responding to the topography and existing roads. - The mix of residential building typologies of various density forming distinct internal neighbourhoods/character areas surrounding a mixed use village/urban centre. - The character and quality of the architectural design, the embedded sustainable technologies, and the high quality building materials. - The extensive, diverse network of open space designed in accordance with the principles of Green Infrastructure (connectivity, multi-functionality to deliver a variety of ecosystem services). This is conducive to the establishment of a new urban quarter that both forms a part of the expanded Bray urban area, and has a distinct, contemporary identity.

Urban Design Criteria and Indicators (*Urban Design Manual - A Best Practice Guide*)		Yes/ No	Comment
01e	Appropriate responses are made to the nature of specific boundary conditions	Yes	The response to boundary conditions is most evident in the location and design of the District Park, which wraps around the northern edge of the development to form a landscape buffer between the new urban quarter and Ballyman Glen (and the Ballyman area to the north). The design of the park is increasingly naturalistic towards its interface with the SAC-designated valley, so that these two major landscape elements would complement each other. Other notable design responses to boundary conditions include: - The buffering of an existing light industrial business premises on Berryfield Lane ('A' on the excerpt of the Landscape Masterplan, right), which is external to the site, with an enclosing belt of woodland forming part of the District Park. This response protects the privacy of the business premises and the amenities of the future park and its users. - The high density typology of Character Area 1 in the lower-lying eastern area, fronting/above the existing Fassaroe access road. The proposed Apartment Block 01 would be a prominent, distinctly urban element in views from the main 'road gateway' into Fassaroe from Bray and the M11. This would contribute to establishing a contemporary urban character/identity. A further design response in this area is the dense belt of trees proposed on the north side of the three apartment blocks - to form a landscape/visual buffer between the new residential neighbourhood and the waste facility to the north. 
02 Connections - How well connected is the new neighbourhood?			
02a	There are attractive routes in and out for pedestrians and cyclists	Yes	The proposed development includes a new pedestrian / cycle route including a bridge across the N11 to link Fassaroe to Dargle Road Upper and the main Bray urban area.

Urban Design Criteria and Indicators (*Urban Design Manual - A Best Practice Guide*)		Yes/ No	Comment
			The proposed new Link Street traversing the area from east to west, connecting the N11 to Ballyman Road, includes dedicated pedestrian and cycle paths on both sides, segregated from the carriageway by green verges. This will facilitate and encourage pedestrian and cycle access to both Bray to the east and Enniskerry to the west.
02b	The development is located in or close to a mixed-use centre	Yes	The development includes the first phase of a mixed use village/urban centre to serve the Fassaroe area.
02c	The development's layout makes it easy for a bus to serve the scheme	Yes	Bus stops are proposed along the east-west Link Road as part of the application. Four pairs of bus stops are proposed at the Neighbourhood Centre, at the east side of the District Park, at the western housing area and to the south east of the ESB substation. All of the new dwellings would be within minutes' walk from a bus stop. There are also existing bus bays in place at the existing dual carriageway entering the Fassaroe area from the N11.
02d	The layout links to existing movement routes and the places people will want to get to	Yes	See 02a above.
02e	Appropriate density, dependent on location, helps support efficient public transport	Yes	The proposed development is a mixed/medium density scheme providing an overall net density of 56.3 units per ha within the development lands. The higher density building typologies (Apartment Blocks 1, 2, 3, 4 and the Neighbourhood Centre) are all located in close proximity to the existing and/or proposed bus stops.

Urban Design Criteria and Indicators (*Urban Design Manual - A Best Practice Guide*)		Yes/ No	Comment
03 Inclusivity – How easily can people use and access the development?			
03a	There is a range of public, communal and/or private amenity spaces and facilities for children of different ages, parents and the elderly.	Yes	The proposed development includes a proposed District Park and Active Open Space with a combined area of 15.3 ha. These spaces together form a broad belt of open space traversing the centre of the Fassaroe lands connecting to Ballyman Glen to the north and (potentially) to the Cookstown River valley to the south. The developer also previously provided a 3.1ha football pitch along Berryfield Lane to the west of the ESB substation. The central location and scale of these combined public open spaces, and the diversity of active and passive recreation opportunities provided, would cater for all age groups in the new Fassaroe population and the wider Bray area.  All public areas are designed for inclusive access. Additionally, a number of local public and communal open spaces, incorporating playgrounds, are proposed within the various residential cells/character areas.

Urban Design Criteria and Indicators (*Urban Design Manual - A Best Practice Guide*)		Yes/ No	Comment
03b	New buildings present a positive aspect to passers-by, avoiding unnecessary physical and visual barriers.	Yes	The higher and lower density areas have been designed so that the built form provides streetscape definition (reinforcing the new urban structure) without excessive enclosure or physical and visual barriers. The proposed Neighbourhood Centre buildings (and ground floor uses) are designed to generate an active urban streetscape/public realm. 
05 Efficiency - How does the development make appropriate use of resources, including land?			
05a	The proposal looks at the potential of higher density, taking into account appropriate accessibility by public transport and the objectives of good design	Yes	See 01b and 02e above.
05b	Landscaped areas are designed to provide amenity and biodiversity, protect buildings and spaces from the elements	Yes	The proposed development is an exemplar of Green Infrastructure design. The Landscape Masterplan includes a range of open spaces of varying character designed to (a) provide passive and active recreation opportunities for all age groups, (b) contribute to the area's place-identity, (c) create a legible environment for people to live in and move through.

Urban Design Criteria and Indicators (*Urban Design Manual - A Best Practice Guide*)		Yes/ No	Comment
	and incorporate SUDs		The proposed development incorporates a range of SUDs measures including (a) swales in park areas adjacent to roads, (b) permeable type paving system in light traffic areas (parking bays), (c) Green Roofs to a minimum of 60% of the total area of suitable flat roofs (apartments), (d) Underground Modular system within green corridors / park areas, (e) Filter Drains in rear gardens where suitable, and (f) Attenuation Ponds incorporated into landscape features in public parks. The District Park is located and designed to form a landscape buffer between the new urban area and the SAC-designated Ballyman Glen - to protect and complement its biodiversity. The park itself is designed to produce a mosaic of native habitats to maximise the biodiversity potential of the site while also providing opportunities for passive and active recreation. The habitats that are proposed across the park include: - Areas of native deciduous and mixed woodland - Areas of mixed scrub - Areas of tall herb grassland - Wildflower meadows - Areas of close-cropped amenity grassland - Marshland and riparian planting - Areas of loose rock and scree for lichens, mosses and chasmophytic plants 
06 Distinctiveness - How do the proposals create a sense of place?			
06a	The place has recognisable features so that people can describe where they live and form an emotional attachment to the place	Yes	The proposed development employs variety in development typologies (e.g. lower density, higher density, mixed density, neighbourhood centre) and architectural treatments, along with a hierarchical network of streets and the extensive and diverse network of open space to generate distinct internal character areas. These are emphasised by the pronounced topography of Fassaroe and environs. The result will be an urban landscape characterised by distinct, recognisable neighbourhoods, with a high degree of legibility and navigability.

Urban Design Criteria and Indicators (*Urban Design Manual - A Best Practice Guide*)		Yes/ No	Comment
06b	The scheme is a positive addition to the identity of the locality	Yes	See 01a-e and 06a above.
06c	The layout makes the most of the opportunities presented by existing buildings, landform and ecological features to create a memorable layout	Yes	See 01a-e, 03a, 05b and 06a above.
06d	The proposal successfully exploits views into and out of the site	Yes	The topography of Fassaroe and the surrounding landscape lends itself to the 'exploitation' of views into and out of the site (see **Figures 10.4, 10.6, 10.7** and **10.8** above) to generate character, identity and visual amenity. The proposed urban structure/layout and the positioning of the buildings and open space – in responding to the topography – maximises the amenity benefit of the views east (towards Bray and the coastline), west (into Ballyman Glen and up the hill towards Carrickgollogan), west (into the Wicklow Mountains) and south (towards the Sugarloaf). The new urban area will have an unparalleled range of high quality views in all directions. The proposal also considers the views into the area from the surroundings. For example: - The central position of the District Park, its fan-like form (broadening to the north) and its wrapping around the northern edge of the urban area, will result in the best possible outcome for the views from Ballyman Road (identified as preserved views in the DLR CDP). - The continuity of the District Park and the active open space, forming a broad belt of green space on a north-south alignment across the area, will divide the urban landscape and reduce its perceived extent, lending it a 'green' character in views from the north and south. - In contrast, the positioning and scale of Apartment Building 01 towards the east, facing the main road gateway into the area from Bray and the N11, is intended to establish an urban character and identity for the area.

Urban Design Criteria and Indicators (*Urban Design Manual - A Best Practice Guide*)		Yes/ No	Comment
06e	There is a discernible focal point to the scheme, or the proposals reinforce the role of an existing centre	Yes	The proposed development incorporates several diverse focal points functioning at a different scales. For example, the Neighbourhood Centre and the District Park (particularly the water features) will function as focal points within the overall new urban area. At the local scale, each character area will have focal points in the form of key buildings and/or pocket parks.
07 Layout - How does the proposal create people friendly streets and spaces?			
07a	Layout aligns routes with desire lines to create a permeable interconnected series of routes that are easy and logical to navigate around.	Yes	See 02a and 02c above.
07b	The layout focuses activity on the streets by creating active frontages with front doors directly serving the street	Yes	See 03b.
07c	The streets are designed as places instead of roads for cars, helping to create a hierarchy of space with less busy routes having surfaces shared by pedestrians, cyclists and drivers	Yes	The proposed new Link Street, traversing the area from east to west, connecting the N11 to Ballyman Road, includes dedicated pedestrian and cycle paths on both sides, segregated from the carriageway by green verges. It thus gives equal priority to pedestrians and cyclists as it does to cars. The local/secondary streets are narrower, with a less formal, segregated arrangement of surfaces (cyclists sharing the carriageway with cars and footpaths immediately adjacent as opposed to separated by green verges). Within each residential cell/neighbourhood the non through-routes are designed as home zones, where a shared pedestrian and vehicular carriageway is proposed comprised of a 4.8m carriageway with flush 1.2m wide pedestrian refuge zones intended to slow motorists and create a quieter community feel. Regular street tree planting will be a feature of all residential streets.

Urban Design Criteria and Indicators (*Urban Design Manual - A Best Practice Guide*)		Yes/ No	Comment
07d	Block layout places some public spaces in front of building lines as squares or greens, and some semi private space to the back as communal courts	Yes	The proposed development includes the central, public District Park and active open space within minutes' walk from all dwellings, as well as local pocket parks for communal use within the residential cells/neighbourhoods (see two examples below).  
08 Public Realm - How safe, secure and enjoyable are the public areas?			
08a	All public open space is overlooked by surrounding homes so that this amenity is owned by the residents and safe to use Play areas are sited where they will be overlooked, safe and contribute to the amenities	Yes	Apart from (a) the westernmost extent of the District Park and (b) the active open space, which both will be overlooked by homes to be the subject of future planning applications, all open spaces are overlooked. Additionally, see 03a, 05b and 07d above.

Urban Design Criteria and Indicators (*Urban Design Manual - A Best Practice Guide*)		Yes/ No	Comment
08b	The public realm is considered as a usable integrated element in the design of the development	Yes	See 03a, 05b and 07d.
08d	There is a clear definition between public, semi private, and private space	Yes	Hedges, low ornamental planting and tree lines are used to create defined, defensible private space for ground floor apartments, e.g. Block 04 (see masterplan excerpt left below). In the case of the Neighbourhood Centre, where an active frontage is proposed to the street, the communal open space for the apartments (above the retail units and café) is located to the rear of the building (centre below), separated from the public realm to the front.  
08e	Roads and parking areas are considered as an integral landscaped element in the design of the public realm	Yes	The proposed development is characterised by a generous tree planting in the streets and parking areas, which would generate to a particularly verdant urban landscape. In places the streets are designed specifically to function as public realm more so than vehicular circulation routes.

Urban Design Criteria and Indicators (*Urban Design Manual - A Best Practice Guide*)		Yes/ No	Comment
			 
12 Detailed Design - How well thought through is the building and landscape design?			
12a	The materials and external design make a positive contribution to the locality	Yes	The plans and CGI views included in the analysis above show that the proposed buildings and landscape are of appreciably high design and material quality. The Phase 1 development would set a high standard of urban environmental quality for the future phases of development in Fassaroe.

The assessment of the proposed development against the relevant Urban Design Manual criteria above confirms that the potential landscape effects can be classified positive.

10.4.3 Cumulative Impacts

There are no permitted developments in the vicinity of the site with which the proposed development would interact to cause landscape or visual impacts more significant (or otherwise different) to the effects identified above.

The proposed development would interact with future phases of development of the Fassaroe lands to cause more significant landscape and visual effects (due to the greater extent and diversity of the new urban area). This is intended (and prescribed in planning policy – see Sections 10.3.3.1 and 10.3.3.2 above). It can be assumed that to obtain planning permission the future phases will be of similar design and material quality to the proposed development (see appraisal of the proposal in **Table 10.7** above), and therefore that the greater in-combination effects will also be generally positive or neutral.

10.5 Potential Impacts – Visual Amenity

10.5.1 Construction Phase

During construction the site and immediate environs would be heavily disturbed by construction activities, the transport and storage of materials and equipment, and the incremental growth of the buildings on site. The sensitive visual receptors potentially most affected would be the residential areas in the vicinity:

(1) the row of houses and farms along Berryfield Lane;
(2) the houses along Thornhill Road to the north east;
(3) the houses along Kilbride Lane to the south east, and
(4) the houses and farms along the eastern stretch of Ballyman Road to the north.

The visual change experienced by these receptors would be high close to the site (e.g., the houses on Berryfield Lane), reducing in magnitude with distance from the site.

At the local level the potential construction phase effects on visual amenity would be 'significant', and negative (construction activity is inherently unsightly) - although temporary. Such effects would be experienced only in the immediate environs of the site, i.e., Berryfield Lane, with effects of lesser significance occurring along Thornhill Road, Kilbride Lane and Ballyman Road.

There are few options for effective mitigation of the negative landscape and visual effects of construction, especially in large areas and areas of pronounced topography. The most effective measures are (a) the erection and maintenance of site hoarding and (b) best practice site management. Such measures are included in the *Construction Environmental Management Plan* by Atkins provided at **Appendix 2B** of **Volume 4** of this EIAR.

At the wider scale, i.e., the areas from which the site/proposed works would be viewed from a distance, the magnitude of visual change would generally be low. In most such views the construction activity would be either difficult to discern or seen as a small part of a wide panorama which includes the existing Bray urban area. Change and expansion of urban areas is not unusual or unexpected, and it is also relevant that the affected lands are zoned for such change. **In summary, the macro level effects on visual amenity during construction would be negative but of slight significance, and temporary**.

10.5.2 Operational Phase

22 no. viewpoints (see **Figure 10.13** and **Figure 10.14** and **Appendix 10A**) were selected for detailed assessment of potential visual effects informed by verified photomontages. The viewpoints were selected to address the key elements, areas and sensitivities in the receiving environment, as well as to provide photomontages from a range of angles, distances and elevations.

The assessments below should be read in conjunction with the verified photomontages provided in **Appendix 10A**, Volume 4 of the EIAR. For the methodology and the criteria and terms used, refer to Section 10.2.3 above.

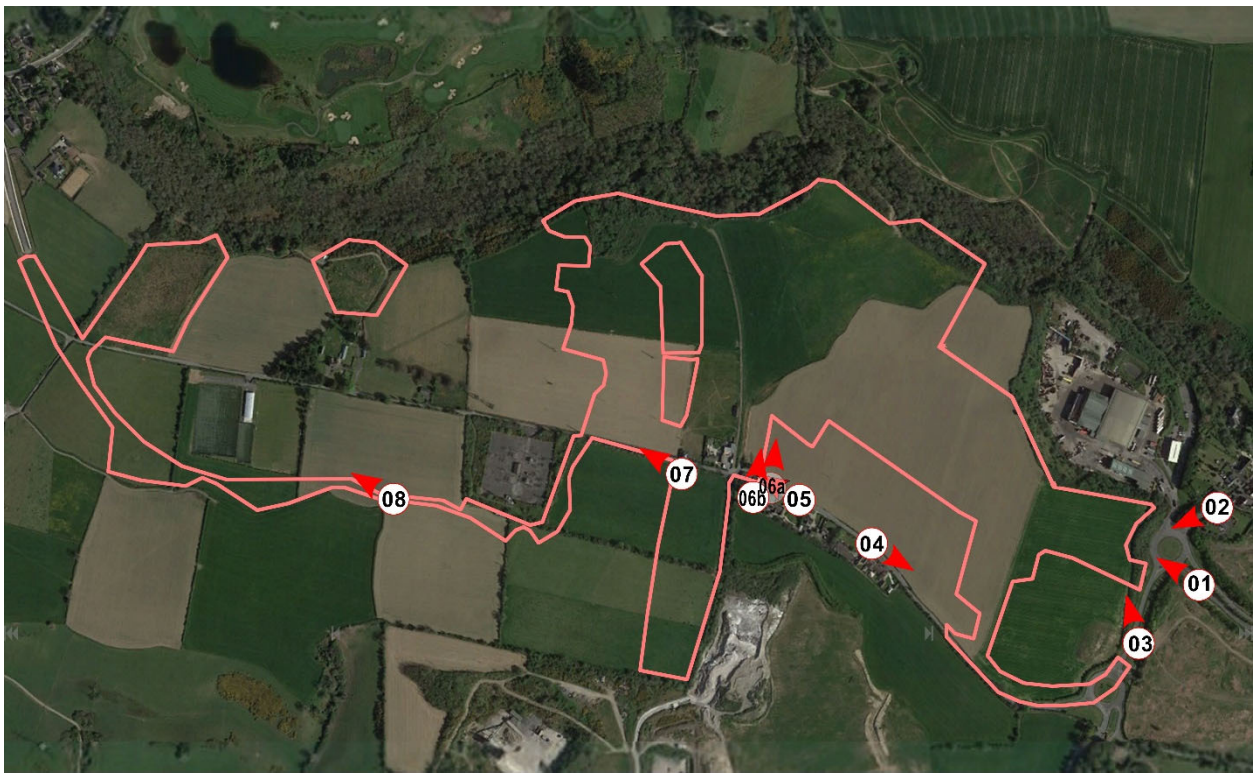


Figure 10.13: Local Viewpoints for Visual Effects Assessment

Figure 10.14: Distant Viewpoints for Visual Effects Assessment

10.5.2.1 Viewpoint 1: Fassaroe access road (R918) from the east

Existing View: The view is taken from the R918 entering Fassaroe from Bray with the N11 to the east. This is a key gateway to the future urban area. The broad boulevard has a row of maturing trees in the central median and is enclosed on both sides by dense belts of trees on steep embankments rising from the roadside. The vegetation and embankments enclose the road and frame the view west towards Fassaroe. A similar belt of vegetation on a tall embankment closes the vista.

There are elements of urban formality in the streetscape (the row of trees and groundcover planting in the central median, the broad carriageway, the segregated pedestrian and cycle paths) and these appear somewhat incongruous/incomplete in the absence of any buildings.

Viewpoint Sensitivity: Low-Medium. (The landscape in view, i.e. the Fassaroe access road corridor, was constructed specifically to facilitate the urban development of Fassaroe.)

Proposed Change: Apartment Building 1 would be a prominent addition to the view, rising above the vegetated embankment at the end of the street. The building is contemporary urban in typology, scale and architecture, announcing the road's arrival in the new urban area. Design measures taken to reduce the perception of scale/massing, e.g., the vertical division of the facade into volumes of different materials, and its articulation by recessed balconies and large windows, are successful. Importantly, the scale of the building is commensurate with the width of the road corridor and the height of the enclosing embankments; its scale can be comfortably accommodated in this landscape.

Magnitude of Change: High.

Significance and Quality of Visual Effects: Moderate positive. The development would initiate the establishment of a new urban character and identity for Fassaroe at this important gateway, setting a high standard of architectural and material quality.

10.5.2.2 Viewpoint 2: Thornhill Road Approaching the Fassaroe Roundabout

Existing View: The view is taken from Thornhill Road on a low rise before it descends towards the roundabout junction. The nearest house on Thornhill Road is behind the vegetation to the left. The houses along the road have limited visual exposure to the site due to the screening effect of the topography and vegetation. The road and the roundabout ahead are enclosed by dense belts of trees on steep embankments rising from the roadside, generating a high degree of visual enclosure (and hiding the waste facility – to the right - from view.

Viewpoint Sensitivity: Low-Medium.

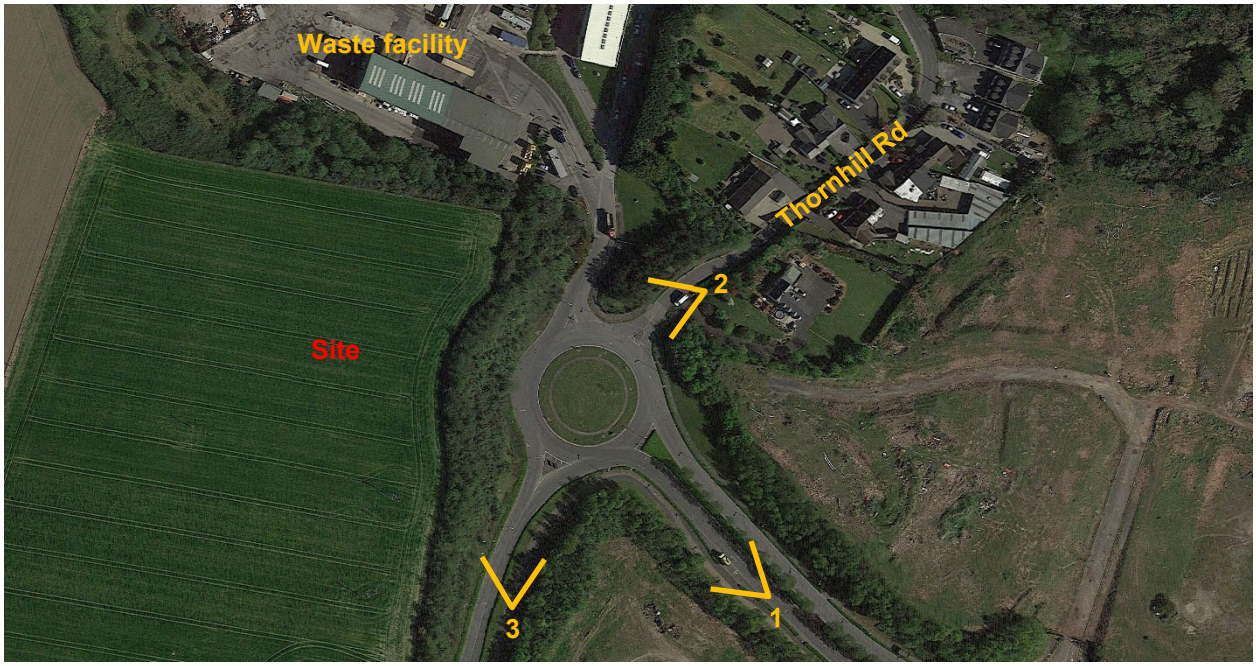


Figure 10.15: Viewpoints 1 – 3 at Eastern Side of Site

Proposed Change: Apartment Building 1 would be a prominent addition to the view, rising above the vegetated embankment above the roundabout. The building is contemporary urban in typology, scale and architecture, announcing the road's arrival in the new urban area. Design measures taken to reduce the perception of scale/massing, e.g. the vertical division of the facade into volumes of different materials, the vertical recesses and the articulation of the façade with recessed balconies and large windows are successful.

Magnitude of Change: High.

Significance and Quality of Visual Effects: Moderate positive. The development would initiate the establishment of a new urban character and identity for Fassaroe at this important gateway, setting a high standard of architectural and material quality.

10.5.2.3 Viewpoint 3: Road Approaching the Fassaroe Roundabout from the South West

Existing View: The view is taken from Fassaroe access road as it descends the hill towards the roundabout junction, which leads to Bray and N11 to the east. The road and the roundabout ahead are enclosed by dense belts of trees on steep embankments rising from the roadside, generating a high degree of visual enclosure (and hiding the waste facility which is directly ahead in the view.

Viewpoint Sensitivity: Medium.

Proposed Change: Apartment Building 1 would be a prominent addition to the view, rising above the vegetated embankment above the road, facing the roundabout and the road approaching from Bray and the N11. The building is of contemporary urban typology, scale and architecture. Design measures taken to reduce the perception of scale/massing, e.g. the vertical division of the facade into volumes of different materials, the vertical recesses, and the articulation of the façade with recessed balconies and large windows, are successful.

Magnitude of Change: Medium.

Significance and Quality of Visual Effects: Moderate positive. The development would initiate the establishment of a new urban character and identity for Fassaroe at this important gateway, setting a high standard of architectural and material quality.

10.5.2.4 Viewpoint 4: Berryfield Lane Existing Houses – View East

Existing View: The view is taken the Berryfield Lane across the road from the easternmost houses in the row of houses at the centre of the Fassaroe lands. Behind the wall across the road from the houses the land falls steadily to the north and east, and the wooded valley side of the Dargle River is prominent in the middle distance. The urban area of Bray can be seen beyond the valley, set against Bray Head which overlooks the sea. The Little Sugarloaf mountain is prominent to the right.

Viewpoint Sensitivity: Medium.

Proposed Change: The most prominent addition to the view would be the buildings making up the neighbourhood centre. The two buildings are located down the hill from the Berryfield Lane houses, beyond the large field which is designated for future development of a school campus. The two red brick buildings have a distinctly urban character (in typology, scale and architecture) and with their layout (at a right-angle to each other, enclosing a communal amenity space and parking) they initiate the establishment of a formal urban structure. The apartment buildings in Character Area 1 are visible behind and to the left of the neighbourhood centre. This adds a diversity of built form to the emerging urban area.

Importantly, (1) a visual connection to Bray is maintained between the two neighbourhood centre buildings, and (2) the topography of the wider landscape remains in the view, lending landscape character and visual amenity to the new urban quarter.

Magnitude of Change: Medium.

Significance and Quality of Visual Effects: Moderate positive. The development would initiate the establishment of a new urban character and identity for Fassaroe, setting a high standard of architectural and material quality. The view shows that the particular character of the wider area will be maintained despite the urbanisation of Fassaroe.

10.5.2.5 Viewpoint 5: View West from Houses on Berryfield Lane

Existing View: This view is taken from Berryfield Lane with the direction of view (to the west) opposite to that of View 4. The houses enclose the road to the left and to the right, behind the field boundary wall, the land falls steadily across the Fassaroe lands towards Ballyman Glen. In the distance are the outer foothills of the Dublin and Wicklow Mountains, with 'the Scalp' discernible.

Viewpoint Sensitivity: Medium.

Proposed Change: A large neighbourhood of lower density housing would be visible in the middle distance beyond the broad entrance to the District Park from Berryfield Lane. The houses are mostly two storeys, but rise to three storeys to the north (where the land falls towards Ballyman Glen). The 'earthy' colours and texture of the brick-clad houses with slate roofs allows them to integrate into the landscape despite causing a significant shift in character.

Also of note is the extent to which this view differs from proposed View 4 (the view towards the neighbourhood centre), illustrating the diversity of character in the proposed development – and its effect on legibility of the new urban structure.

Again it is noteworthy that the topography of the wider landscape would remain in the view, lending landscape character and visual amenity to the new urban quarter.

Magnitude of Change: Medium.

Significance and Quality of Visual Effects: Moderate positive. The development would initiate the establishment of a new urban character and identity for Fassaroe, setting a high standard of architectural and material quality. The view shows that the landscape character and visual amenity of the wider area will be maintained despite the urbanisation of Fassaroe.

10.5.2.6 Viewpoint 6a: View North from Berryfield Lane

Existing View: This view is taken from the northern side of Berryfield Lane, over the roadside/field boundary wall. It shows the sweeping fall of the Fassaroe lands towards Ballyman Glen (which is hidden by the foreground topography). Beyond the valley the land rises towards the distant peak of Carrickgollogan. The alignment of Ballyman Road along the distant hillside is indicated by the line of trees and occasional buildings.

Viewpoint Sensitivity: Medium. (This classification takes account of the land use zoning of the Fassaroe lands.)

Proposed Change: The large field in the foreground is designated for the development of a two-school campus, with the school buildings set back from Berryfield Lane behind playing fields. Beyond the field (future school campus) the residential neighbourhood of Character Area 2 can be seen, with the houses fronting the new Main Street. To the left is the District Park, broadening as it extends towards Ballyman Glen.

It is noteworthy the extent to which the character of the residential neighbourhood in view differs from that in View 5. The arrangement of the houses fronting the Main Street appears more formal, and the houses share the red brick cladding of the neighbourhood centre (just out of view to the right). This illustrates the success of the proposed design in achieving a diversity of character to generate local identity and legibility.

Again it is noteworthy that the topography of the wider landscape would remain in the view, lending landscape character and visual amenity to the new urban quarter.

Magnitude of Change: Medium-High.

Significance and Quality of Visual Effects: Moderate positive. The development would initiate the establishment of a new urban character and identity for Fassaroe, setting a high standard of architectural and material quality.

10.5.2.7 Viewpoint 6b: View North from Houses on Berryfield Lane

Existing View: This view is supplementary to View 6a. It is included to illustrate the effects on the houses on the south side of Berryfield Lane. The houses are mostly set back from the road behind gardens enclosed by vegetation and boundary walls. This combines with the convex topography and the wall on the north side of the road to limit the visibility of the field (and the site) across the road.

Viewpoint Sensitivity: Medium.

Proposed Change: The visual effects would be the same as for Viewpoint 6a but reduced in extent by the screening of the roadside wall (and further by the existing houses' garden vegetation and boundary walls).

Magnitude of Change: Medium.

Significance and Quality of Visual Effects: Moderate positive. The development would initiate the establishment of a new urban character and identity for Fassaroe in keeping with the land use objectives for the area.

10.5.2.8 Viewpoint 7: View West Along Berryfield Lane

Existing View: This view is taken from Berryfield Lane where the road passes a retail/light industrial premises at the end of the row of houses. This is the point at which the urban-generated development gives way to the rural landscape – although there are two utilities sites and a soccer club a short distance further west along the road.

Viewpoint Sensitivity: Medium.

Proposed Change: This stretch of Berryfield Lane is the interface between the proposed District Park to the north and the Active Open Space to the south of the road. The existing business premises in the view is proposed to be enclosed by a dense belt of woodland within the District Park, thereby protecting the amenities of the future park and its users while also retaining the road frontage for the business premises.

The proposed view shows the parkland edge to the Active Open Space in the foreground to the left. Beyond the stretch of road between the Active Open Space and District Park, the houses of the low density neighbourhood in Character Areas 4 and 5 can be discerned.

Magnitude of Change: Medium.

Significance and Quality of Visual Effects: Moderate positive. There would be a change of character from peri-urban to verdant suburban, in keeping with the land use zoning objectives and retaining a high level of visual amenity.

10.5.2.9 Viewpoint 8: View East Along Berryfield Lane

Existing View: This viewpoint is included to illustrate the effects where the proposed built form addresses Berryfield Lane directly. Currently the road is enclosed on both sides by hedgerows which restrict the visibility of the adjacent lands. Bray Head is a prominent feature on the distant horizon, and a church spire in Bray is discernible, lending some legibility to the view.

Viewpoint Sensitivity: Medium. (This classification takes account of the land use zoning of the Fassaroe lands.)

Proposed Change: The composition of the view and the character of Berryfield Lane would be transformed. The roadside hedgerow would be replaced by a row of semi-detached houses set back behind off-street parking interspersed with beds of ornamental planting and trees. The floor and roof levels of the houses are stepped to respond to the topography. Beyond the houses the wide frontage of the District Park to Berryfield Lane can be seen, and the alignment of the road is fortuitous in retaining the visibility of Bray Head in the distance.

It is noteworthy the extent to which the character of the neighbourhood in view differs from that in View 6, and from the high density areas at the neighbourhood centre and in Character Area 1. This illustrates the success of the proposal in achieving a diversity of character to generate local identity and legibility.

Magnitude of Change: High.

Significance and Quality of Visual Effects: Moderate positive. The development would initiate the establishment of a new urban character and identity for Fassaroe, setting a high standard of architectural and material quality.

10.5.2.10 Viewpoint 9: Farm house to west of Fassaroe lands

Existing View: This view is from a farm house which lies some 750m to the west of the Fassaroe lands beyond Berryfield House and the Enniskerry Football Club. The farm house is on a rise and orientates east

towards Fassaroe. In the view east, beyond the garden and farm yard in the foreground there are undulating grassland fields divided by mature hedgerows. The pavilion, lighting and fencing of the soccer club can be seen in the middle distance and beyond that the broad shelter belt of mature trees around Barryfield House, and a cluster of pylons and telecommunications masts to the right of that. Bray Head is prominent on the horizon and the sea is visible in the distance to the left.

Viewpoint Sensitivity: Medium. (The landscape in view is a complex, working landscape with valued features but also a quantity of urban-generated development typical of a peri-urban environment.)

Proposed Change: The majority of the Phase 1 development including all of the buildings would be screened from view by a combination of the topography and the mature trees around Berryfield House. Even the proposed Link/Main Street, which passes relatively close to the farm, would be hidden by the foreground topography and vegetation.

Magnitude of Change: Negligible.

Significance of Visual Effects: Imperceptible.

10.5.2.11 Viewpoint 10: Ballyman Road North-West of Main Proposed Development Area

Existing View: Heading east from Enniskerry, Ballyman Road climbs out of a valley to run along the face of a long hillside above Ballyman Glen. To the north west of the main proposed development area the road passes between two parts of the Dun Laoghaire Golf Club course. Along this stretch the road is enclosed by a tall, dense hedge (maintained as part of the golf course), which even in winter restricts views of the surrounding landscape.

Viewpoint Sensitivity: Medium-High.

Proposed Change: The development would be screened by the roadside hedge.

Magnitude of Change: None.

Significance of Visual Effects: No effect.

10.5.2.12 Viewpoint 11: Ballyman Road North of the Site

Existing View: Further east along Ballyman Road, to the east of the golf course, the landscape is more rural in character, with roadside houses and farms widely dispersed along the road. The road is elevated along this stretch as it passes to the north of the Fassaroe lands, providing occasional panoramic views south (where not obstructed by roadside vegetation).

The view is taken from a position between two of the roadside houses/farms. The field in the foreground falls away into Ballyman Glen, beyond which the Fassaroe lands are discernible (including the houses along Berryfield Lane). The uplands to the south, including the distinctive Sugarloaf Mountain, form a dramatic backdrop and horizon line. The foreground and distant topography and vegetation generate a high level of amenity but the view is not without detractors, most notably the overhead power lines.

Viewpoint Sensitivity: Medium-High. (This takes account of the DLR CDP ‘preserve view’ objective for views from Ballyman Road, and the visibility of existing urban-generated development and the land use objective for the Fassaroe lands.)

Proposed Change: The view aligns with the District Park at the centre of the proposed development. Most of the proposed buildings are to either side of the park, or partially screened by the proposed parkland trees.

Magnitude of Change: Low. (There would be little discernible change to the composition or character of the view.)

Significance of Visual Effects: Slight positive. The outcome of the development on this view would be entirely benign. The land use objectives for Fassaroe would be realised with no negative impacts, only an overall increase in vegetation in the view.

10.5.2.13 Viewpoints 12a, 12b and 13: Ballyman Road North of the Site

Existing View: Further to the east along Ballyman Road (from Viewpoint 11) there is a stretch of the road where unobstructed views south across the Fassaroe lands are afforded.

The combination of Viewpoints 12a and 12b (from the same position but with slightly different directions of view) and 13 (a short distance to the east and angled slightly to the east), is intended to show the full, 'worst case' effects on views from Ballyman Road. These views also illustrate factors such as (a) the separation distance between the affected houses/farms on Ballyman Road from the site, and (b) the existing visibility of the Bray urban area to the east.

The view composition includes broad fields in the foreground sloping down into Ballyman Glen (which is hidden by the foreground topography), the large fields of Fassaroe rising beyond the valley, the row of houses and trees along Berryfield Lane, and in the distance the complex topography of the Wicklow Mountains including the distinctive forms of the Sugarloaf and Little Sugarloaf. To the left beyond the wooded Dargle River valley is the urban area of Bray.

Viewpoint Sensitivity: Medium-High. (This takes account of the DLR CDP 'preserve view' objective for views from Ballyman Road, and the visibility of existing urban-generated development and the land use objective for the Fassaroe lands.)

Proposed Change: The three apartment buildings in Character Area 1 would be prominent in the lowest lying part of Fassaroe to the left. Up the slope from the apartments the neighbourhood centre buildings protrude above the roofs of a large estate of houses. There is a green belt wrapping around this estate and extending further up the hill, with the many trees in this space (the District Park) screening further housing to the west (right). Another notable characteristic of the green space around the housing (in addition to the trees) is the sculpted topography (see excerpt from photomontage below).

Figure 10.16: View from Ballyman Road South Across Site

Magnitude of Change: Medium. (While a part of the panoramic view, i.e. the Fassaroe lands, would be transformed, the majority of the complex panorama including the fields in the foreground, the distant uplands and horizon, and the Bray urban area to the east would be unaffected.)

Significance of Visual Effects: Moderate positive. The Fassaroe lands would be transformed from agricultural to urban, with the new urban area characterised by diversity of built form, a high proportion of green space and pronounced topography. The most valued elements of the views from Ballyman Road, i.e. the foreground fields, Ballyman Glen and the distant mountains, would be unaffected. The resulting composition would thus deliver the land use objective for Fassaroe and also preserve the visual amenity experienced along Ballyman Road.

10.5.2.14 Viewpoint 14: Dun Laoghaire Golf Course

Existing View: The view is taken from a viewing platform above the clubhouse. The golf course is built on the mid- and lower slopes of Carrickgollogan above Ballyman. The viewpoint affords a panoramic view past the clubhouse, over the golf course, the wooded Ballyman Glen and Fassaroe towards the Wicklow Mountains which span the horizon. Due to their slope and aspect, and the elevation of the viewpoint, the Fassaroe lands are exposed in the view. Also due to the viewpoint's elevation and the absence of

foreground enclosure, the field of view is exceptionally wide with a vast area of Co. Wicklow visible. The urban area of Bray is visible to the left, with large retail and industrial buildings notable around the base of the Little Sugarloaf. Outside of Bray the landscape in view is rural in character, with occasional pockets of development visible particularly on the slopes above Enniskerry.

Viewpoint Sensitivity: Medium.

Proposed Change: The roofscape of a large new low density neighbourhood (parts of Character Areas 4 and 5) would be visible beneath the Sugarloaf in the view. To the east (left) the red brick neighbourhood centre buildings and the lighter coloured apartments of Character Area 1 would be visible down the slope towards the existing urban area of Bray. The variety in typology, scale and materials would generate a desirable diversity in character in the new urban area. The presence of the buildings would be softened by the large area of densely vegetated open space dividing and wrapping around the new urban area, merging with the existing woodland in Ballyman Glen and integrating the development into the landscape.

Magnitude of Change: Low-Medium.

Significance of Visual Effects: Slight-moderate positive. The Fassaroe lands would be transformed from agricultural to urban in use, with the new urban area characterised by diversity of built form and a high proportion of green space. The most valued elements of the view, i.e. the golf course in the foreground, Ballyman Glen and the distant mountains, would be unaffected. The resulting composition would thus deliver the land use objective for Fassaroe and also preserve the visual amenity experienced on the slopes of Carrickgollogan.

10.5.2.15 Viewpoint 15: Killegar Road North West of Fassaroe

Views of Fassaroe are not afforded, or are only fleetingly afforded from the Scalp Road. The road is enclosed for most of its length by a combination of topography and vegetation. However, there are stretches of the Killegar Road to the west which afford views in which Fassaroe is visible and accordingly Viewpoint 15 is taken from here.

Existing View: Killegar Road traverses a rural landscape with dispersed houses and farms along the road. In the view south east from this location there is an allotment farm in the foreground and beyond that an undulating landscape of fields, hedgerows and patches of woodland. There are infrastructural elements visible in the landscape including pylons and telecommunications masts. The urban area of Bray is visible in the distance against a backdrop of Bray Head and the Little Sugarloaf.

Viewpoint Sensitivity: Medium. (The landscape in view is complex, with a high visual absorption capacity.)

Proposed Change: The most notable addition to the view would be the lower density neighbourhood of Character Areas 4 and 5. The avenue of trees along the new Link/Main Street would also mature in time to form a new feature of the view. At a distance of 1.7km, and seen against a backdrop of the existing urban area in a complex landscape, this would amount to a low magnitude of change.

Magnitude of Change: Low.

Significance of Visual Effects: Slight neutral. There would be no significant change to the composition, character or quality of the view.

10.5.2.16 Viewpoint 16: Parknasillogue Court West of Enniskerry

The majority of the village of Enniskerry is in the valley of the Cookstown/Glencullen River where the topography and woodlands generate a high degree of visual enclosure. Therefore, despite its relative proximity Fassaroe is not visible from most of the village. There are several estates up the hill to the west of Enniskerry from which views of Fassaroe are afforded, including Parknasillogue Court.

Existing View: In the views east from the estate there is a grassland field in the foreground with a hedgerow on the far boundary behind which the land falls away into the Glencullen River valley (where Enniskerry is hidden). In the distance beyond the valley the large, undulating fields of Fassaroe (the fields south of Berryfield Lane) can be seen. A stand of mature trees around the farm buildings west of Berryfield is prominent. The trees along Berryfield Lane and the telecommunication masts, substation and pylons are all discernible. The urban area of Bray can be seen in the distance against a backdrop of the sea and Bray Head.

Viewpoint Sensitivity: Medium.

Proposed Change: The proposed development would largely be hidden from view by the domed landform of Fassaroe and the existing trees along Berryfield Lane. The avenue of trees along the new Link/Main Street (the stretch to the south of Berryfield Lane) would be the only notable addition to the view.

Magnitude of Change: Negligible.

Significance of Visual Effects: Not significant neutral.

10.5.2.17 Viewpoint 17: Rocky Valley Drive

Existing View: Rocky Valley Drive runs around the flank of an outlying hill at the northern foot of the Great Sugarloaf. Lateral views from the road are generally restricted by roadside hedgerows and scrub, but at gaps in the vegetation panoramic views north and east are afforded. The small number of houses along the road are sited to take advantage of the views.

The land falls away steeply from the road into the densely wooded Dargle and Cookstown River valleys in the middle distance. Beyond the valleys the large fields of Fassaroe and Ballyman can be seen. The Fassaroe quarry is discernible, as are the houses along Berryfield Lane. Carrickgollogan forms the horizon to the left, covered by a matrix of farmland, forest and moorland. The urban area of Bray is visible to the right against a backdrop of the sea and Bray Head. Killiney Hill is visible in the distance protruding into the sea. There are numerous pylons and other infrastructural elements in the landscape (including a stretch of the M11) which add to the complexity of the view.

Viewpoint Sensitivity: Medium. (Rocky Valley Drive is a scenic area but due to its complexity the visual absorption capacity of the landscape in view is high.)

Proposed Change: The three apartment buildings in Character Area 1 would be prominent in the lowest lying part of Fassaroe to the right. To the left up the slope from the apartments the neighbourhood centre and a low density residential neighbourhood would form a new strip of urban development, merging with the houses of Berryfield Lane. The (a) texture and colours of the brick facades and slate roofs and (b) the appreciable response of the development to the topography, would contribute to the development integrating subtly into the landscape – apart from the apartment buildings which are intended to establish an urban identity for Fassaroe.

Magnitude of Change: Low-Medium.

Significance of Visual Effects: Slight-moderate neutral. There would be an expansion of the urban component of the landscape but the most valued elements in the view – the foreground rural landscape, the wooded valleys, Carrickgollogan and Killiney Hill, the coastline and sea) would be unaffected. The visual effects would be neutral.

10.5.2.18 Viewpoint 18: Trail on the Northern Slope of the Great Sugarloaf

Existing View: The view is taken from a trail on the northern flank of the Sugarloaf above Kilmacanogue. The mountainside in the foreground and the surrounding landscape are densely vegetated. At the foot of the mountain in the middle distance the roofs of the houses of Kilmacanogue protrude through the vegetation and a short stretch of the M11 is visible. In the distance beyond the broad, wooded valleys of the Dargle and Cookstown Rivers the Fassaroe lands can be seen. Carrickgollogan and the Scalp form the horizon to the left, covered by a matrix of farmland, forest and moorland. The Bray urban area is hidden from view by the Little Sugarloaf to the right, beyond which Killiney Hill and Howth Head can be seen projecting into the sea.

Viewpoint Sensitivity: Medium-High. (Although representing the view from a mountain trail, the area of landscape in view is vast and complex so there is a high visual absorption capacity.)

Proposed Change: The three apartment buildings in Character Area 1 would be visible in the lowest lying part of Fassaroe, with the lower density residential areas discernible up the slope to the left. The texture and colours of the brick facades and slate roofs would contribute to the development integrating subtly into the landscape. At a distance of 4km, in a panoramic view of a complex landscape, this would amount to a negligible to low change.

Magnitude of Change: Negligible-Low.

Significance of Visual Effects: Not significant neutral. There would be a noticeable expansion of urban development in the landscape but the most valued elements in the view – the foreground rural landscape,

the wooded valleys, Carrickgollogan and Killiney Hill, the coastline and sea) would be unaffected. The visual effects would be neutral.

10.5.2.19 Viewpoint 19: Trail Near Summit of Little Sugarloaf

Existing View: The trail at the summit of Little Sugarloaf affords a 360 degree view. The Bray urban area lies to the north at the foot of the mountain, surrounded by the woodland on the mountainside and in the valleys of the Dargle and Cookstown Rivers. The Fassaroe lands lie to the west of the urban area, part of a landscape in which urban and rural elements can be seen, enclosed by mountains spanning the horizon to the north and west. The sea is to the right of the field of view Dublin city centre is visible in the distance.

Viewpoint Sensitivity: Medium-High. (The viewpoint represents an outdoor recreation location but the landscape in view is vast and complex, and includes the Bray urban area, which contributes to the capacity to accommodate change.)

Proposed Change: The proposed development would be fully exposed to view, with the apartment buildings prominent on the lower slope of Fassaroe facing Bray across the wooded Dargle valley (and the M11). Behind the apartments the neighbourhood centre can be discerned, and further up the hill are two areas of lower density housing, softened by the large number of trees around and between the buildings. Each character area has a distinct material/colour palette, which in combination with the variations in building typology generates a diverse new urban area. A notable characteristic of the development is the extent to which the texture and colours of the facades and roofs contribute to its subtle integration into the wider landscape (see excerpt from the photomontage below, in which the rendered and painted houses in the suburbs of Bray are far more conspicuous). The shape of the District Park can be discerned between the two lower density neighbourhoods, and the park fans out to form a green buffer between the new urban area and Ballyman Glen to the north.

Figure 10.17: Viewpoint 19 from Trail near Little Sugarloaf

Magnitude of Change: Low-Medium. (At a distance of 3km the development would occupy a small part of the vast and complex landscape in view, and the key elements of the view would be largely unaffected.

Significance of Visual Effects: Slight-moderate positive. There would be an expansion of the urban component of the landscape, but the most valued elements in the view (the foreground upland landscape, the wooded valleys, the surrounding mountains, the coastline and the sea) would be unaffected. The considered layout and design of the new urban area – delivering the land use objectives for Fassaroe - would be appreciable from this angle.

10.5.2.20 Viewpoint 20: Bray Head

Existing View: From Bray Head views are afforded west over the town towards Fassaroe. The land falls away steeply in the foreground to the Bray urban area on the coastal plain. The townscape slopes evenly down to the coastline (to the right out of view), and the arrangement of the houses and other buildings in response to the topography is appreciable. The built form becomes more dispersed towards the west, and beyond the Dargle Valley there is an area of peri-urban character which includes Fassaroe. Its large, sloping fields are visibly contained by the Cookstown River valley to the left and Ballyman Glen to the right, with the tree-lined Berryfield Lane at the centre. The forest and moorland covered Wicklow Mountains span the horizon. The mountains and the urban area are the key elements of the view, although the eye is drawn to the coastline to the north and east (out of view to the right on the photomontage).

Viewpoint Sensitivity: Medium-High. (Although representing the view from a recreation trail, the area of landscape in view is vast and complex so there is a relatively high visual absorption capacity.)

Proposed Change: The proposed development would be fully exposed to view, with the apartment buildings prominent on the lower slope of Fassaroe facing Bray across the Dargle valley (and the M11). Behind the apartments the neighbourhood centre can be discerned, and further up the hill are two areas of lower density housing, softened by the large number of trees around and between the buildings. Each character area has a distinct material/colour palette, which in combination with the variations in building typology generates a diverse new urban area. The texture and colours of the facades and roofs contribute to the development's subtle integration into the wider landscape. The effect of the District Park as a landscape buffer between the urban area and Ballyman Glen is appreciable from this vantage point.

The view illustrates how the clear definition of Fassaroe (by the river valleys and hillsides to the north and south) makes it suitable for development - in that it lends itself to maintaining a clear urban-rural distinction. This is one of three targets for 'Landscape and Visual Amenity' set out in the Bray MD LAP SEA. The new Fassaroe quarter appears to be a natural extension of the Bray urban area to the west, between the valleys, contained by the surrounding hills.

Magnitude of Change: Low-Medium.

Significance of Visual Effects: Slight-moderate positive. The composition and character of the view would be altered by the urban expansion. However, the new urban elements can be seen to respond to the context, achieving the land use objectives without harming the landscape character or visual amenity. Additionally, the most valued elements in the view (e.g. the existing townscape, the wooded valleys, the surrounding mountains, the coastline and the sea) would be unaffected.

10.5.2.21 Viewpoint 21: Ardmore Wood Estate

There are very few locations in Bray from which the Fassaroe lands can be seen. Even from the western edge of the town, closest to Fassaroe, the views are limited. This is due largely to the mature woodland in the Dargle Valley, which abuts the urban area and creates a high degree of visual enclosure. At one location in the Ardmore Wood estate (Viewpoint 21) there is a clearing in the woods at the estate boundary allowing a view west from the street towards Fassaroe (see image below).

The view is taken over the estate boundary wall. It should be noted that the houses themselves do not have the same view (the windows of the houses face either north or south, i.e. away from the site which lies to the west).

Figure 10.18: Viewpoint 21 from Ardmore Wood Estate

Existing View: The land falls away steeply in the foreground into the wooded Dargle Valley, most of which (including the corridor of the N11) is screened from view by the vegetation in the foreground. The Fassaroe lands are on the far side of the wide valley. To the right is the waste facility in a deep cutting which limits its prominence. Behind and to the left of that are the broad, domed fields of Fassaroe, zoned for the town's expansion. The houses along Berryfield Lane are visible to the left, as are the telecommunications masts and pylons that characterise the area. The distant forest and moorland covered mountains form an undulating horizon.

Viewpoint Sensitivity: Medium.

Proposed Change: The apartment buildings of Character Area 1 would be a prominent addition to the view, rising behind the densely vegetated embankments above the Fassaroe access road, facing Bray across the broad Dargle valley and drawing the eye due to their urban typology and scale. Behind and the to the left of the apartments the two buildings of the neighbourhood centre can be seen, and to the right an estate of lower density housing. Due to their combined spatial extent and their diversity of form and architecture these three elements/areas generate an urban character (as opposed to having the appearance of an isolated, extra-urban development). This angle of view also clearly shows the breadth of the District Park which wraps around the northern edge of the development, forming a green buffer to Ballyman Glen (to the right).

Magnitude of Change: Medium-High.

Significance of Visual Effects: Moderate positive. The composition and character of the view would be significantly altered by the urban expansion - as is intended. (It is necessary and desirable for the 21st century expansion of Bray to identify itself strongly to overcome its physical and visual separation from the main urban area.) The new urban elements can be seen to respond to the context, achieving the land use objectives without harming landscape character or visual amenity. Additionally, the most valued elements in the view (e.g. the wooded valleys and the surrounding mountains) would be unaffected.

10.5.2.22 Viewpoint 22: M11 Road Corridor

Existing View: The M11 approaches Bray from the north and south in deep cuttings, and bypasses the town running along the floor of the Dargle Valley. For most of its length in the vicinity of Bray the road is enclosed by broad belts of mature trees on the roadside embankments and the valley sides. As a result of the topography and vegetation in the road corridor there are no views of the Fassaroe lands from the road. To test the visibility of the proposed development from the road corridor a view was taken from a bridge over the motorway at Kilcroney. In this view the motorway corridor itself is prominent in the foreground and the roadside vegetation frames a view of Carrickgollogan on the horizon. The Fassaroe lands lie at the foot of Carrickgollogan and are barely visible above the trees in the Cookstown River valley.

Viewpoint Sensitivity: Low.

Proposed Change: One of the apartment buildings in Character Area 1, the neighbourhood centre buildings and an estate of lower density housing would be visible, forming a new strip of urban development at the base of Carrickgollogan. The texture and colours of the facades and roofs would contribute to the development integrating subtly into the landscape, although it would cause a shift in character.

Magnitude of Change: Low.

Significance of Visual Effects: Not significant neutral. The development would only be briefly glimpsed from limited positions along the N11/M11 if at all.

10.6 Mitigation Measures

10.6.1 Construction Phase

No mitigation measures are recommended for landscape and visual impact mitigation other than standard best practice construction site management.

10.6.2 Operational Phase

The potential landscape and visual effects of the proposal in the operational phase have been classified as generally positive or neutral. No negative effects have been identified. Therefore no mitigation measures are required for landscape and visual effects.

10.6.3 Cumulative Impacts

There are no permitted developments in the vicinity of the site with which the proposed development would interact to cause landscape or visual impacts more significant (or otherwise different) to the effects identified above. Therefore no mitigation of potential cumulative effects is required.

10.7 Predicted Impacts

10.7.1 Construction Phase – Landscape

While at a macro-level the landscape sensitivity to the proposed development can be classified low (due to the site's zoning for urban development), at the local level there are pockets of sensitivity to landscape change. These include:

- Areas of existing residential use:
  - (1) the row of houses and farms along Berryfield Lane,
  - (2) the houses along Thornhill Road to the north east,
  - (3) the houses along Kilbride Lane to the south east, and
  - (4) the houses and farms along the eastern stretch of Ballyman Road to the north.
- The two river valleys, i.e. Ballyman Glen (SAC and pNHA) to the north and the Cookstown River valley to the south.

The landscape change experienced by these receptors would be high close to the site, reducing in magnitude with distance from the site.

Measuring the magnitude of change against the sensitivity of the receiving environment, **at the local level the construction phase effects on landscape character would be 'significant' and negative (construction activity is inherently disturbing of the landscape, and unsightly) - although temporary**. Such effects would be experienced only in the immediate environs of the site, i.e. Berryfield Lane and the southern edge of Ballyman Glen, with effects of lesser significance occurring along Thornhill Road, Kilbride Lane, Ballyman Road and the Cookstown River valley.

At the wider scale, i.e. the areas from which the site/proposed works would be viewed from a distance, the magnitude of landscape change experienced would be low. In most such views the construction activity would be seen in the wider context, therefore *visibly an extension of the existing Bray urban area*. **In summary, the macro level effects on landscape character during construction would be negative but of slight significance, and temporary**.

10.7.2 Construction Phase – Visual Amenity

At the local level the potential construction phase effects on visual amenity would be 'significant', and negative (construction activity is inherently unsightly) - although temporary. Such effects would be experienced only in the immediate environs of the site, i.e. Berryfield Lane, with effects of lesser significance occurring along Thornhill Road, Kilbride Lane and Ballyman Road.

At the wider scale, i.e. the areas from which the site/proposed works would be viewed from a distance, the magnitude of visual change would generally be low. **The macro level effects on visual amenity during construction would be negative but of slight significance, and temporary**.

10.7.3 Operational Phase - Landscape

10.7.3.1 Landscape Character and Sensitivity to Change

Overall, the sensitivity of the receiving environment to landscape change of the type proposed can be classified 'medium' (definition[3]: *Areas where the landscape has certain valued elements, features or characteristics but where the character is mixed or not particularly strong, or has evidence of alteration, degradation or erosion of elements and characteristics. The landscape character is such that there is some capacity for change. These areas may be recognised in landscape policy at local or county level and the principle management objective may be to consolidate landscape character or facilitate appropriate, necessary change*).

This sensitivity classification is based on the following factors:

- The Fassaroe lands have been zoned for urban development since the 1990s when the area was identified as the only option for the necessary large scale expansion of the Bray urban area. The lands are zoned for urban development in both the Wicklow CDP and the Bray MD LAP. Both plans were subject to Strategic Environmental Assessment and the SEA report for the LAP states: *"The potential impacts on landscape and visual amenity are predominantly neutral with some positive impacts likely to occur. Development would generally be consolidated within Bray town centre, undertaken on appropriately zoned lands in Fassaroe and generally avoid impacts on landscape and visual amenity."*
- The Fassaroe lands are already classified as 'urban' in the Landscape Assessment contained in the Wicklow CDP. The Landscape Assessment states: *"In terms of landscape classification, these [areas] have already been deemed suitable for development (of the type allowed by the settlement strategy and the development standards of this plan) and the impacts on the wider landscape of such development has already been deemed acceptable".*
- There are relatively few cultural heritage sensitivities in and around the Fassaroe area, and no protected views identified in the area in the Bray MD LAP or the Wicklow CDP (see **Figure 10.11** and **Figure 10.12**). The 'preserve views' objective of the DLR CDP for Ballyman Road to the north (**Figure 10.13**) can be assumed to allow for the planned urban development of Fassaroe.
- Due to its intensive agricultural use there is relatively little vegetation of 'landscape value' in the Fassaroe area. The exceptions to this include (a) a shelter belt of trees around Berryfield House, (b) a belt of screening vegetation on the embankments surrounding the waste facility, (c) belts of screening vegetation on the embankments either side of the Fassaroe access road, and (d) the woodland in the river valleys.

[3] Refer to 'Note on definitions used in this assessment' in Section 10.2.2.1.

- The main areas of landscape sensitivity in the Fassaroe area are:
  - The Cookstown River valley to the south and the Ballyman Glen to the north – due to their valley topography, woodland/trees and other habitats. Ballyman Glen is particularly sensitive due to its SAC and pNHA designations.
  - The pockets of residential use in the area including (1) the row of houses and farms along Berryfield Lane, (2) the houses along Thornhill Road to the north east, (3) the houses along Kilbride Lane to the south east, and (4) the houses and farms along the eastern stretch of Ballyman Road to the north.

10.7.3.2 Magnitude of Landscape Change

Taking account of the scale (site area of 78.5 ha) and the nature of the proposed development, **the magnitude of landscape change which would result from the development would be 'high'** (definition[4]: *Change that is moderate to large in extent, resulting in major alteration to key elements, features or characteristics of the landscape, and/or introduction of large elements considered uncharacteristic in the context. Such development results in change to the character of the landscape*).

10.7.3.3 Significance of Landscape Effects

Measuring the magnitude of change against the sensitivity of the receiving environment, **the operational phase effects on the landscape would be 'significant'**.

The development would initiate and realise a substantial part of the planned urban expansion of Bray into the Fassaroe area, delivering several key elements including (a) the east-west road link between the N11 and Ballyman Road, (b) the neighbourhood centre, (c), the district park and active open space and (d) extensive residential neighbourhoods of diverse typology/density and character. The overall effect, i.e. the shift in the landscape character of Fassaroe from peri-urban towards a contemporary urban condition, would be permanent.

In order to determine whether the landscape effects can be classified positive, neutral or negative, the proposal was appraised against the relevant 'Key Principles of Good Design' as stated in the Development and Design Standards of the Wicklow CDP. (These principles are derived from the 'Urban Design Criteria and Indicators' provided in the *Urban Design Manual - A Best Practice Guide* (2009) published by the Department of Housing, Local Government and Heritage.)

The appraisal (see Table 10.7) found that the proposal is in accordance with all the relevant 'principles of good urban design' and therefore the landscape effects, while significant, would be positive.

10.7.4 Operational Phase – Visual Amenity

To assess the proposal's visual effects 22 no. representative viewpoints in the receiving environment were selected for detailed assessment informed by verified photomontages. The viewpoints were selected to address the key elements, areas and sensitivities in the receiving environment, as well as to provide photomontages from a range of angles, distances and elevations. The findings of the assessment are summarised in **Table 10.8** below.

[4] Refer to 'Note on definitions used in this assessment' in Section 10.2.2.1.

Table 10.8: Summary of Predicted Visual Effects

Viewpoints	Viewpoint Sensitivity	Magnitude of Change	Significance & Quality of Visual Effects		
			Construction (Temporary)	Operation (Permanent)	Residual (Permanent)
01 – Fassaroe access road (R918) from the east	Low-Medium	High	Moderate negative	Moderate positive	Moderate positive
02 – Thornhill Rd approaching the Fassaroe roundabout	Low-Medium	High	Moderate negative	Moderate positive	Moderate positive
03 –Approaching the Fassaroe roundabout from the SW	Low-Medium	High	Moderate negative	Moderate positive	Moderate positive
04 – Berryfield Lane existing houses – View east	Medium	Medium	Moderate negative	Moderate positive	Moderate positive
05 – View west from houses on Berryfield Lane	Medium	Medium	Moderate negative	Moderate positive	Moderate positive
06a – View north from Berryfield Lane	Medium	Medium-High	Moderate negative	Moderate positive	Moderate positive
06b – View north from houses on Berryfield Lane	Medium	Medium	Moderate negative	Moderate positive	Moderate positive
07 - View west along Berryfield Lane	Medium	Medium	Moderate negative	Moderate positive	Moderate positive
08 – View east along Berryfield Lane	Medium	High	Moderate negative	Moderate positive	Moderate positive
09 – Farm house to west of Fassaroe lands	Medium	Negligible	Imperceptible neutral	Imperceptible neutral	Imperceptible neutral
10 – Ballyman Road NW of main development area	Medium-High	None	No effect	No effect	No effect
11 – Ballyman Road north of the site	Medium-High	Low	Slight negative	Slight positive	Slight positive
12a, 12b, 13 – Ballyman Road north of the site	Medium-High	Medium	Moderate negative	Moderate positive	Moderate positive
14 - Dun Laoghaire Golf Course	Medium	Low-Medium	Slight-Moderate negative	Slight-Moderate neutral	Slight-Moderate neutral
15 - Killegar Road north west of Fassaroe	Medium	Low	Slight negative	Slight neutral	Slight neutral
16 - Parknasillogue Court west of Enniskerry	Medium	Negligible	Not Significant negative	Not Significant neutral	Not significant neutral

Viewpoints	Viewpoint Sensitivity	Magnitude of Change	Significance & Quality of Visual Effects		
			Construction (Temporary)	Operation (Permanent)	Residual (Permanent)
17 - Rocky Valley Drive	Medium	Low-Medium	Slight-Moderate negative	Slight-Moderate neutral	Slight-Moderate neutral
18 - Trail on northern slope of Great Sugarloaf	Medium-High	Negligible-Low	Not Significant negative	Not Significant neutral	Not significant neutral
19 - Trail near summit of Little Sugarloaf	Medium-High	Low-Medium	Slight-Moderate negative	Slight-Moderate positive	Slight-Moderate positive
20 – Bray Head	Medium-High	Low-Medium	Slight-Moderate negative	Slight-Moderate positive	Slight-Moderate positive
21 - Ardmore Wood estate	Medium	Medium-High	Moderate negative	Moderate positive	Moderate positive
22 - M11 road corridor	Low	Low	Not Significant neutral	Not Significant neutral	Not significant neutral

The key findings can be summarised as follows:

- Views from the Fassaroe access roads and Bray to the east of the site. The access road and roundabout to the east of the site form the main gateway to Fassaroe from the N11/M11 and Bray. The landscape in view from the roads (Viewpoints 1, 2, 3) was constructed specifically to facilitate the urban development of Fassaroe. Therefore, the sensitivity can be considered low-medium despite there being limited development visible from the road currently. In views from the road the apartment buildings of Character Area 1 would be a prominent addition. Being of contemporary urban typology, scale and architecture, the building would announce the road's arrival in the new urban quarter. Design measures such as the vertical division of the facade into volumes of different materials, and its articulation by recessed balconies and large windows, are successful in reducing the perceptions of scale. Importantly, the scale of the building is commensurate with the width of the road corridor and the height of the enclosing embankments; the development can be comfortably accommodated in this landscape. The magnitude of change in these views would be high (the development being the first step in the area's urbanisation following the construction of the road itself). The significance of the visual effects would be moderate and positive.
- Views from Berryfield Lane. Berryfield Lane passes through the centre of the Fassaroe lands. The road users and the linear cluster of houses and business premises on the road are unavoidably exposed to the area's future development/urbanisation. Taking account of their position at the centre of the planned new urban quarter, the sensitivity of these viewpoints (nos. 4-8) can be considered medium. The viewers would experience change ranging from medium to high magnitude, with various elements of the development visible, including the apartments in Character Area 1 down the hill, the neighbourhood centre, the different lower density residential neighbourhoods (including houses fronting Berrfyfield Lane itself) and the District Park and Active Recreation Space. Berryfield Lane would effectively become incorporated in the new urban area. Two noteworthy aspects of the proposed views are the following: (1) the extent to which the proposal visibly responds to the topography of the area (in terms of building height and urban grain/layout), and (2) the diversity of character within the new urban quarter, generating local identity and legibility. The significance of the visual effects would be moderate and positive.
- Views from Ballyman Road. Ballyman Road passes along the hillside north of Ballyman Glen to the north of Fassaroe. The western stretch of the road, closer to Enniskerry, would experience no change (due to the topography and vegetation along the road). The eastern stretch of the road, closer to Bray,

is more exposed. The DLR CDP has an objective to 'preserve views' from the road. Viewpoints 11, 12a and b and 13 assess the effects on views from the road. Much of the proposed development would be visible, including the apartment buildings in Character Area 1, the neighbourhood centre, the lower density residential estates and the District Park which wraps around the northern edge of the development to form a green buffer to Ballyman Glen. The Fassaroe lands would thus be transformed from agricultural to urban, with the new urban area characterised by diversity of built form, a high proportion of green space and pronounced topography. The most valued elements in the existing views from Ballyman Road, i.e. the foreground fields, Ballyman Glen and the distant mountains, would be unaffected. The resulting composition would thus deliver the land use objectives for Fassaroe and also preserve the visual amenity experienced along Ballyman Road. The significance of the visual effects would be moderate and positive.

- Views from the uplands south and east of Fassaroe including the Sugarloaf, Little Sugarloaf and Bray Head. The hills/mountains to the south and east of Fassaroe are an important outdoor recreation amenity, affording views of high amenity value. Due to the elevation of the trails in these uplands the proposed development would be exposed to view – although it would be seen from some distance (several kilometres) and as part of a vast and diverse panorama. In these views (as in the views from Ballyman Road) the responsiveness of the development to the landscape context would be evident, as well as the new urban area's diversity. Also of note is the extent to which (a) the texture and colours of the buildings and (b) the extent of the open space and vegetation, would contribute to the development's integration into the wider landscape. The visual effects would range from not significant to slight-moderate, and would be neutral or positive.

In conclusion, none of the 22 no. viewpoints is predicted to experience a negative visual impact. The proposed development would achieve the land use zoning objective for the site, initiating the planned expansion of Bray into the Fassaroe area, and the proposal can be considered an exemplar of best practice in urban design.

10.7.5 Cumulative Impacts

There are no permitted developments in the vicinity of the site with which the proposed development would interact to cause landscape or visual impacts more significant (or otherwise different) to the effects identified above.

The proposed development would interact with future phases of development of the Fassaroe lands to cause more significant landscape and visual effects (due to the greater extent and diversity of the new urban area). This is intended (and prescribed in planning policy – see Sections 10.3.3.1 and 10.3.3.2 above). It can be assumed that to successfully attain planning permission the future phases will be of similar design and material quality to the proposed development (see appraisal of the proposal in **Table 10.7** above), and therefore that the in-combination effects will also be generally positive or neutral.

10.8 Monitoring and Reinstatement Measures

No monitoring of landscape and visual effects is required other than the monitoring of soft landscape works after planting to ensure the health and viability of the plants.

11 ARCHAEOLOGICAL, ARCHITECTURAL AND CULTURAL HERITAGE

11.1 Introduction

Cultural Heritage is defined by UNESCO as "the legacy of physical artefacts and intangible attributes of a group or society that are inherited from past generations, maintained in the present and bestowed for the benefit of future generations" (www.unesco.org/new/en/cairo/culture/tangible-cultural-heritage).In terms of the present project, Cultural Heritage is assumed to include all humanly created features on the landscape, including portable artefacts, which might reflect the prehistoric, historic, architectural, engineering and/or social history of the area.

The Heritage Act (1995) contains a list of various aspects of heritage, including archaeological monuments and objects, architectural heritage, fauna, flora, geology, heritage gardens and parks, heritage objects, inland waterways, landscapes, monuments, seascapes, wildlife habitats and wrecks.

The Cultural Heritage of the area of the proposed project was examined through an Archaeological, Architectural, and Historical study. The Archaeological and Architectural studies involved a documentary/ cartographic search and focussed field inspection of the area, while the Historical study involved a documentary search.

This chapter discusses the receiving environment from a Cultural Heritage perspective. It provides information with respect to previously identified baseline data and assesses the impact of the proposals on identified sites and areas of Cultural Heritage interest and/or potential.

11.2 Methodology

11.2.1 Definition of Study Area

The subject development lands (application red-line boundary) and an area of 300m surrounding such lands were determined to be the Study Area for Cultural Heritage. The extent of the Cultural Heritage Study Area was chosen on the basis of the topography of the subject site and environs and to reflect an appropriate context for the development, beyond which it was considered that a development of this nature would have no direct/indirect impacts.

11.2.2 Paper Survey

As part of a documentary/cartographic search, the following principal sources were examined from which a list of sites and areas of Cultural Heritage interest/potential was compiled:

- Record of Monuments and Places (RMP) – Cos. Wicklow & Dublin.
- Sites and Monuments Records (SMR) of the Archaeological Survey of Ireland – www.archaeology.ie.
- Topographical File Records of the National Museum of Ireland.
- Annual Archaeological Excavation Bulletin – www.excavations.ie.
- Historic cartographic and aerial photographic records of Ordnance Survey Ireland – www.osi.ie
- National Inventory of Architectural Heritage (NIAH) – Cos. Wicklow & Dún Laoghaire-Rathdown – www.buildingsofireland.ie.
- Heritage Council Data – www.heritagemaps.ie
- Open Topographic Data Viewer (LiDAR information) – www.dcent.maps.arcgis.com
- Documentary and cartographic sources (**See Chapter 15 – References**).
- Wicklow County Development Plan 2016 – 2022 (WCDP).
- Bray Municipal District Local Area Plan 2018 – 2024 (BMDLAP).

- Dún Laoghaire – Rathdown County Development Plan 2016 – 2022 (DLRCDP).
- Placenames Commission – www.logainm.ie
- National Folklore Collection (The School's Collection) – www.duchas.ie

11.2.3 Field Inspection

From the preceding paper survey, a list of cultural heritage sites/sites of cultural heritage potential was compiled for inspection. The subject lands and a *c.* 300m area surrounding the boundaries of such lands were assessed for the presence of archaeological monuments by reference to map and aerial photographic sources. Intensive field surveys of the subject lands were undertaken in October 2015 and in late August 2021.

An attempt was also made to identify previously unrecorded sites of cultural heritage potential within, and in the immediate environs of, the proposed development area.

Sites of cultural heritage potential identified on the basis of the paper survey were inspected in an attempt to confirm their locations on the ground and to determine, if possible, their likely extent.

11.3 Receiving Environment

11.3.1 Local History

The subject development is largely located within the townland of Fassaroe and civil parish of Kilmacanoge, with a small section within the townland of Monastery and civil parish of Powerscourt (O.S. 6" maps: Wicklow Sheets 7 & 3 respectively), all in the barony of Rathdown (half-barony of Rathdown, Co. Wicklow). The name Fassaroe may derive from the Irish *An Fásach Rua* – the 'red wilderness' or 'red wasteland', although the Irish form has not yet been validated by the Placenames Commission (www.logainm.ie), while the Irish form of the name 'Monastery' has yet to be verified.

The Barony of Rathdown nestles between the fringes of the Wicklow and Dublin mountains to the west and the Irish Sea to the east. It stretches as far north as the city limits of Dublin, from Rathfarnham to Blackrock, and south to Delgany and Greystones in County Wicklow. In 1609 Rathdown Barony was divided into two by the establishment of the county boundary between Dublin and Wicklow.

At the beginning of the historic period, the whole area bounded by the Dublin and Wicklow mountains to the west was known as *Cualu.* Corlett (1999, 34) notes *"a tradition that this area was famous for its ale, which was consumed from vessels made from the horns of wild ox, and according to one early text 'he is not king over glorious Ireland who does not consume the ale of Cualu".* At this time, Cualu was controlled by the Dál Messin Corb, a leading tribe in Leinster. Maelodran, a legendary hero of the Dál Messin Corb, was celebrated as the slaughterer of a rival tribe, the Uí Mail, killing their warriors 'as a quern might crush corn'. Maelodran married the daughter of a rival Uí Mail king, who successfully conspired to have him killed, after which the Dál Messin Corb withdrew to the area around Arklow and the Uí Mail rose to power as kings of Leinster during the seventh century. At this time, the Uí Théig became the leading tribe of north-east Wicklow and south-east Dublin. They were replaced during the eighth century by the Uí Briúin, who lent the name *Uí Briúin Cualann* to much of the territory known today as Rathdown. Davies (1998, 1), notes that the area of south-east Dublin and north-east Wicklow *"was described by one scholar as a 'political backwater' in early Ireland"*. During the Viking Age the area around Bray was, according to Flynn (2003, 15), *"handed over to the Torkjell family, whose domain extended from Donnybrook to Glencree"*.

Following the Anglo-Norman Invasions, the subject lands formed part of the properties granted to Walter de Ridelesford (*c.* 1173), who based the seat of his manor in nearby Bray. A similar manor was established at Fassaroe. Whatever the manors' condition in the first years of its existence, by the fourteenth century their hold on prosperity and ability to carry on agricultural activities was tenuous. The threat came from the south-west where two major families, the O'Byrnes and the O'Tooles, expelled from Kildare by the Anglo-Normans, maintained bases in the inaccessible uplands from which to wage war against the crown and to attack the settled communities in the lowlands below. Indeed, much of the area remained marchland, the edge of 'the land of war', rather than part of the 'land of peace' under the control of the English crown; it was terrorised, particularly at harvest time, by 'the Irish of the mountains'.

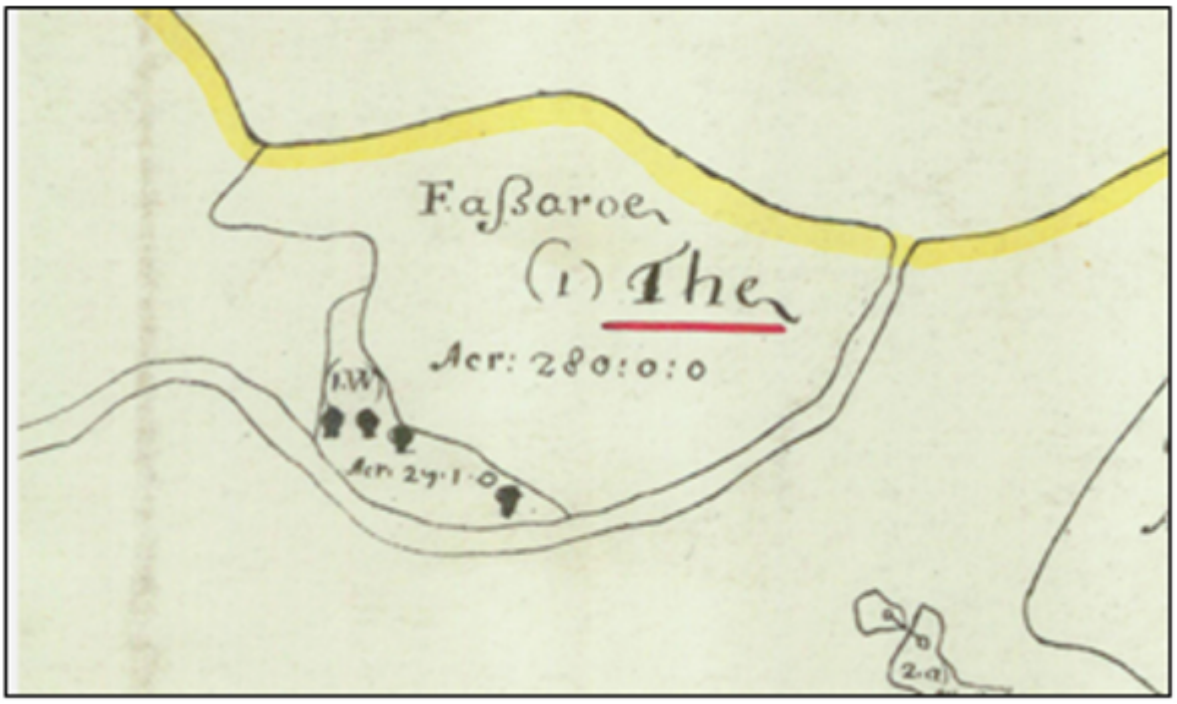
The manor of Fassaroe was granted to the Brabazon family, one of which, William, became Chief Treasurer of Ireland and built a castle at Fassaroe in 1535. The castle is mentioned by Thomas Cromwell, when writing to Henry VIII's minister about the troubles with the O'Byrnes and O'Tooles: 'Master Tresorer Brabazon is engaged in defending the country and is building the castles of Powere's Court and the Fassagh-Rowe'. In 1536 Henry VIII decided to extend the Pale (area of English influence defined and defended by an earthwork) to the area south and south-west of Bray. He subsequently granted the lands and castle at Rathdown, north of Greystones, to the Talbot family and, in addition, granted to them the castle and lands at Ballyman and the manors of Fassaroe and Powerscourt, along with their associated water and fishing rights.

Following the formal establishment of County Wicklow in 1605, a grand jury administrative structure was established. Policing was one of the responsibilities of the grant jury and watchmen were appointed to stop and examine, and, if necessary, arrest and detain 'suspected persons'. Speed's Map of the area at around this time (1610) is illustrated in **Figure 11.1**. On 16th July 1612, the grand jury ordered *"that £31 be raised on the Half Barony of Rathdown for a watch-house to be built in the town of Fassaroe and appointed Captain Richard Lambert overseer for it"* (Donnelly, 1994, 858). The location of the 'town' is not known but it is assumed to refer to a small settlement close to Fassaroe castle.

Figure 11.1: Extract from Speed's Map – 1610

In 1609, James I granted the castle and all the lands of Fercullen, with the exception of a thousand acres, to Sir Richard Wingfield. Shortly afterwards, the lands were formed into a manor and in 1618 the proprietor was created Viscount Powerscourt (Lewis, 1837, 470). The Civil Survey of 1656-8 notes that the townland of Monastery, then known as Manister, was owned by Sir Edward Wingfield in 1641 and that it included 331 'plantation acres' of profitable land; Wingfield is also the recorded owner in 1670. The extent of the lands at Fassaroe is illustrated in **Figure 11.2**. Sir William Flower is the recorded owner of Fassaroe in 1670; it was then known as Ballytaskin and formed part of the parish of Glencapps – names which were subsequently discarded.

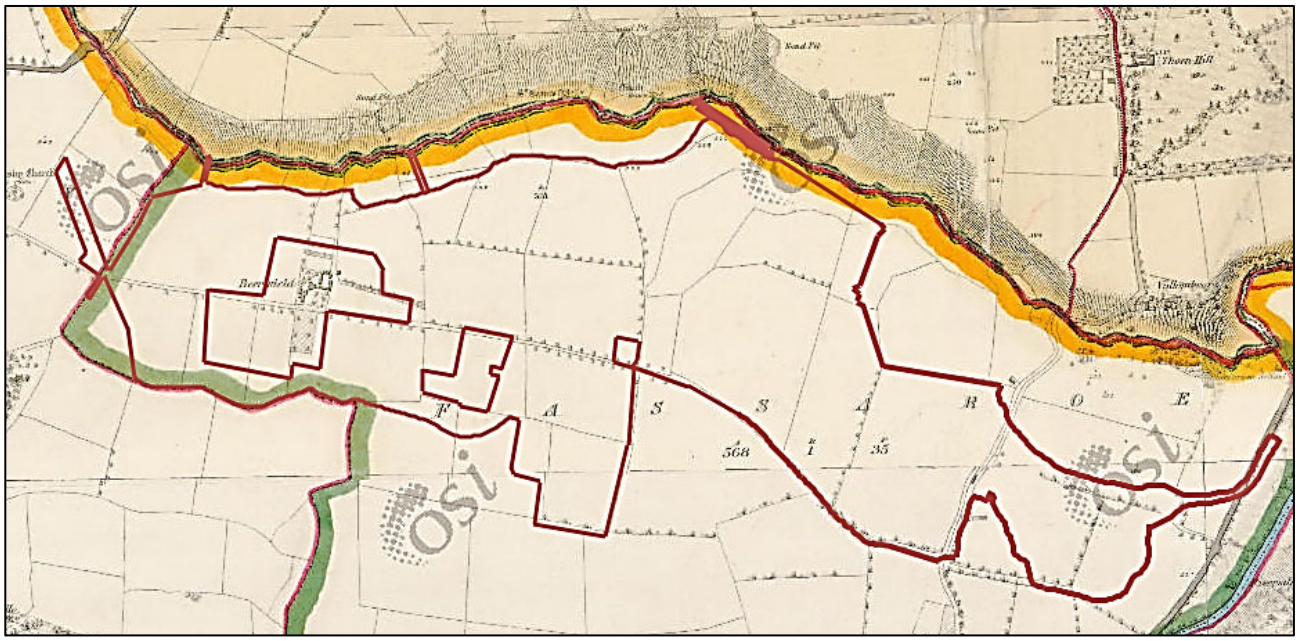
Figure 11.2: Extract from Down Survey Map for Fassaroe – 1656-8



Very little history is known about the area in the eighteenth and early nineteenth centuries. The Ordnance Survey map of 1838 (**Figure 11.3**) indicates that it was largely rural in form, with the townland of Fassarow bisected by a road – present Berryfield Lane – aligned in a general west-northwest – east-south-east direction and extending northwest through the townland of Monastery to connect with the Ballyman Road. The townland boundary between Fassaroe and Monastery is illustrated; this also acted as a civil parish boundary. In addition, the County Brook Stream to the north is indicated as a townland, civil parish, barony and county boundary.

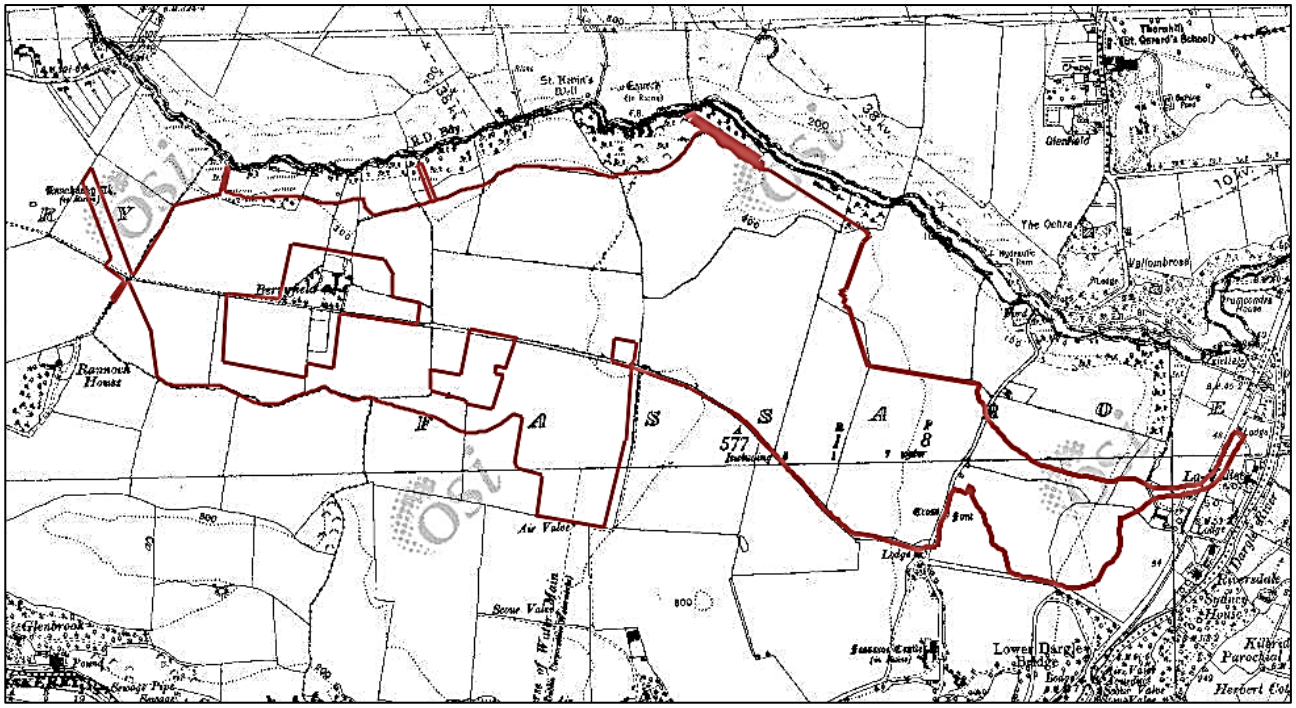
The subject lands are largely laid out in small – medium-sized fields, many of which are still evident today. Many of the field boundaries are indicated as being planted, as is much of edge of Berryfield Lane. There is very little evidence of housing, except for two large houses - Berryfield House and Fassaroe House, both of which are situated outside the extent of the subject lands, and a number of smaller properties located adjacent to Fassaroe House and along the southern boundary of the Fassaroe townland.

Figure 11.3: Extract from O.S. Map – 1838



Griffith's Valuation of 1854 notes that the section of land within Monastery townland was then owned by Viscount Powerscourt, and leased to Charles Stronge, Patrick Costello and John Hill. The lands which form the subject development within Fassaroe townland were then owned by Mrs. Beresford-Stronge and the Hon. Judge Crampton, and were leased by Edward Barrington. Judge Crampton lived in St. Vallery's House and the Bereseford-Stronges' lived in Berryfield House.

Figure 11.4: Extract from O.S. Map – 1912



An extract from the Ordnance Survey map of 1912 is reproduced in **Figure 11.4**. This indicates, when compared to the map of 1838 (Figure 11.3), that very little changes to the general topographical landscape had occurred in the area since that time. The agricultural field patterns are largely similar and the number of dwellings in the area had increased, although by very little. The modern development of electrical overhead lines is evident to the north and northwest and the banks of the Ballyman River/County Brook are shown to have been planted by this time.

While a significant portion of the lands have been extensively quarried for sand and gravel in more recent times, most of the lands remain in agricultural use, with a number of field boundaries removed in the eastern/north-eastern areas. Many of these former sand and gravel pits, particularly adjacent to the northern boundary of the lands, subsequently functioned as a landfills (**Figure 11.5**), but have now been returned to agricultural use (**Figure 11.6**).

Figure 11.5: Locations of Former Quarry/Landfill Sites Within Subject Lands

Figure 11.6: Aerial View of Subject Lands (red-line boundaries)

11.3.2 Archaeological Heritage

11.3.2.1 Introduction

Archaeology is the study of past societies through their material remains and the landscapes they lived in. "The archaeological heritage consists of such material remains (whether in the form of sites and monuments or artefacts in the sense of moveable objects) and environmental evidence" (DoAHG 1999, p9).

Archaeological heritage comprises all material remains of past societies, with the potential to enhance our understanding of such societies. It includes the remains of features such as settlements, burials, ships and boats and portable objects of all kinds, from the everyday to the very special. It also includes evidence of the environment in which those societies lived. The terms "site" or "monument" are used generally to refer to fixed structures or areas of activity, as opposed to particular moveable objects. Historic wrecks are also part of the archaeological heritage (DHLG&H, 2021, 3).

The area examined included the proposed development lands (application red-line boundary), as well as an area of c. 300m surrounding the defined boundaries of the site, where possible.

The area under assessment is part of a landscape which is rich in historical and archaeological material. The general region has attracted settlement from early times as evidenced by the presence of monuments dating back to the prehistoric period. Continuity of settlement is illustrated by artefacts dating to the Bronze Age and by identified monuments ranging from Neolithic to Medieval and Post-Medieval remains.

The siting preferences of particular monument types are well documented. Broadly speaking, the general landscape of the proposed development area offers a potential setting for the discovery of archaeological sites and remains, as follows:

- The general rolling nature of the landscape is a favoured position for the location of prehistoric burial sites, ringforts and enclosure sites in the general region surrounding the subject development lands.
- The area's adjacent watercourses are a favoured landscape for Fulachta Fiadh (prehistoric cooking sites). In addition, these features generally occur in groups.

11.3.2.2 Archaeological Inventory

There are twelve previously recorded monuments, identified on the basis of the Paper Survey, located within the defined Study Area (Section 11.2.1). These are listed below in **Table 11.1** and their locations illustrated in **Figure 11.11** (with Zones of Archaeological Notification indicated, where relevant)**.** One of the monuments – Site CH-1 is located within the extent of the subject development lands. In addition, Site CH-1 is a National Monument and CH-3 is subject to a Preservation Order; all are listed in the respective Record of Monuments and Places (RMP) for Cos. Wicklow and Dublin except Sites CH-10 and CH-12, which were discovered following the publication of the RMPs in the mid-1990s.

The legislative/statutory protections relating to the monuments are contained in **Appendix 11A**; the monument classifications and descriptions are in **Appendix 11B** and **Appendix 11C**, respectively.

No additional sites or features of archaeological potential were noted by an inspection of historic maps, aerial photographs or on available LiDAR survey information on Open Topographic Date Viewer (**Figure 11.7**)

Figure 11.7 LiDAR Survey Plan

The following abbreviations/codes are used in relation to **Table 11.1**:

- **Site No.**: Individual site number assigned to site with respect to the defined study area.
- **SMR No**.: Individual number assigned to site in the Sites and Monuments Record (SMR) of the Archaeological Survey of Ireland.
- **ITM**: International Transverse Mercator Grid Reference.
- **Classification:** Brief nature of the archaeological site as listed in the SMR.
- **NM:** National Monument.
- **PO:** Subject to Preservation Order.
- **RMP**: Listed in the Record of Monuments and Places.

Table 11-1: Archaeological Inventory

Site No.	SMR No.	ITM	Townland	Classification	Protection
CH-1	WI007-026	724245 717785	Fassaroe	Ecclesiastical Remains - possible	NM; RMP
CH-2	WI007-024	723524 717550	Fassaroe	Burial	RMP
CH-3	WI007-027	724218 717516	Fassaroe	Castle – Tower House	PO; RMP
CH-4	WI003-032	722415 718407	Monastery	Ecclesiastical Remains – possible	RMP
CH-5	WI007-023	722790 717628	Monastery	Mound	RMP
CH-6	DU028-001	723492 718629	Ballyman	Standing Stone	RMP
CH-7	DU028-002	723479 718629	Ballyman	Ecclesiastical Remains	RMP
CH-8	DU026-113	723533 718829	Ballyman	Pit Burial	RMP
CH-9	DU026-065	724134 718853	Ballyman	Ring Ditch	RMP
CH-10	-----	723203 718717	Ballyman	Pit Burials	-----
CH-11	WI007-060	724357 717166	Kilcroney	Mound	RMP
CH-12	WI004-006	724980 718200	Killarney	Pier/Jetty	-----

11.3.2.3 Archaeological Artefacts

A search of the Topographical Files of the National Museum of Ireland with respect to the townlands of Fassaroe and Monastery was undertaken as part of the preparation of the report. The following artefacts were reported:

MONASTERY TOWNLAND:

NMI: 1938:142 – Lough Ravel flat axe from a quarry pit.
NMI: 1938:143 – 'Copper Cake' from a quarry pit.
NMI: 1938:144 – Lough Ravel flat axe from a quarry pit.
NMI: 1938:145 – Lough Ravel flat axe from a quarry pit.

The only reported finds with respect to Fassaroe Townland relate to Site CH-2 above.

11.3.2.4 Results from Documented Relevant Archaeological Investigations

A number of licensed and unlicensed archaeological investigations have been undertaken within the defined study area. These include intrusive investigations associated with Sites CH-1, CH-4, CH-7, CH-10 and CH-12 above, all of which are discussed in terms of the monument descriptions in **Appendix 11C**. Other relevant investigations are as follows:

- A programme of unlicensed Archaeological Monitoring of topsoil stripping was undertaken by Martin Byrne in 2005 of the lands adjacent the eastern boundary of the subject development, to the immediate north and south of the road leading from the M11. Nothing of archaeological interest/potential was uncovered – **Figure 11.8**.

Figure 11.8: Extent of Topsoil Stripping Undertaken in 2005 at Easternmost Site Extent

- Archaeological Monitoring associated with the Carrickmines-Bray Gas Pipeline was undertaken by John O Neill in 1998 (Licence No: 98E0445; www.excavations.ie Ref: 1998:125). Nothing of archaeological interest was uncovered along the pipeline route within Fassaroe townland.

- Archaeological Monitoring associated with the Enniskerry Water Supply Scheme was carried out by David Bayley in 2008 (License No.: 07E169 ext.; www.archaeology.ie Ref: 2008:1312). A continuous archaeological presence was kept throughout all topsoil-stripping within greenfield areas including within the southern section of Pipeline A in the townland of Fassaroe. Nothing of archaeological significance was uncovered during monitoring works.
- Archaeological Testing was undertaken by Martin Byrne in May 2009 (Licence No.: 09E225; www.archaeology.ie Ref: 2009:819) of proposed development lands at Berryfield Lane, Fassaroe, in compliance with a planning condition with respect to the development of the lands for playing pitches, as well as the construction of a new clubhouse. There are no known monuments located within 500m of the site, which has a total area of 2.2ha. A total of 54 trenches of varying lengths and orientations were excavated by machine fitted with a toothless ditching bucket. No features, deposits or artefacts of archaeological interest were uncovered during the course of the works.
- Archaeological Testing was undertaken in the townland of Ballyman, Co. Dublin, by Martin Byrne (Licence No.: 02E1864; www.archaeology.ie Ref: 2002:0460) before a proposed diversion of 110kv ESB overhead lines required to facilitate the proposed construction of a new golf-course for Dún Laoghaire Golf Course. The area of testing was confined to the south of the Ballyman Road, in the vicinity of a possible castle (SMR 26:63), a pit burial (SMR 26:113), possible standing stones (SMR 28:1) and ecclesiastical remains (SMR 28:2). The proposed locations of two pairs of poles and a pylon were subjected to the programme of testing. No features or finds of archaeological interest were uncovered.
- Monitoring was carried out in 2005 by Ciara McCarthy (Licence No: 05E0057; www.archaeology.ie Ref: 2005:386) at the site of erection of angle masts 40E and 40W for the Carrickmines–Fassaroe 110kV line diversion. The site was located on the south-facing slope of the River Dargle valley c. 100m from SMR 28:1, a standing stone, and 28:2, a complex of archaeological sites including a church and graveyard. The angle mast 40W required the installation of four box trenches 3.35m by 3.35m and 2.6m deep. The angle mast 40E required the installation of a linear trench 2m wide and 1.6m deep. No archaeological features or deposits were identified.
- A Geophysical Survey was undertaken in June 2016 by J.M. Leigh Surveys (Licence Ref: 16R0086) within the field containing Site CH-4. The geophysical survey has successfully located the extent of the outer enclosure (RMP WI003:032001) of a partially extant church (RMP WI003:032002). Although the responses appear fragmented in places, a sub-circular enclosure, measuring c.77m in diameter was clearly represented in the data (See **Figure 11.9** below; **Appendix 11D**). This correlates with a ditch feature identified in aerial photographs. In addition, several pit-type responses and rectilinear ditch type features have been identified. It is most likely that multiphase activity is represented here, and it is possible that several enclosure features, including a possible rectilinear enclosure, were represented by the recorded responses. Elsewhere in the data, broad amorphous responses may represent plough damaged remains of large enclosing features. However, it is equally possible that the responses result from natural features within the sub-soil and interpretation is cautious. Adjacent to a large electricity pylon there is a circular response, measuring c.7m in diameter. This occurs in the magnetic 'shadow' of the pylon. Although there are no further responses in the vicinity this may represent a small circular enclosure. This is speculative but must be considered.
- Archaeological Testing was undertaken by Martin Byrne in August 2016 (Licence No: 16E0356) within the field containing Site CH-4. A total of 14 test trenches were excavated across the field but excluding the area of the enclosure detected by the geophysical survey. The locations of the trenches are illustrated below in **Figure 11.10**. In general, the trenches were positioned to gain information with respect to the geophysical anomalies detected outside the 'monastic enclosure', and within potential development areas. In particular, T5 was excavated across F13, T2 across F11 and T12 in the area of F9. T8 and T9 were positioned to determine if any potential burials existed outside the 'monastic enclosure', with the latter (T9) to be excavated from north to south and to terminate at the inside edge of the detected outer enclosing element of the 'monastic enclosure'. Such testing uncovered the remains of a ditch feature at a location along the external enclosure (RMP: WI003-032001), as detected by the geophysical survey, thereby proving its archaeological origins. The remaining geophysical anomalies across the field and outside the enclosure were determined to be either of geological origin, or related to magnetic variations associated with the electricity pylon/mast and its associated overhead lines. Three sherds of late-12th/early-13th century pottery were recovered – see **Appendix 11E** for further details.

Figure 11.9: Interpretative Plan of Geophysical Survey Results of Site CH-4

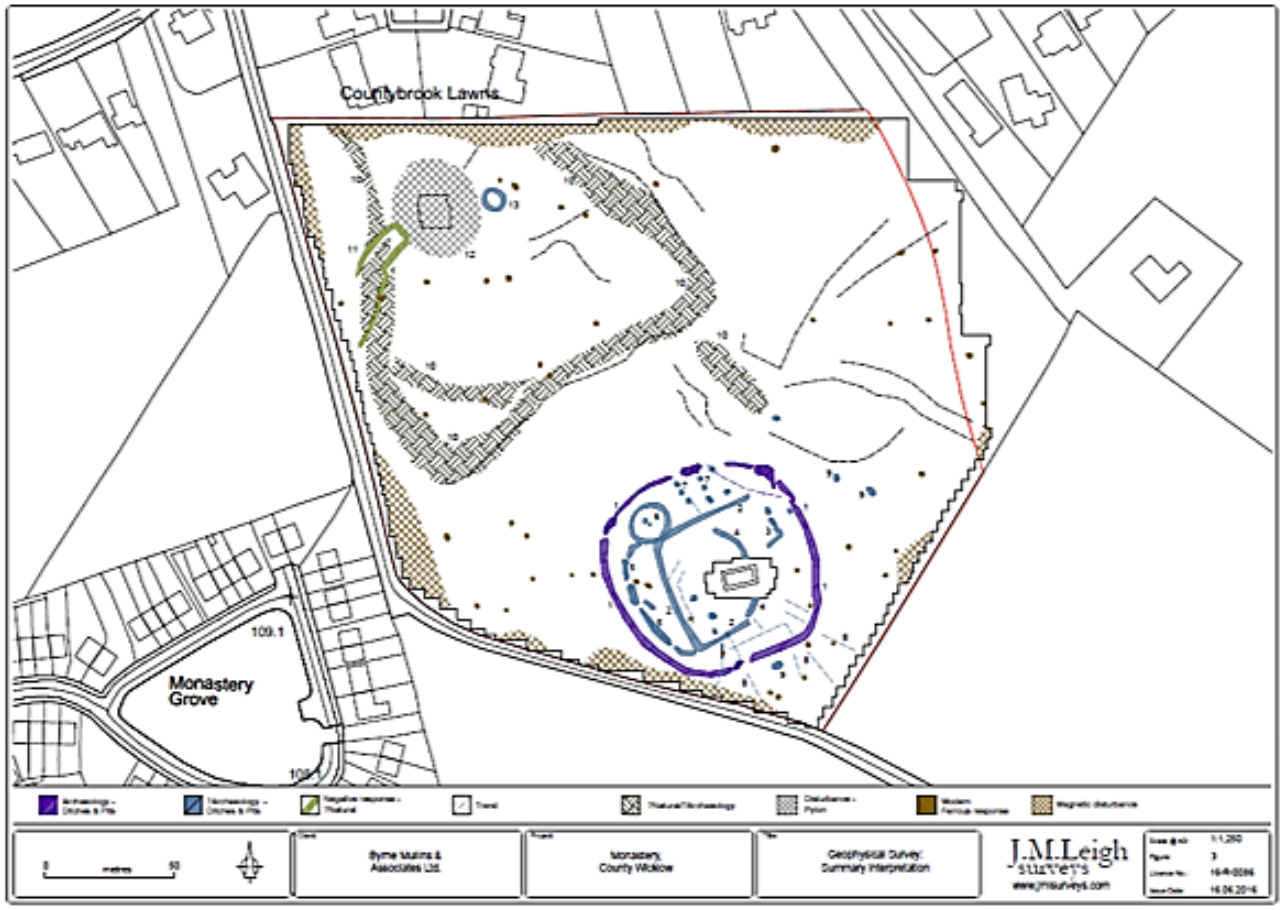
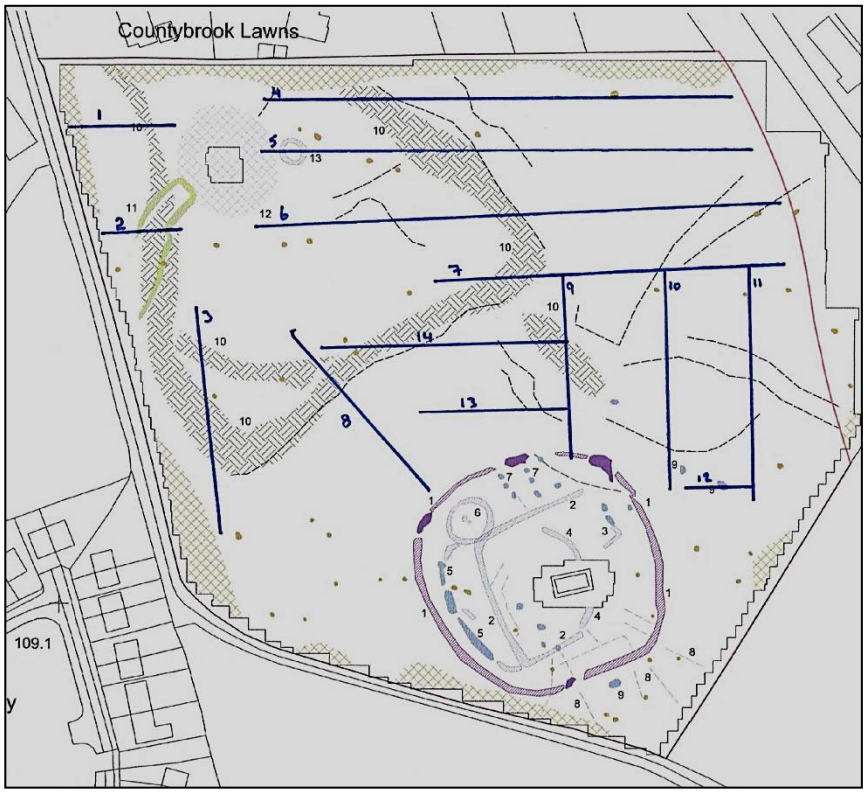


Figure 11.10: Locations of Archaeological Test Trenches in Field Containing Site CH-4



- Two programmes of unlicensed Archaeological Monitoring were subsequently undertaken by Martin Byrne in the environs of Site CH-4.
  - A programme of Trial Pits excavations undertaken as part of Geotechnical Site Investigations was undertaken in August 2019 and nothing of archaeological interest was uncovered.
  - Monitoring of topsoil stripping associated with site preparations for an access road from Ballyman Road, together with the construction of boundary walls, was monitored in late 2019 – early 2020. A buffer area around Site CH-4 was established at this time and nothing of archaeological interest was uncovered.

11.3.3 Architectural Heritage

11.3.3.1 Introduction

Architectural heritage has several definitions and meanings for people. The definition set out in the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act, 1999 states that “architectural heritage” means all-

a. Structures and buildings together with their settings and attendant grounds, fixtures and fittings,
b. Groups of such structures and buildings, and
c. Sites, which are of architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest.

11.3.3.2 Architectural Inventory

A. Record of Protected Structures

Section 51 of the Planning and Development Act, 2000 (as amended) requires a Development Plan to include a record of structures which form part of the architectural heritage of the County and are to be protected. County Councils draw up these lists, referred to as the Record of Protected Structures (RPS). The RPS is a section of a Development Plan in which each structure is given a reference number

There are no protected structures within the meaning of the Planning and Development Act, 2000 situated within the boundaries of the proposed development lands.

There are two structures (Sites CH-13 & CH-14) listed in the Wicklow County Development Plan 2016- 2022 (Record of Protected Structures), and one (Site CH-15) listed in the Dún Laoghaire – Rathdown County Development Plan 2016 – 2022 (Record of Protected Structures) as being situated within the defined study area. These are listed below in **Table 11.2**; the respective locations are indicated in **Figure 11.11** and they are described in **Appendix 11F**.

B. National Inventory of Architectural Heritage

The National Inventory of Architectural Heritage (NIAH) is a state initiative under the administration of the Department of Housing, Local Government and Heritage. It was established on a statutory basis under the provisions of the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act 1999. Its purpose is to identify, record, and evaluate the post-1700 architectural heritage of Ireland, uniformly and consistently as an aid in the protection and conservation of the built heritage. It is intended that the NIAH will provide the basis for the recommendations of the Minister for Housing, Local Government and Heritage to the planning authorities.

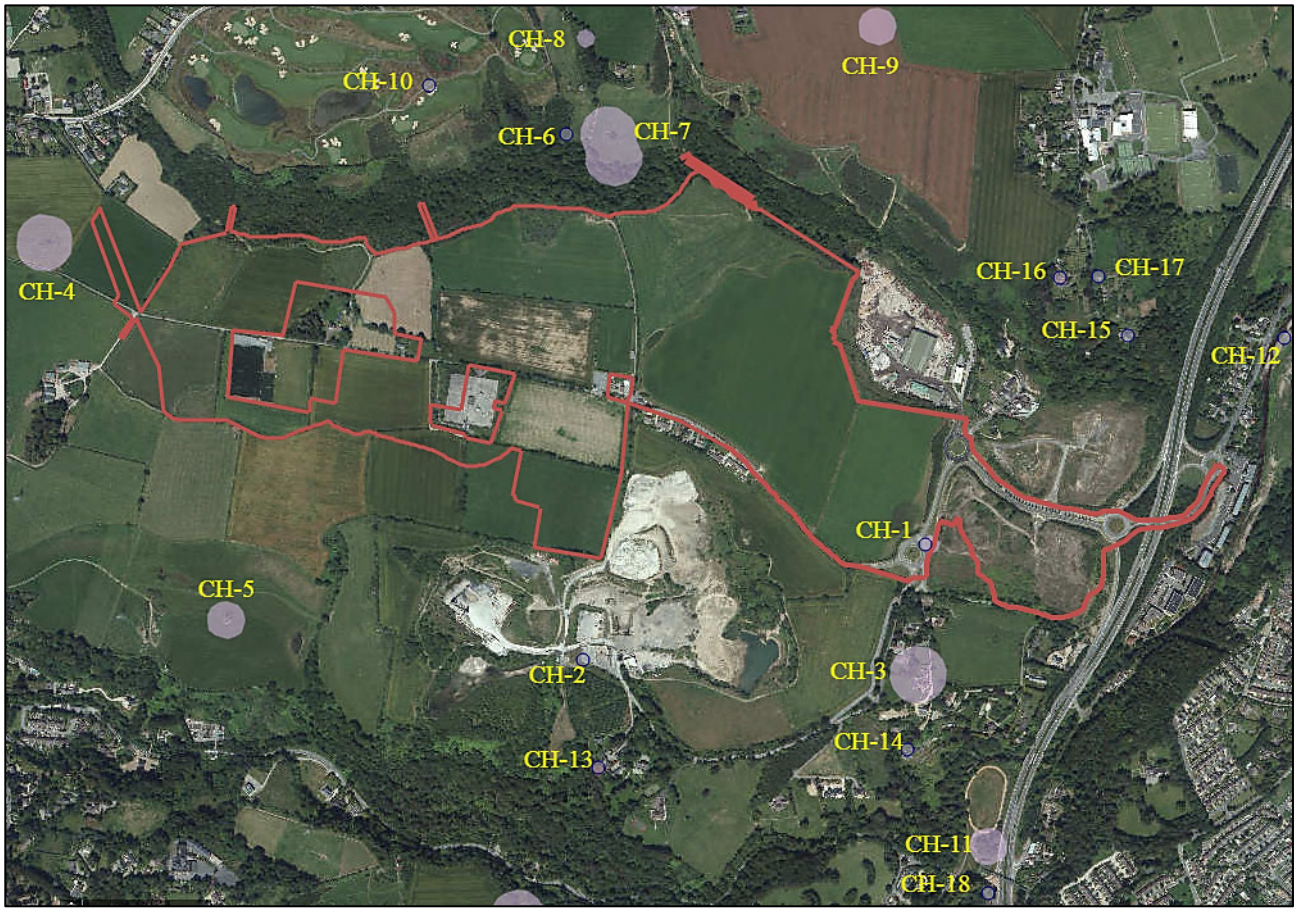
There are no structures identified by the NIAH as being located within the boundaries of the proposed development lands.

There are four structures identified by the NIAH) *Architectural Heritage of County Wicklow* as being located within the defined study area, one in Co. Wicklow (Site CH-18) and three in the Dún Laoghaire – Rathdown area (Sites CH-15 – 17); in addition, Site CH-15 is listed in both the RPS of the Dún Laoghaire – Rathdown Development Plan and the NIAH.

Table 11-2: Architectural Inventory

Site No.	RPS No.	NIAH Ref. No.	ITM	Townland/ Address	Name	Classification
CH-13	03-32	----	723725 717329	Fassaroe	Fassaroe House	Country House
CH-14	03-34	----	724164 717426	Fassaroe	St. Valery's	Country House
CH-15	1886	60280004	724651 718204	Thornhill Road, Old Connaught	Valombrosa	House
CH-16	----	60280006	724511 718330	Thornhill Road, Old Connaught	The Ochra	House
CH-17	----	60280007	724592 718334	Thornhill Road, Old Connaught	The Ochra	Gate Lodge
CH-18	----	16400705	724359 717065	Kilcroney	Kilcroney House	Gate Lodge

Figure 11.11: Locations of Cultural Heritage Sites Identified Within Defined Study Area



11.4 Potential Impacts

11.4.1 Construction Phase

11.4.1.1 Local History

The general historical background to the subject development area was introduced above in **Section 11.3.1.** In summary, there are no significant historical events associated with the proposed development lands which have the ability to be impacted upon by the proposed development.

11.4.1.2 Archaeological Heritage

The general archaeological background to the subject development area was introduced above in Section **11.3.2.**

In summary, as noted in Section **11.3.2.2**, there are twelve previously recorded monuments, identified on the basis of the Paper Survey, located within the defined Study Area (Section 11.2.1). No additional sites or features of archaeological potential were noted by an inspection of historic maps, aerial photographs or on available LiDAR survey information on Open Topographic Data Viewer.

One of the monuments – Sites CH-1 is located within the extent of the subject development lands.

- Site CH-1 (SMR: WI007-026; Ecclesiastical Remains – possible; National Monument) is positioned adjacent to an area where an existing section of the distributor road from the east has already been constructed. Furthermore, the lands immediately east, and adjacent to the monument, were previously subjected to a programme of archaeological testing (Site CH-1; **Appendix 11C**) and no subsurface features were encountered. Furthermore, archaeological monitoring of topsoil stripping within the field to the immediate east of the monument, undertaken in 2005, did not reveal any subsurface features of archaeological interest or potential.

  It is noted that the existing roundabout at the junction of Berryfield Lane and the existing constructed section of Fassaroe Avenue will be removed. This is located adjacent to Site CH-1. However, given the nature of the works, as proposed, it is not considered likely that any direct impacts to the monument will occur.

- Site CH-4 (SMR: WI007-032; Ecclesiastical Remains) are positioned almost immediately outside the westernmost extent of the development lands. A geophysical survey (**Appendix 11D**) undertaken in the field containing the monument uncovered a probable monastic enclosure surrounding the partially extant/ruined remains of a later church. A subsequent programme of intrusive archaeological testing (**Appendix 11E**) determined that this enclosure was formed by a ditch and no subsurface features of interest were uncovered outside the extent of the enclosure feature.

  The closest element of the proposed development (distributor road to Ballyman Road) to the outermost extent of the probable monastic enclosure is 70m; consequently it is not considered likely that any direct impact on the monument will occur with respect to the present proposals.

In general, ground reductions associated with a development of this kind, in areas of previously generally undisturbed ground, have the ability to uncover and disturb hitherto unrecorded subsurface features, deposits, structures and finds of archaeological interest and potential. Without the adoption and implementation of a suitable mitigation strategy, any unknown subsurface archaeological features or artefacts that might be located within the site during the construction phase of the development might not be identified and recorded.

11.4.1.3 Architectural Heritage

There are no protected structures, within the meaning of the Planning and Development Act, 2000, or NIAH-listed structures, situated within the boundaries of the proposed development lands.

There are three Protected Structures and three NIAH-listed structures located outside the subject proposed boundaries but within the defined study area.

Given the locations of these structures and the extents of their attendant grounds (curtilages), it is not considered likely that any direct impacts will occur during the construction phase of the development with respect to these structures of architectural heritage interest.

11.4.2 Operational Phase

11.4.2.1 Local History

The general historical background to the subject development area was introduced above in **Section 11.3.1**. In summary, there are no significant historical events associated with the proposed development lands which have the ability to be impacted upon by the proposed development.

11.4.2.2 Archaeological Heritage

The general archaeological background to the subject development area was introduced above in **Section 11.3.2**. In summary, there is one previously recorded archaeological monument located within the subject development area (Site CH-1).

The only extant remains of CH-1 is a granite cross (SMR: WI007-026002) known as St. Vallery's Cross, with a circular head and chamfered edges. This is now located fronting onto a footpath adjacent to the eastern distributor road (Fassaroe Avenue) to the subject development lands – see **Plate 11.1** below. It is noted that the existing roundabout at the junction of Fassaroe Avenue and Berryfield Lane will be removed as part of the subject proposals, although given the existing nature of the road infrastructure with respect to the monument; it is not considered that any visual impact to the existing setting of such is likely to occur.

Plate 11-1: Site CH-1

There are a further eleven previously identified archaeological monuments (Sites CH-2 – CH-12) located outside the subject proposed boundaries but within the defined study area, the closest extant monuments being Site CH-4 (WI003-032; Monastery Td; Ecclesiastical Remains) and Site CH-7 (DU028-002; Ballyman Td.; Ecclesiastical Remains), both of which are positioned approximately 90m and 150m, respectively, outside the red-line boundary of the application; in addition, the physical extant remains of the latter are positioned approximately 200m from the nearest proposed element of the subject development.

Given the distance between these monuments with respect to the nearest proposed development site boundary and/or development area, it is not considered likely that any visual impacts will occur to the settings of such following the construction of the subject development.

11.4.2.3 Architectural Heritage

There are no protected structures, within the meaning of the Planning and Development Act, 2000, or NIAH-listed structures situated within the boundaries of the proposed development lands.

There are three Protected Structures and three NIAH-listed structures located outside the subject proposed boundaries but within the defined study area.

Given the locations of these structures outside the proposed development boundary, their topographical settings and respective distances from the various elements of the proposed development, it is not considered likely that any visual impacts to such will occur following construction of the development.

11.4.3 Potential Cumulative Impacts

It is not considered that the cumulative effect of the proposed development will cause any increased impacts to identified sites of Cultural Heritage interest. This is due to the locations of such sites with respect to the subject development lands and the existing nature of such sites.

11.5 Mitigation Measures

11.5.1 Construction Phase

11.5.1.1 Local History

There are no potential impacts on any on sites features or areas of historical interest. Consequently, no mitigation measures are considered.

11.5.1.2 Archaeological Heritage

As noted above in **Sections 11.4.1.2**, it is not considered likely that the development, as proposed, will cause any direct impacts to any identified archaeological monuments. Furthermore, as noted above in **Section 11.4.1.2**, given the locations of the documented archaeological monuments, together with the topographical situation of the site and its associated localised areas of previous extensive ground disturbances, it is considered there is moderate potential for the discovery of subsurface archaeological features/deposits within the specific proposed development areas associated with the overall subject development. In that regard, it is considered, in general, that ground reductions associated with a development of this kind, in areas of previous generally undisturbed ground, have the ability to uncover and disturb hitherto unrecorded subsurface features, deposits, structures and finds of archaeological interest and potential. Without the adoption and implementation of a suitable mitigation strategy, any subsurface archaeological features or artefacts that might be located within the site during the construction phase of the development might not be identified and recorded.

Consequently, given the above, the following mitigation measures are suggested:-

1. Prior to the commencement of development, a suitably qualified and licence-eligible archaeologist should be appointed.
2. A temporary safety barrier shall be erected, under supervision of the appointed archaeologist, around Site CH-1 in order to ensure that no accidental damage is caused to the monument during the works associated with the realignment of the adjacent road.
3. A 10m wide buffer area should be established around the perimeter of the detected outer edge of the monastic enclosure of Site CH-4. This should be marked by means of the erection of a temporary post-and-rope fence. No development works shall be undertaken, or materials, including spoil, stored within this buffer area. In addition, no construction related vehicles should enter the buffer area,
4. Prior to the commencement of development/site preparation works, the extent of the subject development should be subjected to archaeological investigations. Where considered feasible, an archaeological geophysical survey should be undertaken, followed by a programme of intrusive testing. A report detailing the results of such investigations should be prepared for submission to the Local

Authority and National Monuments Service, Department of Housing, Local Government and Heritage. The report should detail any subsurface archaeological remains if such are identified, assess the impact of the development on such remains and propose any further archaeological requirements necessary prior to commencement of construction works (including monitoring, recording and excavation if and as appropriate). No site preparation/construction works should commence until written agreement to any such further archaeological proposals is forthcoming from the Local Authority and/or National monuments Service.

11.5.1.3 Architectural Heritage

As noted above in **Section 11.4.1.3** there are no protected structures, within the meaning of the Planning and Development Act, 2000, or NIAH-listed structures, situated within the boundaries of the proposed development lands. There are three Protected Structures and three NIAH-listed structures located outside the subject proposed boundaries but within the defined study area,

Given the locations of these structures and the extents of their attendant grounds (curtilages), it is not considered likely that any direct impacts will occur during the construction phase of the development with respect to these structures of architectural heritage interest. Consequently, no mitigation measures are deemed necessary.

11.5.2 Operational Phase

11.5.2.1 Local History

The general historical background to the subject development area was introduced above in **Section 11.3.1**. In summary, there are no significant historical events associated with the proposed development lands which have the ability to be impacted upon by the proposed development. Consequently, no mitigation measures are deemed necessary.

11.5.2.2 Archaeological Heritage

The general archaeological background to the subject development area was introduced above in **Section 11.3.2**. In summary, as noted in Section **11.3.2.2**, there are twelve previously recorded monuments, identified on the basis of the Paper Survey, located within the defined Study Area (**Section 11.2.1**). No additional sites or features of archaeological potential were noted by an inspection of historic maps, aerial photographs or on available LiDAR survey information on Open Topographic Date Viewer.

One of the monuments – Sites CH-1 is located within the extent of the subject development lands.

The only extant remains of CH-1 is a granite cross (SMR: WI007-026002) known as St. Vallery's Cross, with a circular head and chamfered edges. This is now located fronting onto a footpath adjacent to the eastern distributor road (Fassaroe Avenue) to the subject development lands. It is noted that the existing roundabout at the junction of Fassaroe Avenue and Berryfield Lane will be removed as part of the subject proposals, although given the existing nature of the road infrastructure with respect to the monument; as noted above in **Section 11.4.2.2**, it is not considered that any visual impact to the existing setting of such is likely to occur.

As further noted in **Section 11.4.2.2**, there are a further eleven previously identified archaeological monuments (Sites CH-2 – CH-12) located outside the subject proposed boundaries but within the defined study area, the closest extant monuments being Site CH-4 (WI003-032; Monastery Td; Ecclesiastical Remains) and Site CH-7 (DU028-002; Ballyman Td.; Ecclesiastical Remains) which are positioned approximately 90m and 150m outside the red-line boundary of the site. Given the distance between these monuments with respect to the nearest proposed development site boundary and/or development area, it is not considered likely that any visual impacts will occur to the settings of such following the construction of the subject development; consequently, it is considered that no mitigation measures are required.

11.5.2.3 Architectural Heritage

As noted above in **Section 11.4.2.3,** there are no protected structures, within the meaning of the Planning and Development Act, 2000, or NIAH-listed structures situated within the boundaries of the proposed development lands. There are three Protected Structures and three NIAH-listed structures located outside the subject proposed boundaries but within the defined study area.

Given the locations of these structures outside the proposed development boundary, their topographical settings and respective distances from the various elements of the proposed development, it is not considered likely that any visual impacts to such will occur following construction of the development. Consequently, it is considered that no mitigation measures are required.

11.6 Predicted Residual Impacts

11.6.1 Construction Phase

There are no predicted impacts in terms of Cultural Heritage.

11.6.2 Operational Phase

There are no predicted impacts in terms of Cultural Heritage.

11.6.3 Cumulative Impact

There are no predicted impacts in terms of Cultural Heritage.

11.6.4 'Worst-Case' Scenario

There are no predicted 'worst-case' scenarios with respect to matters pertaining to Local History or to structures identified as being of Architectural Heritage interest.

A 'worst case' scenario with respect to archaeological heritage would arise where the development was permitted to commence without a condition being included in the Final Grant of Planning Permission to undertake pre-development archaeological testing and further archaeological requirements as identified as appropriate; without the appointment of an archaeologist to undertake / oversee the pre-development monitoring and testing requirements. In such scenarios, features or artefacts which might be uncovered during the course of the works would, most likely, be destroyed and not recorded. The inclusion of a condition requiring such pre development testing and further archaeological requirements if necessary, however, will ensure this situation does not arise.

11.7 Monitoring and Reinstatement Measures

Post-construction monitoring issues or reinstatement measures with respect to cultural heritage are not considered a requirement with respect to the subject development.

12. TRAFFIC AND TRANSPORTATION

12.1. Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) assesses the impact of the proposed development at Fassaroe on the surrounding traffic and transportation network and identifies the mitigation measures where required.

The site location and project description are detailed in Chapter 2 – Project Description. Some key elements and transport related infrastructure are summarised below.

12.1.1. The Project

The lands at Fassaroe, Co. Wicklow, are set out as Area Action Plan 1 of the Bray Municipal District Local Area Plan (2018). This plan sets out an overall development potential of approximately 4,000 residential units and 3,000 jobs at this location in the western environs of Bray adjacent to Junction 6 of the N11.

The Bray and Environs Transport Study (BETS) (2019) identifies what it refers to as 'Phase 1a' of Fassaroe incorporating the development of 650 residential units and appropriate support facilities. The current proposed development aligns with this 'Phase 1a' quantum of development, comprising 650 residential units and associated land uses. This chapter sets out the impacts of the traffic and transportation proposals associated with this first phase of development at Fassaroe and includes consideration of cumulative impacts of other key development sites in the Bray Environs as well as assumed background growth in traffic.

The following are relevant to note in relation to the development proposal in terms of traffic and transport:

- The proposed Phase 1 development includes a mix of residential, commercial, community, recreation and amenity uses to provide a mixed use development that maximises opportunities for active and sustainable travel in accordance with "15-minute neighbourhood" principles.
- The site is located adjacent to the N11/ M11 with access achievable via junction 6 Fassaroe interchange. A Traffic Management Framework has been agreed between Wicklow County Council (WCC) and Transport Infrastructure Ireland (TII) at this junction, incorporating an agreed set of measures to appropriately manage traffic flow and minimise the impact of traffic on the N11 and adjacent M50 mainlines. This Traffic Management Framework and agreement with TII is provided in **Appendix 3A – 3D**.
- A Public Transport Access Strategy (PTAS) setting out how the proposed and future development of the Fassaroe lands can be served by bus services in line with BETS requirements has been prepared by Atkins on behalf of Cosgrave Property Group (CPG). The PTAS is submitted as part of this planning application and details how bus services will be provided from first occupation and will increase in line with growth in population as required under BETS. The PTAS was developed in collaboration with the National Transport Authority (NTA). The NTA has confirmed in writing that they are "*satisfied with the overall approach to bringing bus services through Fassaroe"*. The written agreement is provided in **Appendix 2A**.
- The lands will be developed in accordance with BETS to ensure that the phased delivery of the development will go hand in hand with the provision of transport infrastructure and public transport services that will be delivered by WCC, the NTA and the Applicant.
- The development will be phased with increases in public transport (bus services) to and from the development coordinated with increases in population and demand.
- Bus priority measures are designed into the scheme from the outset. These will be complemented by bus priority measures that are currently being developed and implemented by WCC.
- A masterplan has been prepared for all lands within Fassaroe in the control of the applicant. It comprises a layout for the current application proposals as well as future development phases. The masterplan layout has been developed to comply with the Design Manual for Urban Roads and Streets (DMURS) principles that prioritises walking and cycling and to minimise any adverse impacts of private car use.
- There is extensive internal walking and cycling infrastructure including a mixture of fully segregated pedestrian and cycle routes throughout the CPG masterplan lands.

- The Phase 1 lands will provide a pedestrian and cycle link from the development over the N11 where onward connections to the Bray town centre and the Bray DART Public Transport Interchange are available.
- Car and cycle parking provisions align with WCC Development Plan standards and are appropriate for the site location and the level of public transport proposed so as to strike an appropriate balance between car parking provision and encouraging sustainable travel by future residents and users.

The development—including its transport planning infrastructure—has been progressed in close consultation between the Applicant, WCC, the NTA and TII. This consultation has included an extensive quantum of pre-application meetings over a number of years.

12.2. Methodology

12.2.1. Assessment Methodology

The methodology for this chapter was developed using recognised national assessment guidelines[1] and is outlined in the following sections. The assessment was undertaken using desktop research, policy review, geographic information system (GIS) mapping, aerial photography, site visits, traffic surveys, traffic modelling and detailed consultation with relevant stakeholders including TII, the NTA and WCC.

12.2.2. Defining the Study Area

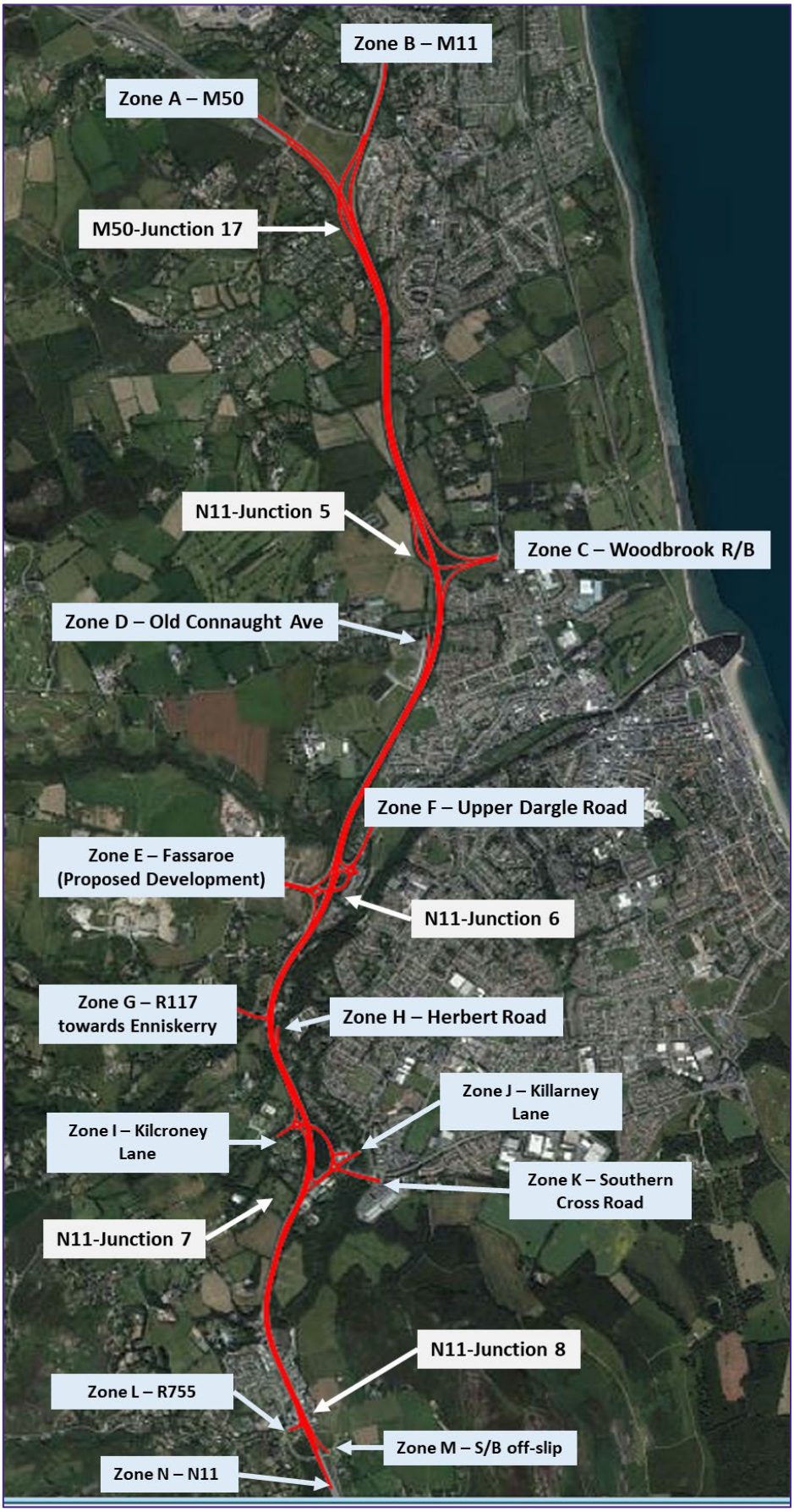
The study area for the traffic and transportation assessment has been established based on the likely areas of influences of the development on various travel modes—such as walking, cycling, public transport and vehicular traffic—and on key travel destinations:

- **Walking** – the focus is on the provision of walking facilities both within the development and on the pedestrian network adjacent to the site including connections across the N11 / M11 towards Bray;
- **Cycling** – the focus is on the provision of cycle facilities both within the development and on the road network surrounding the site including connections across the N11 / M11 towards Bray;
- **Public Transport** – the focus is on the provision of access to public transport facilities—including services and associated bus infrastructure such as local bus stops and bus priority measures—and any potential impact that traffic could have on public transport service reliability; and
- **Vehicular Traffic** – the focus is on the impact of traffic flows both within the development and at several key junctions and road links surrounding the site and the impact that traffic could have on network performance.

The type and extent of traffic modelling undertaken was identified in a scoping document prepared in May 2019 and agreed by all stakeholders including TII, NTA and WCC. As agreed by all stakeholders, a Vissim microsimulation traffic model for the area extending from M50 Junction 17 (M50/M11 interchange) southwards to N11 Junction 8 (N11/R755 interchange, Kilmacanogue, Co. Wicklow) was developed. The key junctions and links included in the microsimulation model are shown in **Figure 12.1**.

[1] See references in Section 12.2.16

Figure 12-1 - Agreed Microsimulation Model Extent



12.2.3. Defining Significance

12.2.3.1. Significance of Effects

The 2017 Environmental Protection Agency (EPA) guidelines included in the Guidelines on the Information to be contained in Environmental Impact Assessment Reports, Draft identify that significance of effects

> *"Is usually understood to mean the importance of the outcome of effects (consequences of the change). Significance is determined by a combination of (objective) scientific and subjective (social) concerns".*

In general, impact significance is defined using a combination of sensitivity (e.g., high, medium and low) of the environmental feature and the magnitude of impact (e.g., major, moderate, slight and negligible).

The criteria for assessing sensitivity and magnitude level have been defined in **Table 12-1** and **Table 12-2**. The overall significance of an impact, taking the relationship between sensitivity and the magnitude level into consideration, is set out in **Table 12-3.**

The significance level attributed to each effect has been assessed based on the magnitude of change due to the proposed development and the sensitivity of the affected receiving environment to change.

12.2.3.2. Receptor Sensitivity (or significance)

The criteria for assessing the traffic and transport sensitivity are defined according to the matrix as set out in **Table 12-1**.

Table 12-1 -Sensitivity and Description of Impact

Sensitivity Description of Impact	Criteria
High	Receptors of greatest sensitivity to change such as highly congested links or junctions, which have a low capacity to accommodate change without significant effect arising.
Medium	Links and junctions which have a moderate capacity to accommodate change without significant effects arising.
Low	Links and junctions which have a high capacity to accommodate change without significant effects arising.
Negligible	Receptors with low sensitivity to traffic flows, those sufficiently distant from affected links and junctions and those that are very lightly used (relative to other modes within the study area) which have a very high capacity to accommodate change without significant effects arising.

12.2.3.3. Magnitude of Impact

The criteria used to assess the magnitude of change are set out in **Table 12-2**. These criteria were used to identify the magnitude of change for quantitative assessment and were supported by professional judgement to take full account of the specific context in the study area.

Table 12-2 - Magnitude of Impacts Assessment Criteria

Magnitude of Impacts	Criteria
High / Major	Changes which are perceptible and would result in significant alterations to conditions.
Medium	Changes which are perceptible and would alter conditions which otherwise prevail.
Low / Small	Changes which are perceptible but would not alter conditions which otherwise prevail.
Negligible	Changes that is unlikely to be perceptible.

12.2.3.4. Significance of Impact and Typical Description

The 2017 EPA guidance has been used to categorise the significance of impact as shown in **Table 12-3.**

Table 12-3 - Significance of Effect Description

Significance of Effect	Description
Imperceptible	An effect capable of measurement but without significant consequences.
Not significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight Effects	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate Effects	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
Significant Effects	An effect which, by its character, magnitude, duration and intensity significantly alters most of a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of sensitive aspects of the environment.
Profound Effects	An effect which obliterates sensitive characteristics.
Neutral	No effect or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.

12.2.3.5. Traffic and Transport Impact Matrix

The significance of effects for the traffic and transport assessment of the proposed development was based on the receptor sensitivity and the magnitude of impact. This is defined in **Table 12-4**.

Table 12-4 - Traffic and Transport Significance of Effect Matrix

	Existing Environment (Significance / Sensitivity)			
Magnitude of Impact	**High**	**Medium**	**Low**	**Negligible**
High	Profound	Very Significant	Moderate / Slight	Not Significant
Medium	Very Significant	Moderate	Moderate / Slight	Slight / Not Significant
Low	Significant / Moderate	Moderate / Slight	Slight / Not Significant	Not Significant
Negligible	Not Significant	Not Significant	Not Significant	Imperceptible

Effects are generally considered significant (and in need of mitigation) if they are profound, very significant, significant or moderate. Slight and imperceptible effects are not considered to be significant.

Effects have been described as:

- Beneficial, neutral or adverse;
- Permanent or temporary; and
- Short (< 5years), medium (5-10 years) or long term (10+ years).

Temporary effects are those associated with the demolition and construction activity, while permanent effects are those associated with the operation of the development.

12.2.4. Baseline Transport Review

A baseline transport review was completed via a desktop review of current planning policies and objectives, existing public transport services, the walking and cycling network and existing road infrastructure. This also included a review of relevant committed developments in the vicinity of the proposed development site.

12.2.5. Traffic Modelling Scenarios

As noted above, a scoping document was prepared and issued to TII, NTA and WCC by Atkins in May 2019 for the development of the Vissim microsimulation traffic model. The scenarios to be modelled were agreed with TII, NTA and WCC and were subsequently developed and extended during the modelling process. The scenarios include Do Minimum, Fassaroe development only, all BETS development and options for upgrades at N11 Junction 6. The assumed design years are +4 and +9 and the model incorporates both the AM and PM peak periods.

Phase 1a of development in Fassaroe as identified in BETS incorporates approximately 650 residential units. This equates to the scale of development proposed under the current planning application. This development is assessed for both the +4 and the +9-year scenarios. To also assess the impact of a potential further build out at Fassaroe in the +9-year scenario, a sensitivity analysis was included to account for a second phase of development (Phase 2) up to a combined total of 1,200 units on this site. It should be noted that this potential further phase of development does not form part of the current SHD application. The full suite of scenarios modelled are outlined in **Table 12.5**.

The final N11 Junction 6 microsimulation model was agreed with all relevant stakeholders, including TII, NTA and WCC. The agreed model report resulted in the agreed package of measures at Junction 6 that forms the Traffic Management Framework Agreement, that is set out in **Section 12.4** and **Appendices 3A – 3D**.

Table 12-5 - Model Scenarios

Scenario	Name	Future Development	Traffic Management Measures at N11 Junction 6
1	Base Year	N/A	N/A
Base + 4 Design Year Scenarios			
2	Do Minimum +4	None	Roundabout priority
3	Fassaroe Phase1a and roundabout priority at Junction 6	Fassaroe Phase 1a	Roundabout priority
4	Fassaroe Phase 1a and traffic signals at Junction 6	Fassaroe Phase 1a	Traffic Signal Controlled Roundabouts
5	Fassaroe Phase1a and improved merges and diverges at Junction 6	Fassaroe Phase 1a	Improvements of merges and diverges at Junction 6
6	All Development sites and roundabout priority at Junction 6	Fassaroe Phase 1a and first phases of Woodbrook, Shanganagh Castle and Bray Golf Club	Roundabout priority
7	All Development sites and traffic signals at Junction 6	Fassaroe Phase 1a and first phases of Woodbrook, Shanganagh Castle, Bray Golf Club	Traffic Signal Controlled Roundabouts
Base + 9 Design Year Scenarios			
8	Do minimum +9	None	Roundabout priority
9	All Development sites and roundabout priority at Junction 6	Fassaroe Phase 1a and full build out of Woodbrook, Shanganagh Castle, Bray Golf Club	Roundabout priority
10	All Development sites and traffic signals at Junction 6	Fassaroe Phase 1a and full build out of Woodbrook, Shanganagh Castle, Bray Golf Club	Traffic Signal Controlled Roundabouts
11	Sensitivity Analysis: All Development sites and roundabout priority at Junction 6	Fassaroe Phase 1a & 1b, full build out of Woodbrook, Shanganagh Castle, Bray Golf Club	Roundabout priority
12	Sensitivity Analysis: All Development sites and traffic signals at Junction 6	Fassaroe Phase 1a & 1b, full build out of Woodbrook, Shanganagh Castle, Bray Golf Club	Traffic Signal Controlled Roundabouts

Scenario	Name	Future Development	Traffic Management Measures at N11 Junction 6
13	Sensitivity Analysis: All Development sites and roundabout priority and ramp metering at Junction 6	Fassaroe Phase 1a & 1b, full build out of Woodbrook, Shanganagh Castle, Bray Golf Club	Roundabout priority with Ramp Metering on N11 Merges

The number of housing units corresponding to key developments located in the vicinity of the model cordon for each scenario are summarised in **Table 12-6**. The details of the assumptions regarding the scale of development at each key site are set out in further sections and is further detailed in the model report.

Table 12-6 - Summary of Housing Units for Different Scenarios

Scenario	Scenario Name	Number of Housing Units Corresponding to Different Developments			
		Fassaroe	Woodbrook	Shanganagh Castle	Bray Golf Club
Base + 4 Design Year Scenarios					
2	Do Minimum +4	0	0	0	0
3	Fassaroe Phase1a and roundabout priority at Junction 6	650	0	0	0
4	Fassaroe Phase 1a and traffic signals at Junction 6	650	0	0	0
5	Fassaroe Phase1a and improved merges and diverges at Junction 6	650	0	0	0
6	All Development sites and roundabout priority at Junction 6	650	685	400	500
7	All Development sites and traffic signals at Junction 6	650	685	400	500
Base + 9 Design Year Scenarios					
8	Do minimum +9	0	0	0	0
9	All Development sites and roundabout priority at Junction 6	650	1,488	800	1,000
10	All Development sites and traffic signals at Junction 6	650	1,488	800	1,000
11	Sensitivity Analysis: All Development sites and roundabout priority at Junction 6	1,200	1,488	800	1,000
12	Sensitivity Analysis: All Development sites and traffic signals at Junction 6	1,200	1,488	800	1,000
13	Sensitivity Analysis: All Development sites and roundabout priority and ramp metering at Junction 6	1,200	1,488	800	1,000

12.2.6. Traffic Surveys

Traffic surveys were undertaken on 28 May 2019 for the key junctions and links outlined in **Figure 12-1** by means of junction turning counts (JTCs) and automatic traffic counters (ATCs). Additionally, an origin and destination (O-D) study was also undertaken. These surveys were commissioned as part of the traffic survey work undertaken for WCC / TII for the N11 Improvement Scheme. The locations of these data collection efforts are shown in **Table 12.7, Table 12.8** and **Table 12.9** respectively.

The surveys were undertaken for the following peak hours:

- AM Peak hours – 07:00 to 10:00 hours
- PM Peak hours – 16:00 to 19:00 hours
- For all the surveys, vehicles were classified as follows:
- Car
- Light Goods Vehicle (LGV)
- Other Goods Vehicle 1 (OGV) which includes two or three axled rigid vehicles
- Other Goods Vehicle 2 (OGV2) which includes three-axle articulated or four to six axle vehicles
- Public Service Vehicle (PSV) which includes buses or coaches
- Motorcycle (MC)
- Pedal Cycle (PC)

Table 12-7 - Locations of Junction Turning Counts

Site. No.	Location	Type
1	West of the N11 N/B* road at N11-Junction 6	4 – Arm Roundabout
2	East of the N11 N/B road at N11-Junction 6	5 – Arm Roundabout
3	West of the N11 N/B road at N11-Junction 7	4 – Arm Roundabout
4	East of the N11 N/B road at N11-Junction 7	4 – Arm Roundabout

Note: *N/B - Northbound

Table 12-8 – Locations of Link Count Surveys

Site. No.	Location
1	All ramps at the N11-Junction 5
2	All ramps at the N11-Junction 6
3	R117
4	Herbert Road
5	All ramps at the N11-Junction 7
6	Northbound off ramp at N11-Junction 7
7	Between N11-Junction 7 and N11-Junction 8

Table 12-9 - Origin and Destination Survey Zones

Zone	Junction	Junction Arm
Zone A	M50 – Junction 17	M50
Zone B	M50 – Junction 17	M11
Zone C	N11 – Junction 5	On slip lane to N11 N/B* road
		Off-slip lane from N11 S/B* road
		On-slip lane to N11 S/B road
Zone D	N11 – Junction 5	Off-slip lane from N11 N/B road
Zone E	Western Roundabout at N11 – Junction 6	Link Road to Fassaroe
Zone F	Eastern Roundabout at N11 – Junction 6	Upper Dargle Road
Zone G	Junction between slip lanes to N11 N/B road and R117 (Located between N11-Junction 6 and N-11 Junction 7)	R117
Zone H	Junction between slip lanes to N11 N/B road and Herbert Road (Located between N11-Junction 6 and N-11 Junction 7)	Herbert Road
Zone I	Western Roundabout at N11 – Junction 7	Kilcroney Lane
Zone J	Eastern Roundabout at N11 – Junction 7	R767
Zone K	Eastern Roundabout at N11 – Junction 7	R768 (east of the junction)
Zone L	Mini-roundabout located near Circle K Northbound fuel station, Kilmacanogue (N11 – Junction 8)	R755
Zone M	N11 – Junction 8	Off-slip lane from N11 S/B Road
Zone N	N11 – Junction 8	N11

Note: *N/B – Northbound, S/B – Southbound

12.2.6.1. Traffic Data and COVID

Traffic surveys were undertaken before the effects of the Covid-19 pandemic and associated restrictions. It was considered more appropriate to use this 2019 data than to undertake new surveys which would likely be skewed due to the reduced travel behaviour resulting from public health measures which has restricted and/or discouraged travel.

12.2.7. Model Calibration

The microsimulation model was calibrated in accordance with TII's Project Appraisal Guidelines for National Roads Unit 5.1 – Construction of Transport Models (PE-PAG-02015) for the base year scenario for the morning and evening peak hours. For the purposes of the modelling, the peak hours were 7:00 a.m. to 10:00 a.m. and 4:00 p.m. to 7:00 p.m., respectively, as this is when the most congestion is experienced on the network.

The model was validated using the GEH statistic for junction turning movements and link volumes and using travel times for journey times. For the calibration process, the model was run five times using varying random speeds for both AM and PM peak periods. This allows for modelling of typical day to day variations in traffic flows and traffic patterns and more accurately models the real-world conditions.

12.2.8. Background Growth

To determine the background traffic growth, historical traffic data recorded by the three traffic monitoring units (TMU) located along the M11/N11 were reviewed. This data were compared to the growth factors for the Dublin Metropolitan Region included in TII's Project Appraisal Guidelines (PAGs), published in May 2019. The details about the background growth are set out further in **Section 12.4**.

12.2.9. AADT

Annual Average Daily Traffic (AADT) has been calculated for links shown in **Table 12-10**.

Table 12-10 - Location of Links (AADT Calculation)

Site. No.	Location
1	Link Road to Fassaroe (N11-Junction 6)
2	R918 bridge (N11-Junction 6)
3	Upper Dargle Road (N11-Junction 6)
4	All Slip lanes at N11-Junction 6 (N11-Junction 6)
5	Between M50-Junction 16 and Junction 17
6	Between M50/M11-Junction 17 and N11- Junction 5
7	Between N11-Junction 5 and Junction 6
8	Berryfield Lane
9	Ballyman Road

AADTs for sites 1 to 9 were calculated for all the scenarios defined in the **Table 12-5.**

For links 1 to 4, AADTs were calculated based on the expansion factor provided in the Project Appraisal Guidelines (PAG) Unit 16.1 – Expansion Factors for Short Period Traffic Counts. The methodology is summarised below:

- Based on the data collected as a part of JTC survey undertaken, the two-way traffic volume for all the links were calculated for both AM peak (07:00 – 10:00) and PM Peak (16:00 – 19:00). For Scenario 2 (Base+4 Do Nothing Scenario) and Scenario 8 (Base +9 Do Nothing scenario), traffic volume for each of the links were grown in accordance with the methodology illustrated in the **Section 12.4.3.2.** For scenarios 3-7 and 9-13, trips from the developments corresponding to each scenario, were added to background traffic for all the links;
- The 6-hour traffic data were converted to 24-hour data using the peak factor (also known as p-factor) for the Dublin region and the day on which survey was undertaken;
- The 24-hour traffic volume were converted to Average Weekly data using the weekly flow indices for the Dublin Region and day for which survey were conducted; and
- Thereafter, Average weekly data were converted to Average Annual Daily traffic using the Monthly flow indices for Dublin Region for the month during which survey were undertaken.

For all the links along the N11/M11 mainline (item number 5 to 7), the AADT were obtained from the TMU counters for the year 2019. The location of TMU counters are as follows:

- TMU M50 040.0 N – Located between M50 Junction 16 Cherrywood and Junction 17 M50/M11, Shankill;
- TMU M11 010.0 N – Located between M50/M11 and Bray North Junction 5 N11; and
- TMU M11 015.0 S – Located between Junction 5 Bray North N11 and Junction 6 Bray Central N11.

Similar to AADT calculations for links near N11-Junction 6 interchange (item number 1 to 4), for Scenario 2 (Base+4 Do Nothing Scenario) and Scenario 8 (Base +9 Do Nothing scenario), traffic volumes for each link were grown in accordance with the methodology noted in **Section 12.4.3.2.** For scenarios 3-7 and scenarios 9-13, development traffic were available for 6 hours (both 3 hours peak). The development traffic was converted to 24-hour using the factor summarised below:

- Traffic volume corresponding to individual TMU counters were summed for both AM (07:00 – 10:00) and PM Peak (16:00 to 19:00) to obtain 6-hour traffic for both northbound and southbound movement;
- Thereafter, the traffic volume for the remaining 18-hours was calculated for all the TMU counters for both northbound and southbound movement; and
- Thereafter, 6-hour traffic volume and 18-hour traffic volume were summed to obtain 24hour traffic volume.

For sites 7 and 8 AADT, a low growth expansion factor was used based on the location to the western side of the development in an area of low density rural setting. AADT has been calculated for these locations for scenarios with and without development for base, opening year, opening year +5 years and opening year +15 in accordance with TII guidance. The AADT for all the links for all the scenarios are summarised in the further sections.

12.2.10. Trip Rates and Trip Generation

The TRICS database was utilised to determine the trip generation for the proposed apartment and house units at Fassaroe for both AM and PM Peak. For other BETS development trip rates were taken either from the previous planning application or using TRICS database. Details about the Trip Rates and Trips Generation are summarised in the following sections.

12.2.11. Mode Share

The likely modal split was determined from the 2016 census data for similar areas in the vicinity using CSO data.

12.2.12. Accident Data

This consisted of a review of the most up to date accident data as contained in the Road Safety Authority's web page[2].

12.2.13. Future Transport Infrastructure Review

This consisted of a review of current proposed future transport plans, strategies and infrastructure in the vicinity of the site in order to identify future short, medium and long terms transport proposals which may have a material impact on the travel behaviour associated with the proposed development.

12.2.14. Development Proposal Review

This review took account of the proposed development in terms of provision for access by walking, cycling, public transport and by vehicles including private car and service and emergency access.

12.2.15. Baseline Information Sources

This assessment has been prepared from both a review of existing information on the site and a site-specific investigation.

[2] https://www.rsa.ie/en/RSA/Road-Safety/RSA-Statistics/Collision-Statistics/Ireland-Road-Collisions/

12.2.16. Reference and Guidance Documents

The following is a list of sources of information consulted for use in this chapter:

- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, August 2017);
- Guidelines on the Information to be Contained in Environmental Impact Statements, (EPA, 2002);
- Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003);
- Transport Infrastructure Ireland (TII) Transport Assessment Guidelines (TII, 2014);
- The Traffic Signs Manual (DTTAS, 2010);
- The Design Manual for Roads and Bridges (DMRB);
- The Design Manual for Urban Roads and Streets (DMURS) (DTTAS, 2013);
- Transport Infrastructure Ireland (TII) Project Appraisal Guidelines (PAG) Unit 16.0 – Estimating AADT on National Roads;
- Transport Infrastructure Ireland (TII) Project Appraisal Guidelines (PAG) Unit 16.1 – Expansion Factors for Short Period Traffic Counts;
- Transport Infrastructure Ireland (TII) Project Appraisal Guidelines (PAG) – Unit 5.5 Link Based Traffic Growth Forecasting;
- National Transport Authority (NTA) Transport Strategy for the Greater Dublin Area 2016-2035;
- National Transport Authority (NTA) Draft Greater Dublin Area Transport Strategy 2022-2042;
- Smarter Travel – A Sustainable Transport Future (DTTAS) 2009-2020;
- Spatial Planning and National Roads – Guidelines for Planning Authorities DoECLG (2012);
- Wicklow County Council Development Plan 2016-2022;
- National Transport Authority, Wicklow County Council and Dun Laoghaire Rathdown County Council, Transport Infrastructure Ireland: Bray and Environs Transport Study (BETS) (2019);
- National Transport Authority, National Cycle Manual (2011); and
- National Transport Authority (NTA) Alternative Future Scenario for Travel Demands (2021).

12.3. Receiving Environment

12.3.1. Introduction

The general site context is described in Chapter 2 Project Description. The proposed development is located west of N11-Junction 6 interchange at Fassaroe, Co. Wicklow. Located immediately adjacent to the N11 in close proximity to existing public transport bus and rail corridors, the development is planned to form an integral part of Bray and the wider Greater Dublin Area public transport network.

The site location in the context of the surrounding transport network is shown in **Figure 12-2.**

Figure 12-2 – Site Location and Existing Transport Infrastructure

The Fassaroe lands are planned to be developed on a phased basis and will incorporate appropriate transport interventions that will support the sustainable development of the lands in tandem with the introduction of transport infrastructure both within and adjacent to the development land and in the wider regional area. In this context the development of the lands, and the subsequent phases of development, will be integrated with the delivery of transport infrastructure by the relevant authorities and agencies, as set out in the Transport Strategy for the Greater Dublin Area 2016-2035, the Draft Greater Dublin Area Transport Strategy 2022-2042 and the Bray and Environs Transport Study (BETS) 2019.

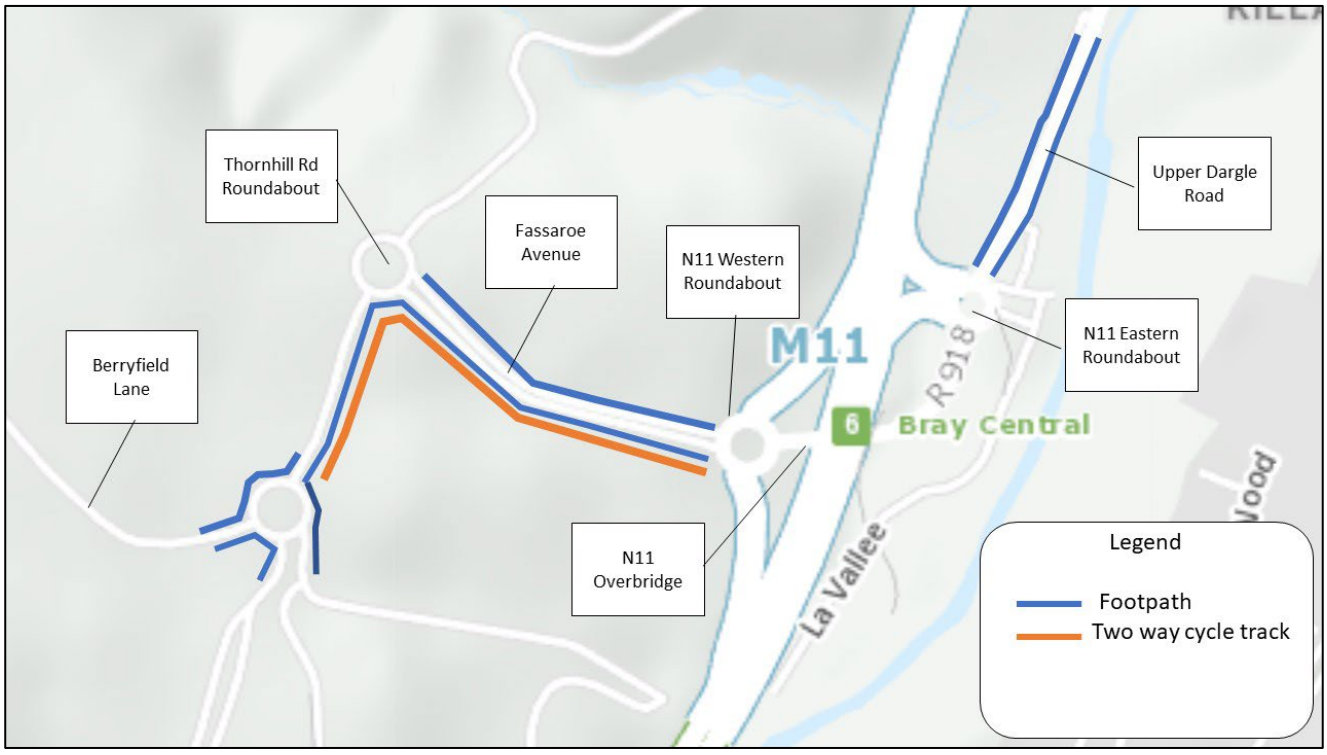
This section sets out a description of the existing and proposed baseline traffic and transport conditions for the defined study area surrounding the proposed development. This includes a review of current walking, cycling, public transport and road network infrastructure as well as setting out the policy context for proposed future transport provision to serve the lands.

12.3.2. Existing Transport Infrastructure

12.3.2.1. Pedestrian and Cycling Accessibility

There are currently limited pedestrian and cycle facilities located in the centre of the proposed site due to the underdeveloped nature of the subject site and surrounding lands. However, there are existing pedestrian and cycle facilities connecting into the site from both the N11 and the Ballyman Road on the eastern and western sides of the site, respectively. **Figure 12-3** shows the existing facilities in the vicinity of the site adjacent to the N11. Further details of these facilities are provided below.

Figure 12-3 - Existing Pedestrian and Cycling Facilities



There are existing footpath facilities from the N11-Junction 6 Western Roundabout to Thornhill Road Roundabout on both sides of Fassaroe Avenue. From the Thornhill Road Roundabout there are pedestrian facilities provided on the eastern side of the road up to the existing roundabout junction with Berryfield Lane.

There is a two-way segregated cycle track provided on the southern and eastern side of Fassaroe Avenue between the N11-Junction 6 Western Roundabout to the junction of Berryfield Lane. The street view layouts of existing pedestrian and cyclist facilities on Fassaroe Avenue are shown in **Figure 12-4**.

Figure 12-4 - Existing Pedestrian and Cycling Facilities on Fassaroe Avenue

No pedestrian or cycling facilities exist further west on the existing roadways within the subject lands. To the east, there is a gap in the existing cycling and pedestrian facilities along the R918 overbridge over the N11 extending from the N11-Junction 6 Western Roundabout to the La Vallee roundabout on the eastern side of the N11-Junction 6 interchange. From La Vallee, pedestrian facilities resume on the Upper Dargle Road which provide onward pedestrian facilities via Dublin Road to Bray Town Centre. There are no existing segregated cycling facilities provided on Upper Dargle Road. Along this section, cyclists share the carriageway with other traffic in a low-speed (50km/h) urban environment. A typical cross section along the Upper Dargle Road is shown in **Figure 12-5**.

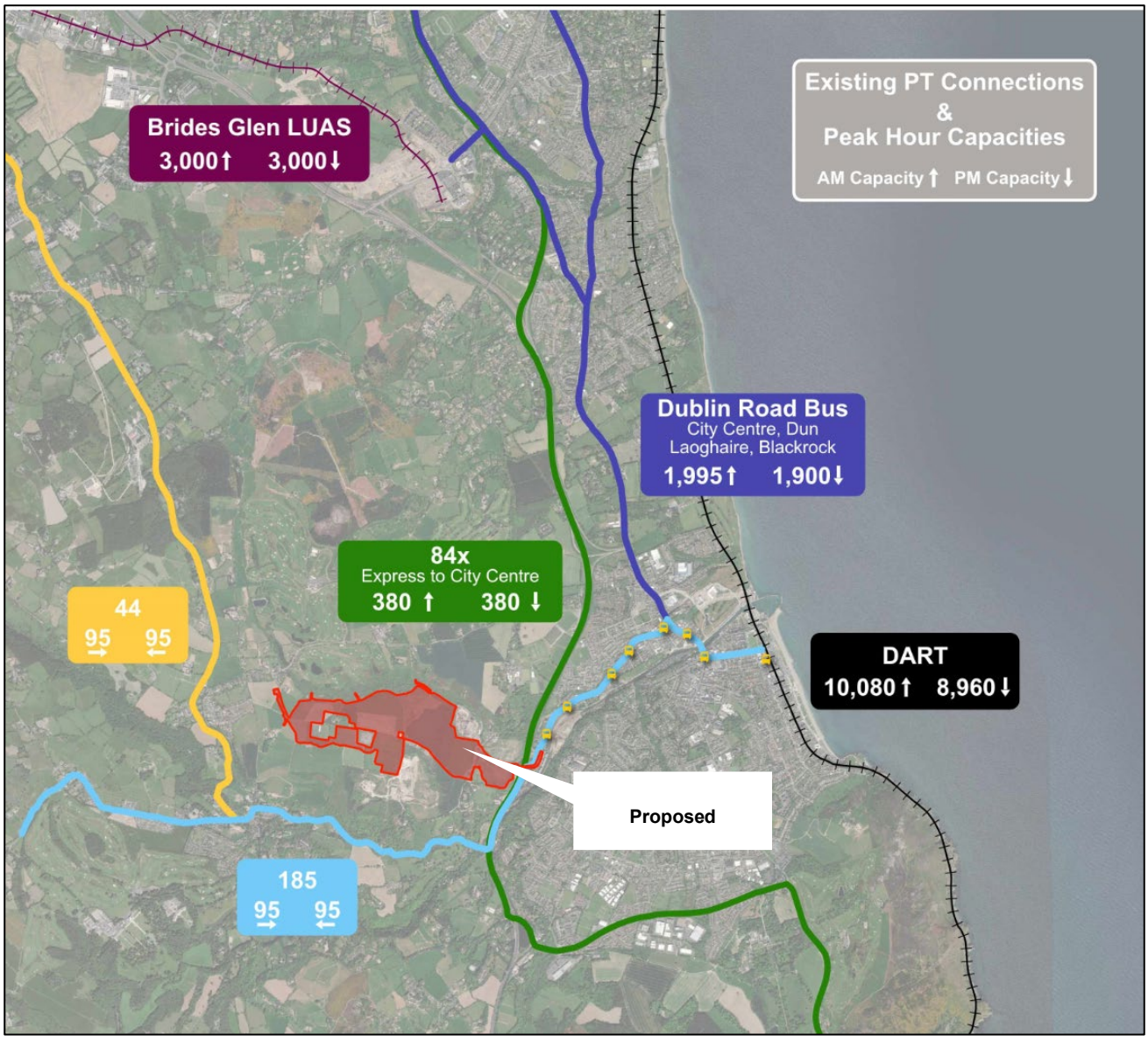
Figure 12-5 - Existing Pedestrian and Cycling Facilities on Upper Dargle Road

Given the undeveloped green field nature of the lands at Fassaroe, the existing pedestrian and cyclist environment is limited. As outlined in **Chapter 2,** the applicant is proposing to provide significant improvements to pedestrian and cyclist facilities which will be augmented by other work being undertaken by WCC that will provide a seamless, safe and segregated connection between the lands at Fassaroe over the N11 and onto Bray. These external connections will complement an extensive internal network of streets and off-road pedestrian and cycling facilities provided within the CPG masterplan lands and incorporated within this first phase planning application.

12.3.2.2. Public Transport Facilities

The existing public transport facilities and peak hour passenger capacities in the context of the Fassaroe development lands is shown in **Figure 12-6** and outlined in the following sections.

Figure 12-6 - Existing Public Transport Provisions and Capacities



12.3.2.3. Existing DART

Bray DART station is located approximately three kilometres from Fassaroe. Bray DART station is served by both DART and commuter rail services as well as facilitating interchange with a number of bus services. DART services from Bray generally operate at 10-minute frequencies during the peak hour morning and evening commuter periods.

12.3.2.4. Existing Bus Services

There are three existing Dublin Bus routes operating in the vicinity of the Fassaroe Lands; the No.185, No.84x and No.44. The route and frequency of peak hour services for all the bus routes are outlined in the **Table 12-11.**

Table 12-11 - Existing Bus Route Services Near Fassaroe

Bus Number	Peak Hour Frequency of Services	Route
185	1 service	Enniskerry – N11 – Upper Dargle Road – Castle Street – Bray Main Street – Bray DART Station
84X	4 services during the peak AM and PM period	Southern Cross Bray via N11 Quality Bus Corridor to City Centre
44	1 service	Enniskerry – Dundrum – O'Connell Street - DCU

In addition to the above, there are five bus services operating from the Bray DART Station that provide onward connections to Dublin City Centre and/or Dun Laoghaire. These are outlined in **Table 12-12**.

Table 12-12 - Existing Bus Route Services from Bray DART Station to Dublin and Dun Laoghaire

Bus Number	Peak Hour Frequency of Services	Route
145	6 services	Bray – Cabinteely – Donnybrook – City Centre – Heuston
155	3 services	Bray – Cabinteely-Donnybrook – O'Connell St – Ballymun
84A	1 service	Bray – Brides Glen (Luas) – Cabinteely – Blackrock
45A	3 services	Bray – Shankill – Dun Laoghaire
45B	3 services	Bray – Shanganagh Park – Dun Laoghaire

As outlined in BETS, the zoned lands at Fassaroe will be delivered in conjunction with improvements to public transport provisions. Further details of the applicant's proposals for the provision of bus services in line with demand is detailed in the Public Transport Access Strategy (PTAS) (Atkins ref: 5186693DG0068) which forms part of the current application. The PTAS, developed by Atkins on behalf of CPG, clarifies the integration between public transport and land-use planning by means of a phased NTA public transport delivery programme aligned with the phased delivery of residential and other land use development at Fassaroe. It shows how the proposed bus services outlined in BETS could be achieved and how those services would increase in frequency in line with demand as required by BETS. Further details of the PTAS are set out in Chapter 2, Project Description, of this EIAR.

12.3.2.5. Road Network

The main road access link to the site from the east is the R918 which connects to both the N11/M11 via Junction 6 and to Upper Dargle Road towards Bray. To the west, there is a connection onto the Ballyman Road that provides connectivity towards Enniskerry to the southwest and Kilternan to the northwest. The existing road network and key junctions in the vicinity of the proposed development are illustrated in **Figure 12-7** and **Table 12-8.**

Figure 12-7 - Existing Road Network and Junctions to the East of the Site

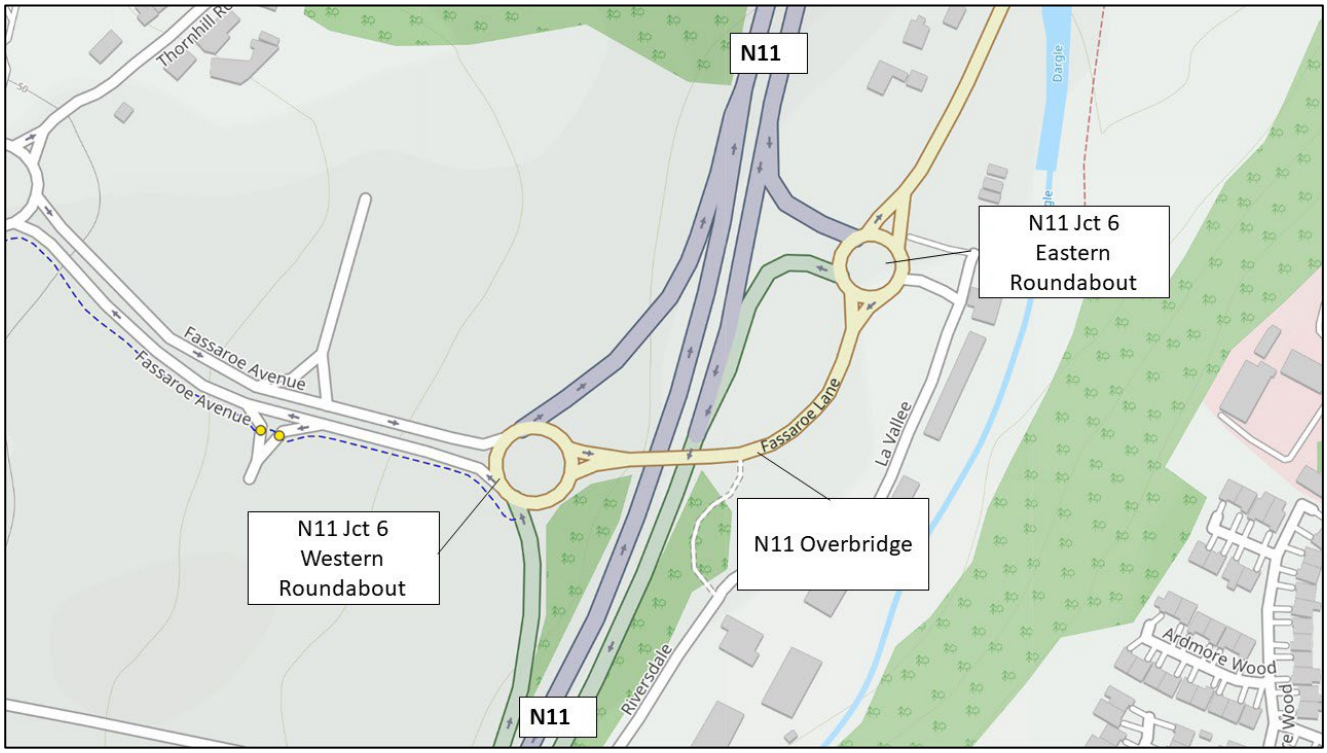


Figure 12-8 - Existing Road Network and Junctions to West of the Site

12.3.2.6. Links

The main public roads serving the proposed development are as follows:

- **N11/M11 –** The N11/M11 is comprised partly of motorway, dual carriageway and single carriageway sections over a distance of approximately 126 km, connecting Dublin to Wexford. The speed limit near the N11-Junction 6 is 100 kph.
- **Upper Dargle Road –** This is a single carriageway facility which connects the N11-Junction 6 interchange to the Dublin Road and Castle Street in Bray.
- **R918 N11 Overbridge –** This is single carriageway regional road which connects N11-Junction 6 eastern and western roundabouts.
- **Berryfield Lane –** is a rural road of varying width, single carriageway facility which runs through the site and connects to the Ballyman Road at the western end of the Fassaroe masterplan lands.
- **Ballyman Road (L5007) –** This is a single carriageway local road that provides a connection between Enniskerry, Old Conna and the north of Bray. It forms a junction with Berryfield Lane.

12.3.2.7. Junctions

The main junctions relevant to the development are:

- **N11-Junction 6 Western Roundabout:** This is a four-arm priority-based roundabout located west of the N11-Junction 6 interchange which provides access to traffic to/from Fassaroe and the northbound N11.
- **N11-Junction 6 Eastern Roundabout:** This is a five-arm priority-based roundabout located east of the N11-Junction 6 interchange which provides access to traffic to/from Bray and the southbound N11.
- **Ballyman Road Junction –** This is a three-arm priority-based junction located to the west of the Fassaroe masterplan lands that will provide a new connection between the development's main link road and the existing Ballyman Road.

12.3.2.8. Junction and Link Traffic Volumes & AADT

Traffic surveys were used to understand the existing operation of the road network. Junction and link traffic volumes in the study area are summarised in **Table 12-13** and **Table 12-14**. All flows are in passenger car units (PCU's).

Table 12-13 - Junction Traffic Volumes (PCU)

Movement	AM Peak			PM Peak		
	07:00-08:00	08:00-09:00	09:00-10:00	16:00-17:00	17:00-18:00	18:00-19:00
N11-Junction 6 Eastern Roundabout						
UDR* – La Vallee	17	26	24	24	43	26
UDR – R918	147	157	91	88	76	52
UDR – On slip	65	117	112	166	196	167
La Vallee – UDR	19	31	26	15	25	18
La Vallee – R918	56	50	21	9	32	10
La Vallee – On slip	7	30	29	21	57	35
R918 – UDR	101	242	256	182	229	161
R918 – La Vallee	27	44	37	22	26	29
R918 – On slip	73	226	205	270	412	313
Off slip – UDR	33	86	66	98	88	125
Off slip – La Vallee	10	21	20	24	25	30
Off slip – R918	25	49	32	28	15	23
N11-Junction 6 Western Roundabout						
R918 – On slip	193	198	104	72	89	57
R918 – Fassaroe Avenue	33	58	46	46	33	28
Off slip – R918	168	387	434	302	406	318
Off slip - Fassaroe Avenue	28	39	33	23	16	10
Fassaroe Avenue – On slip	33	87	35	42	34	16
Fassaroe Avenue – R918	35	127	64	170	262	181

Note: *UDR – Upper Dargle Road

Table 12-14 - Link Volume Flows (Vehicles)

Movement	AM Peak			PM Peak		
	07:00-08:00	08:00-09:00	09:00-10:00	16:00-17:00	17:00-18:00	18:00-19:00
Northbound						
M50 between Junction 16, Cherrywood and Junction 17, M50/M11, Shankill, Co. Dublin	3,160	2,923	2,457	1,623	1,369	1,162
M11 between M50/M11 and Bray North Junction, Bray, Co. Dublin	4,955	4,568	3,598	2,365	2,274	1,879
M11 between Junction 5, Bray North, and Junction 6 Bray Central, Fassaroe, Co. Wicklow	4,309	4,133	3,271	2,140	1,973	1,749
N11 between Junction 8, Kilmacanogue and Junction 9, Glen of the Downs, Kilmacanogue, Co. Wicklow	2,944	2,868	2,503	1,444	1,411	1,235
Southbound						
M50 between Junction 16, Cherrywood and Junction 17, M50/M11, Shankill, Co. Dublin	1,168	1,358	1,273	2,425	1,871	2,096
M11 between M50/M11 and Bray North Junction, Bray, Co. Dublin	1,652	2,192	2,115	3,834	3,596	3,480
M11 between Junction 5, Bray North, and Junction 6 Bray Central, Fassaroe, Co. Wicklow	1,446	1,926	1,843	3,645	3,641	3,478
N11 between Junction 8, Kilmacanogue and Junction 9, Glen of the Downs, Kilmacanogue, Co. Wicklow	1,018	1,406	1,306	3,250	3,327	2,928
Eastbound						
Berryfield Lane	13	13	13	38	45	26
Ballyman Road	26	46	50	67	84	57
Westbound						
Berryfield Lane	9	10	8	12	18	15
Ballyman Road	24	34	47	81	94	75

Based on the traffic volume flows in **Table 12-13** and **Table 12-414** and the methodology identified in Section 12.2.9, AADT for the road network has been calculated and is shown in **Table 12-15**.

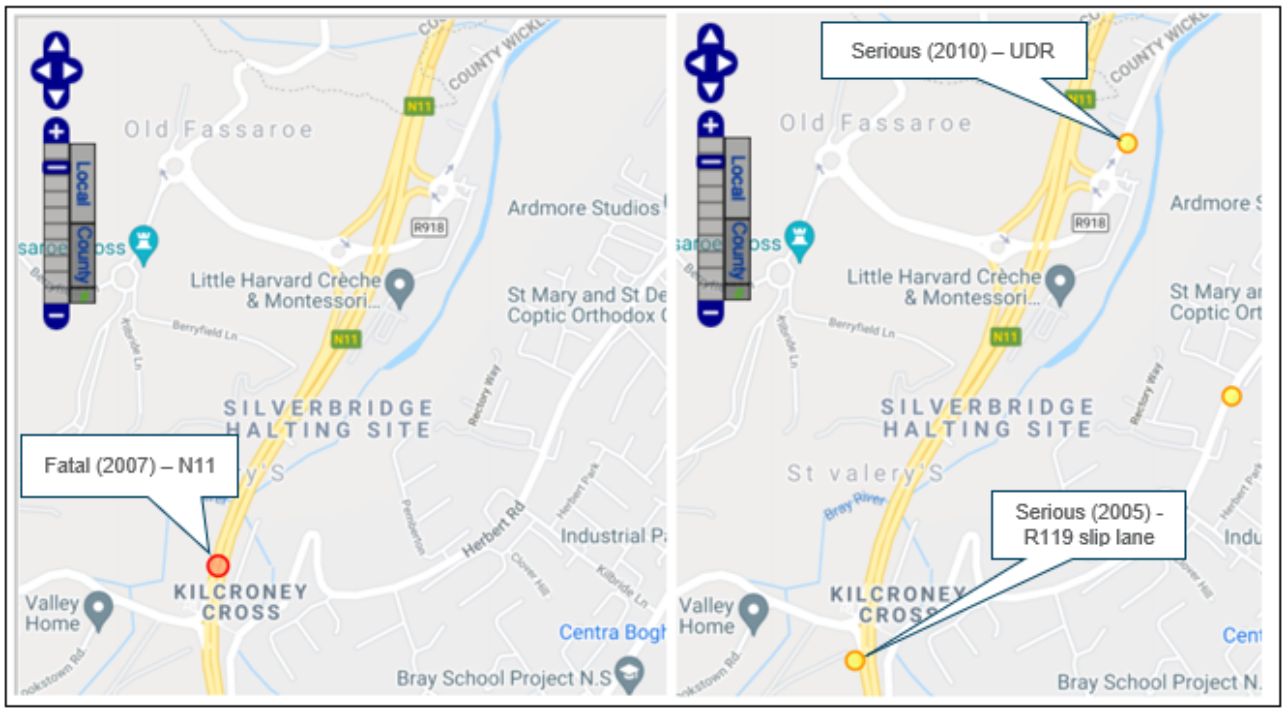
Table 12-15 - AADT

Link	Light Vehicle AADT	Heavy Vehicle AADT	Total AADT
Junction 6 Eastern Roundabout			
Upper Dargle Road	13,346	361	13,706
La Vallee	3,441	140	3,581
R918 Overbridge	13,743	994	14,736
N11 Off slip	2,979	380	3,359
N11 On slip	8,749	552	9,302
Junction 6 Western Roundabout			
N11 On slip	3,620	443	4,063
R918 Overbridge	13,758	988	14,746
N11 Off slip	7,976	564	8,540
Fassaroe Avenue	4,746	1232	5,977
N11/M11			
Between M50 Junction 16 and Junction 17	41,662	1,952	43,614
Between M50 Junction 17 and N11 Junction 5	80,245	2,933	83,178
Between N11 Junction 5 and N11 Junction 6	71,919	2,854	74,773
Berryfield Lane	409	46	454
Ballyman Road	1,378	87	1,465

12.3.2.9. Accident Analysis

A review of the Road Safety Authority (RSA) traffic collision database has been undertaken for the road network in the vicinity of the proposed site to identify any collision trends. Traffic collision data was obtained for the period 2005 – 2016, representing the most up to date data available on the RSA website. The incidents are categorised by severity, which includes minor, serious or fatal collisions. **Figure 12-9** shows the serious collision history data in the vicinity of N11-Junction 6 interchange. From the data it can be observed that one fatal accident event occurred on the N11 south of the Junction 6 interchange in 2007. Two serious accident events happened in the past near the Junction 6 interchange. However, all of the events have happened on or before 2010. A Stage 1 Road Safety Audit has been carried out on the proposed layout for this application and is included in the planning submission.

Figure 12-9 - Historic Collision Data



12.3.2.10. Existing Transport Infrastructure Summary

The proposed development site is located close to M11/N11 road network with direct access provided via Junction 6, Fassaroe interchange. There is currently limited pedestrian and cycle facilities within the centre of the development site. There are existing pedestrian and cycle facilities at both the eastern and western extents of the Fassaroe lands as well as east of Junction 6 along Upper Dargle Road to Bray Town Centre. In addition, public transport services are currently available, but limited. These current facilities are reflective of the existing largely undeveloped nature of the lands at Fassaroe. However, as noted elsewhere in this report development at the lands will be delivered in a phased manner linked to the provision of extensive pedestrian and cyclist facilities, public transport services and infrastructure and road infrastructure that will provide future residents with a high level of modal choice for both internal and external trips.

12.3.3. Existing Policy for Future Transport Provision

12.3.3.1. Introduction

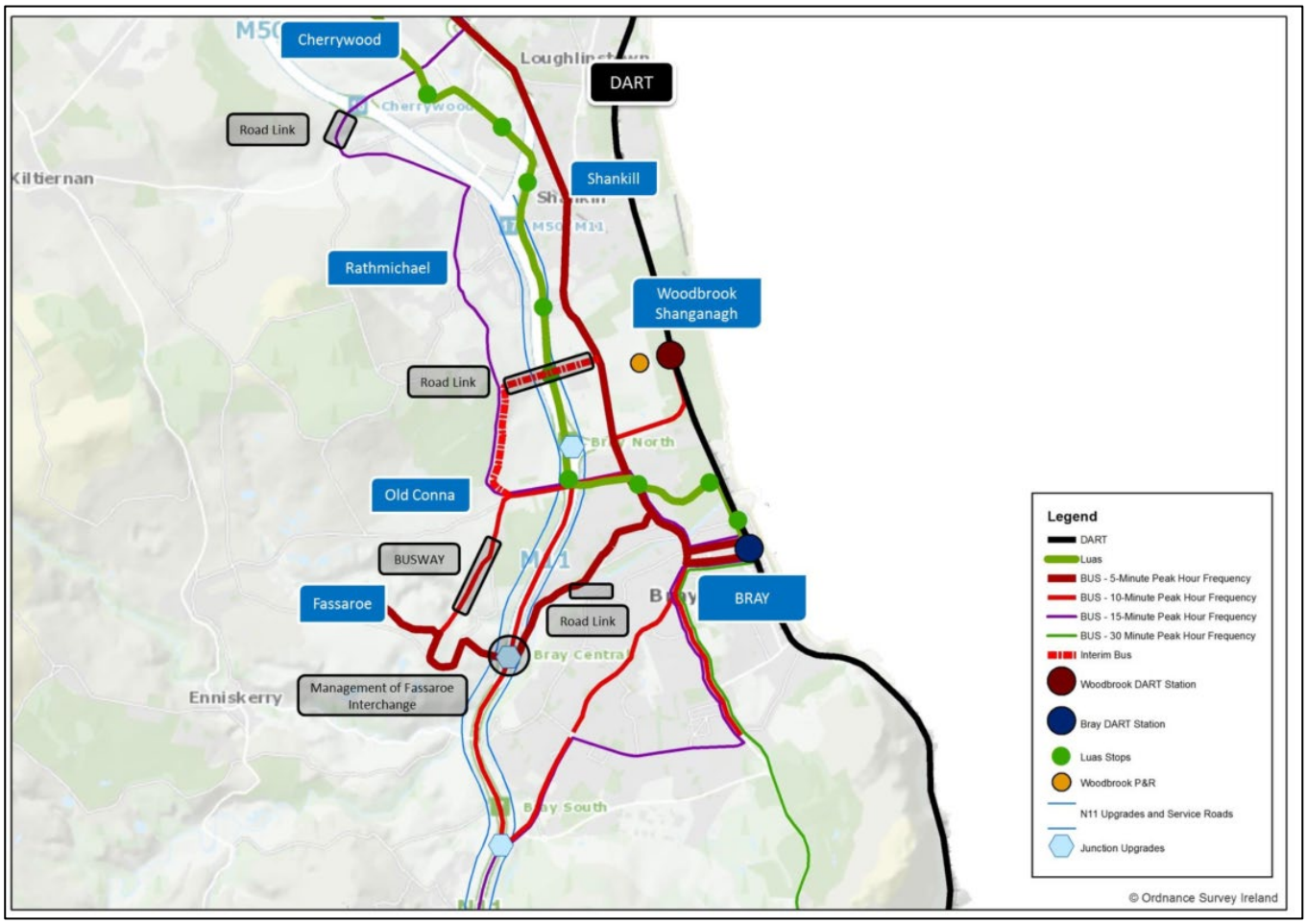
The lands at Fassaroe will be developed in the context of a holistic plan led by an integrated land use and transport strategy based on delivering the regional and county spatial and land-use planning objectives in conjunction with a detailed transport strategy that is coordinated between the relevant agencies and authorities including the NTA, TII, WCC and Dun Laoghaire-Rathdown County Council (DLRCC).

The transport requirements for the development of the zoned lands at Fassaroe are set out in the Transport Strategy for the Greater Dublin Area and are further elaborated and detailed in the Bray and Environs Transport Study (BETS) developed in 2019 by the NTA. The latter contains specific transport infrastructure requirements that are required to facilitate both an initial phase of development and the full build out of the Fassaroe lands.

12.3.3.2. Bray and Environs Transport Study (BETS)

In overall terms BETS outlines a suite of transport infrastructure improvement measures, to be delivered by 2035, that will serve all key development sites in Bray and Environs including Fassaroe, Bray Golf Club, Woodbrook, Shanganagh Castle, Old Conna and Rathmichael. This preferred approach is illustrated **Figure 12-10**.

Figure 12-10 - Preferred BETS Transport Infrastructure 2035



12.3.3.3. BETS Fassaroe Transport Infrastructure Requirement

The specific transport infrastructure requirements for the full development of the lands at Fassaroe are set out in Section 2.3.1 of the BETS. They are;

1. Fassaroe development roads;
2. N11 Cycle and Pedestrian Bridge;
3. N11/M11 Junction 4 to 14 Improvement Scheme;
4. Delivery of Wicklow County Part 8 N11 capacity and safety upgrades at Kilmacanogue, as approved;
5. Busway from Fassaroe to Old Connaught over County Brook at Ballyman Glen;
6. Traffic Management Measures at Fassaroe Interchange to protect strategic function of the N11/M11; and
7. Commitment to a phased introduction of bus and enhanced rail services in line with increased demand.

Items 3 and 6 are effectively mutually exclusive. The traffic management measures at the Fassaroe Interchange (Item 6) are shorter-term requirements ahead of the N11 / M11 Improvement Scheme (Item 3) and these have been fully agreed between WCC and TII (see **Appendices 3A – 3D** of this EIAR) . Item 4 refers to already approved works at Junction 8 of the N11 at Kilmacanogue which have been completed. These are safety works incorporating auxiliary lane provision that will also benefit mainline flow conditions.

In accordance with the policies and provisions of the Bray Municipal District Local Area Plan 2018, the full build out of the zoned development lands at Fassaroe will accommodate 4,000 residential units, employment development for 3,000 jobs, a neighbourhood centre, a primary and secondary school and significant open space provision.

This assessment is for the first phase of development which incorporates 650 residential units, approximately 16% of the ultimate overall residential provision, the first phase of the neighbourhood centre and a significant proportion of the major open space provision. Thus, the first phase of development at Fassaroe will, in the context of the ultimate scale of build out of the lands, be a relatively small portion of development of the lands. However, as set out in more detail below, this first phase of development will deliver much of the transport infrastructure for the full build out.

This initial phase incorporates the Fassaroe development roads, including the road link to the Ballyman Road (Item 1 of section 2.3.1 of BETS), the N11 cycle and pedestrian bridge (Item 2 of section 2.3.1 of BETS), the N11 Part 8 works (Item 4 of section 2.3.1 of BETS), the traffic management measures at the Fassaroe Interchange (Item 6) and the initial phases of public transport services (Item 7) of section 2.3.1 of BETS.

The N11 / M11 Junction 4 to 14 Improvement Scheme (Item 3 of section 2.3.1 of BETS), and Busway from Fassaroe to Old Conna (Item 5 of section 2.3.1 of BETS), will be required for later stages of the development of the lands.

12.3.3.3.1. Bray Environs Transport Study – Requirements for first phase of development at Fassaroe

Section 3.2 and Section 3.3 of the BETS provides more detailed guidance on the transport infrastructure required to deliver the lands at Fassaroe on a phased basis, incorporating this first phase of development of 650 residential units and associated supporting community facilities. Table 3.1 of the BETS outlines required transport infrastructure and services along with proposed implementation mechanisms for this first phase of development as follows:

Table 12-16 - BETS Requirements for Phase 1 Development (650 Units) at Fassaroe

Infrastructure or Service	Delivery Process	Work Commenced	Completed to a Standard to be Taken in Charge
Fassaroe Development Roads	Part of Planning Application	Prior to Occupation of any dwellings	Prior to Occupation of any dwellings
N11 Cycle and Pedestrian Bridge	Part of Planning Application	Prior to Occupation of any dwellings	Prior to Occupation of any dwellings
Traffic Management Measures at Fassaroe Interchange arising from the development	Wicklow County Council Traffic Management System Framework to be agreed with TII within 2 months of the agreement of the Bray Study .	Prior to Occupation of any dwellings	Prior to Occupation of any dwellings
New bus services in line with demand	Part of Planning Application with agreement of NTA	Phased introduction as dwellings are completed	n/a
Bus Priority on Upper Dargle Road including the approach to Sunnybank Junction	In conjunction with Phase 1(a) development	Prior to occupation of any dwellings	n/a – WCC Scheme
Bus priority on Dublin Road – Castle Street	Prior to occupation of 50% of Development	Prior to occupation of 100% of Development	n/a – WCC / NTA Scheme

In addition to these requirements, section 3.2 of the BETS states that for development to proceed the following must also be demonstrated:

a) *That the proposed development provides fully for walking and cycling trips to all local services within Fassaroe;*

b) *That the applicant will provide a bus service for Bray DART Station in advance of demand justifying public investment as part of the expansion of the bus network under BusConnects;*

c) *That the applicant has fully assessed a requirement for a bus service to Bride's Glen or Cherrywood Luas and provides same if demand is deemed sufficient in advance of demand justifying public investment as part of the expansion of the bus network under BusConnects; and*

d) *That the applicant demonstrates how demand for travel to school from Fassaroe can be accommodated without undue recourse to the private car.*

The BETS states that the delivery of the above measures would demonstrate that the first phase of development "could be considered to be consistent with the Transport Strategy for the Greater Dublin Area and the DHPLG's Spatial Planning and National Roads Guidelines for Planning Authorities."

As stated in Section 3.3 of BETS, further phases of development in Fassaroe are recommended to be subject to an Implementation and Monitoring Plan to be developed by WCC with input from the NTA and TII. The Study advises that whereby such a plan has been agreed, the full build out of Fassaroe can proceed on that basis. The Implementation and Monitoring Plan for the further phases will build on the substantive transport infrastructure provisions that will be delivered in tandem with this first phase of development and the clear requirements, set out in the BETS, for the overall transport infrastructure requirements to facilitate the full build out.

12.3.3.4. Park & Ride Policy

As stated in Section 9.4, Park and Ride and Interchanges, of the Draft Greater Dublin Area Transport Strategy 2022-2042, published by the NTA in November 2021, “appropriately located and designed Park and Ride facilities can enable people to access public transport and enhance their option to reach a wide range of destinations in a sustainable manner and increase the usage of public transport.”

Measure INT3 - Park & Ride states:

> *“it is the intention of the NTA to secure the development of a network of regional level bus and rail based Park and Ride facilities in the GDA at appropriate locations where the national road network meets, or is in close proximity to, high capacity bus and rail services.”*

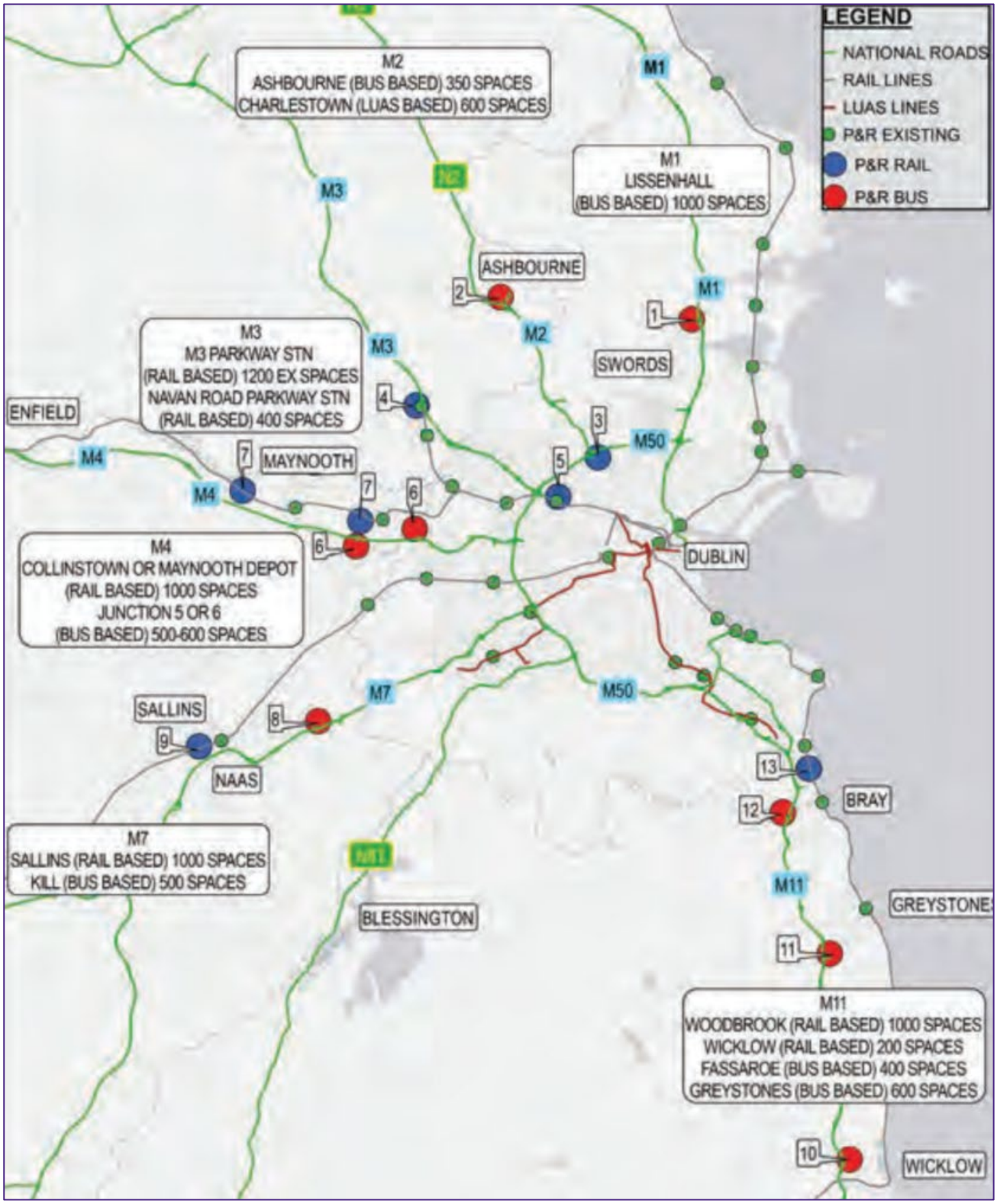
The Draft Strategy highlights a number of potential locations within the GDA where Park and Ride facilities will be developed during the lifetime of the Strategy to capture this demand. Potential Park & Ride locations identified in the Draft Strategy are shown in **Figure 12-11**.

One of the sites identified is at Fassaroe, site number 12. This facility will provide 400 parking spaces for a bus-based Park and Ride facility. As set out in the Draft Strategy, the implementation of a Park and Ride at Fassaroe is anticipated to be one of the early measures delivered.

The provision of a Park and Ride facility at Fassaroe has the potential to provide significant additional bus services and connectivity for future residents to and from key destinations in the GDA metropolitan area including Dublin City Centre and other key trip-end destinations.

The NTA confirmed in a meeting with Atkins that the delivery of the Park and Ride strategy for the GDA was a priority and would form one of the early measures considered for delivery. The location of the Park and Ride facility at Fassaroe is assumed to be adjacent to the southern access to junction 6 off Fassaroe Avenue and provision for a Park and Ride facility at this location can be accommodated on CPG controlled lands.

Figure 12-11 – Draft GDA Transport Strategy 2022-2042 – Park and Ride Locations



12.3.3.5. Future GDA Combined Rail Network

As set out in the Draft GDA Transport Strategy 2022-2042, there is provision for a significantly extended rail network for the GDA including new Luas lines, Dart+ and Metrolink that will provide an interconnected network of high capacity services to meet the travel demand of the metropolitan area. This future rail network is shown in **Figure 12.12**. The proposal includes the extension of the Luas from Brides Glen to Bray.

Figure 12-12 - Draft GDA Transport Strategy 2022-2042 Rail Network

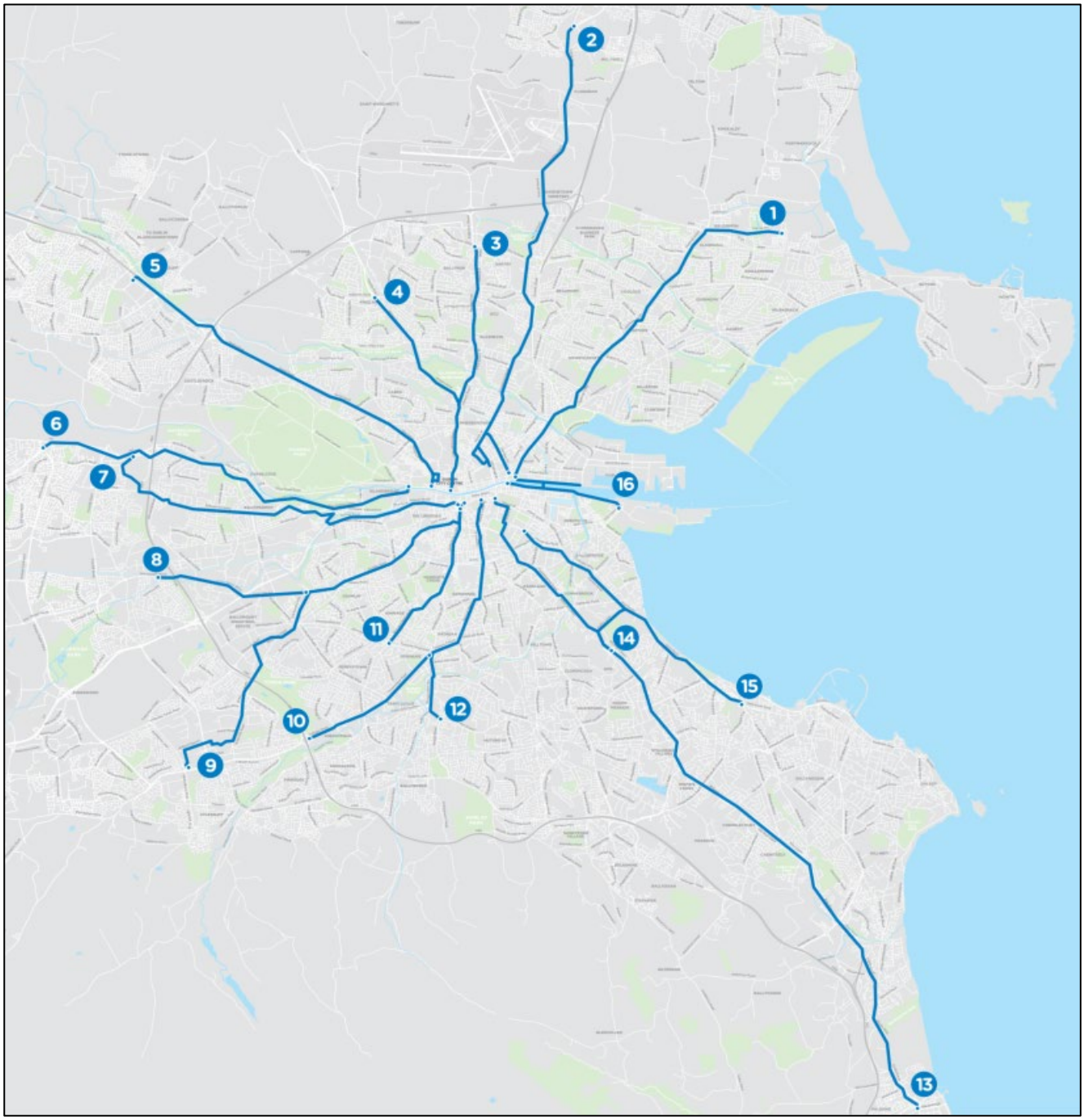
12.3.3.6. Future Bus Services - Public Transport Access Strategy

As set out in the Public Transport Access Strategy (PTAS) prepared by Atkins and agreed with the NTA (and which forms part of the current SHD application) the bus services proposed from Fassaroe to service the future residents of the development would be able to avail of this rail network via interchanges at the Bray Dart Station and Luas services at Cherrywood / Brides Glen. This will provide users with greater connectivity and a wider range of destinations that in turn will facilitate a significant public transport mode share for residents.

12.3.3.7. Bus Connects

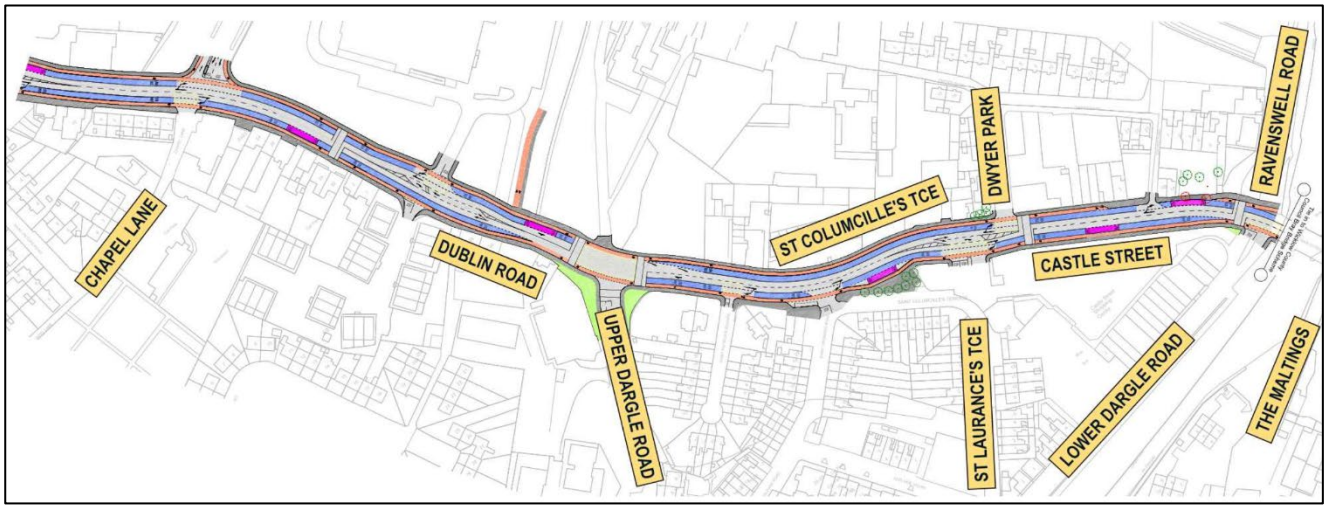
Bus Connects is the NTA's programme to greatly enhance bus services in the GDA. It consists of both the implementation of the Core Bus Corridors (CBCs) and the Network Redesign. Dublin to Bray CBC Route 13 forms one of the 16 radial routes as shown in **Figure 12-13**.

Figure 12-13 - BusConnects Core Bus Corridors



Bus priority measures will be introduced along these sixteen radial routes that will reduce delays to bus journeys making the bus services more reliable and efficient which in turn will help to increase the demand for bus services and increase bus patronage. In the Bray area, the bus priority measures include improvements on Castle Street, Dublin Road and the junction of Dublin Street / Castle Street / Upper Dargle Road. An extract of these emerging preferred route bus priority measures is shown in **Figure 12-14**. Improvements include continuous bus lane provisions southbound on Castle Street, across the River Dargle Bridge, and continuous northbound bus lane provisions along Castle Street to the junction with Upper Dargle Road.

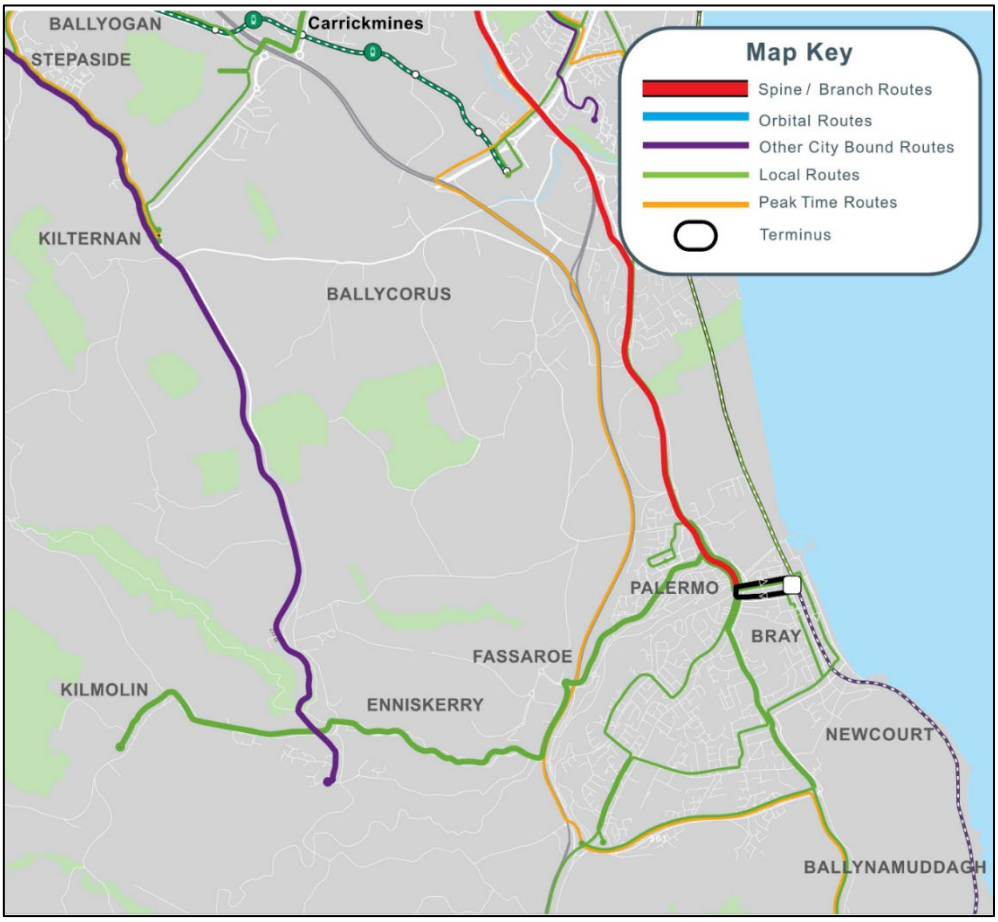
Figure 12-14 - BusConnects - Bus Priority Measures in Bray



All the radial bus routes are currently at the third stage of public consultation by the NTA on their respective emerging preferred routes. Construction of the CBC network is expected to be completed by 2027. It is important to note that once permission is granted for BusConnects it will be possible for sections in the Bray area, such as Castle Street, to be implemented ahead of the delivery of the entire BusConnects Corridor Route 13 and in tandem with the delivery of the Upper Dargle Road and Bray Bridge bus priority measures.

The Bus Network Redesign element of BusConnects will see the existing bus network undergo a redesign to accommodate a more efficient bus service. The redesigned network for Bray is shown in **Figure 12-15**.

Figure 12-15 - BusConnects Network Redesign Bray Area



Upon completion the bus network improvements, services and frequencies set out in **Table 12-17** will be provided in the Bray area.

Table 12-17 - BusConnects - Bus Services in the Bray Area

Route No.	Frequency of Service	Route
E1	Northwood – City Centre – Bray Main Street – Ballywaltrim	Peak hour 8-minute frequency All other times 10 minute
88	Enniskerry – Belarmine – Dundrum – Mountjoy Square	1 per hour
L1	Greystones – Newcastle Loop Clockwise – Bray	40-minute frequency
L2	Greystones – Newcastle Loop Anticlockwise	40-minute frequency
L11	Kilmacanogue – Bray – Dun Laoghaire	20-minute frequency
L12	Ballywaltrim – Bray Station	20-minute frequency
L14	Southern Cross Road – Bray Station	30-minute frequency
L15	Shop River – Enniskerry – Bray	60-minute frequency
X1	Kilcoole – Southern Cross – City Centre	6:00 a.m. to 7:00 a.m. - 2 services 7:00 a.m. to 8:00 a.m. - 4 services 4:00 p.m. to 5:00 p.m. - 1 service 5:00 p.m. to 6:00 p.m. - 6 services
X2	Newcastle – Kilcoole – Southern Cross – City Centre	6:00 a.m. to 7:00 a.m. - 1 service 7:00 a.m. to 8:00 a.m. - 2 services 4:00 p.m. to 5:00 p.m. - 1 service 5:00 p.m. to 6:00 p.m. - 2 services

As shown in **Table 12-17**, the delivery of BusConnects network redesign will result in an enhanced service provision in the Bray area. In the vicinity of Fassaroe, the peak frequency of express services operating on the N11 towards Dublin City, the X1 and X2, will replace the existing No.84X express service and will increase from the current level of four services per hour to six services per hour. The current No.185 service will be retained as the L15 service.

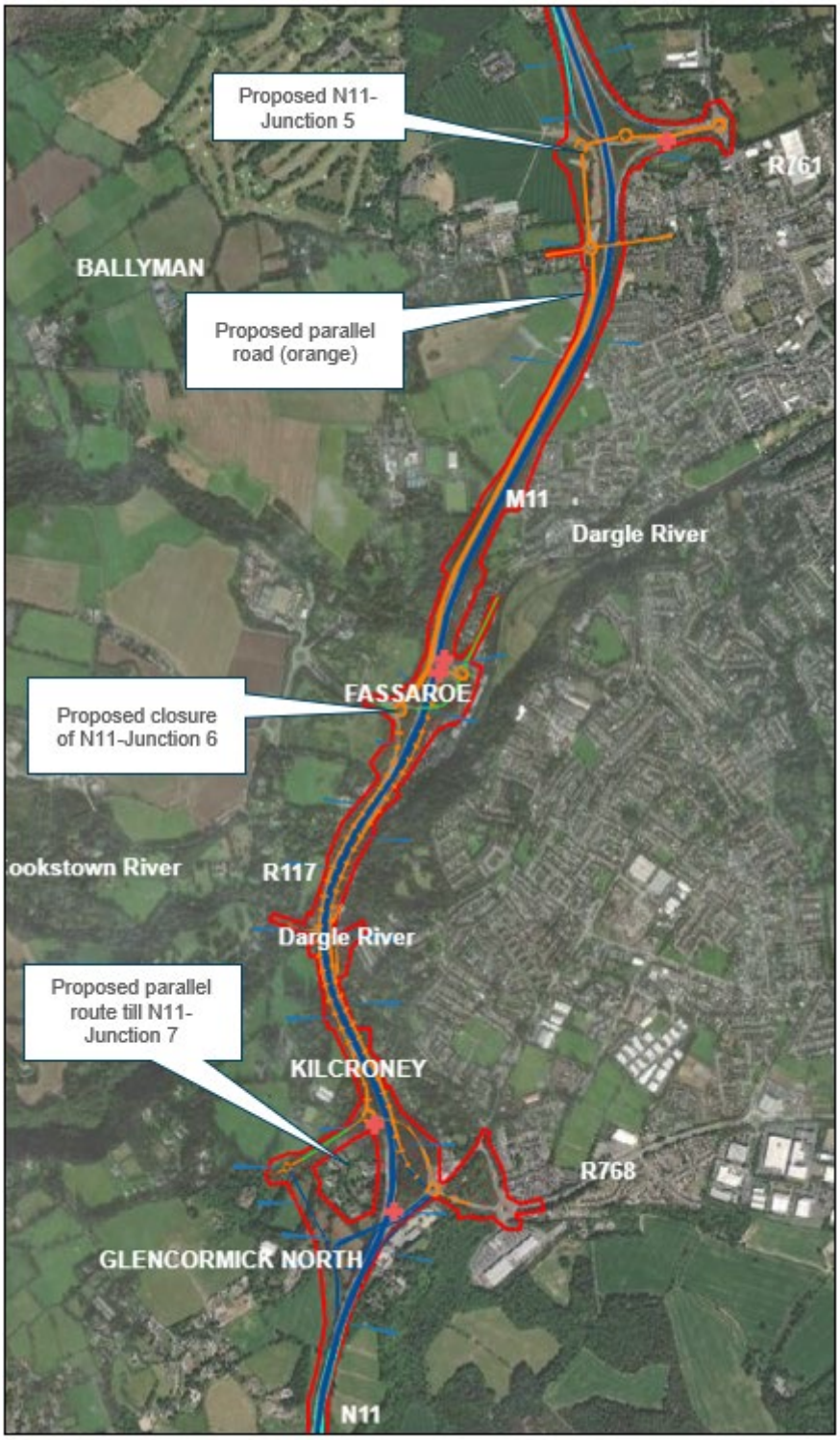
12.3.3.8. N11 Junction 4 to Junction 14 Improvement Scheme

The N11/M11 Junction 4 to Junction 14 Improvement Scheme (hereafter referred to as the N11/M11 Scheme) is a transportation project aimed at alleviating congestion, improving safety and optimising the efficiency and function of the N11/M11 as a transport corridor. The N11/M11 Scheme is approximately 22 km in length and extends from the existing M11/M50 junction west of Shankill, Co. Dublin, to the N11/M11 junction at Coyne's Cross, Co. Wicklow.

The primary objective of Phase 1 of this scheme was to develop and investigate in detail the feasibility of the project and to establish and implement a project management structure. In addition, the integration of the scheme with public transport and/or other transport modes was also assessed. Phase1 was completed in October 2019 and was approved to progress to Phase 2.

Phase 2, Option Selection, undertook a systematic options assessment that resulted in a preferred option being identified. The preferred option was open for public consultation in August 2021. The preferred option involves the provision of new parallel roads adjacent to the N11/M11 mainline, together with improved junction layouts and the proposed closure of certain primary junctions to improve mainline flow and reduce congestion associated with on and off traffic movements at some interchanges. The preferred option identified the closure of N11-Junction 6 at Fassaroe and diversion of all the traffic to/from north of the development to a parallel road which would connect Junction 6 to the proposed upgraded N11-Junction 5 interchange. The vehicles from south of the development will also be diverted to the parallel road which connects Junction 6 to the N11-Junction 7. The preferred option alignment is shown in **Figure 12-16**. The preferred option retains the current roundabouts at Junction 6 and the N11 overbridge which will facilitate the continued direct connection of Fassaroe to Bray via Upper Dargle Road.

Figure 12-16 – Preferred Option for N11-M11 Scheme



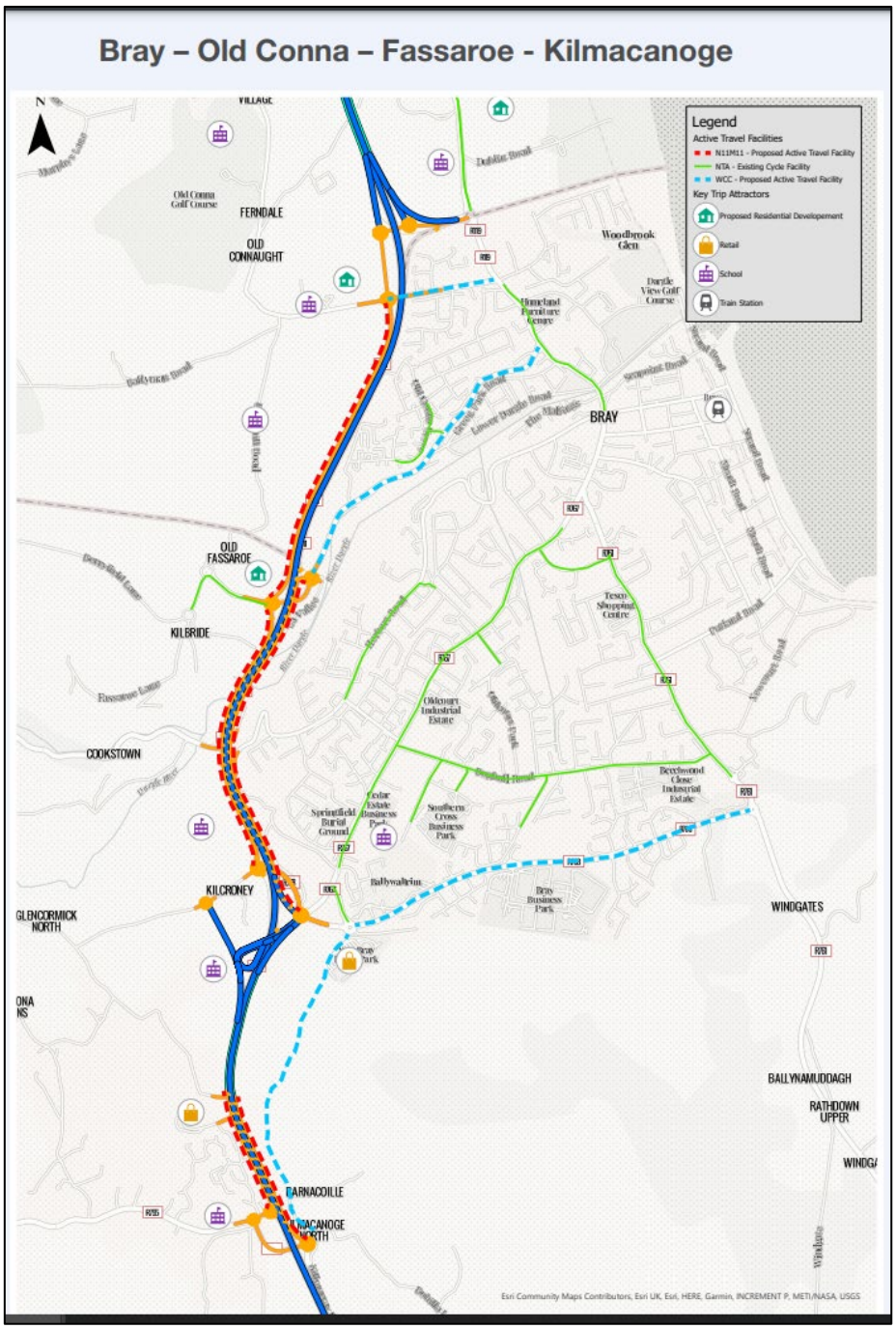
The preferred option also includes a major investment in the bus services within the N11/M11 study area – in addition to those already included in the Bus Connects proposals. This will reduce the car demand on N11/M11 by encouraging mode switch to public transport alternatives. The scheme includes provision of local Bray environs services connecting Fassaroe to Dublin and the Bray Dart station. This will facilitate development at Fassaroe.

The future Active Travel Strategy for the N11/M11 Corridor includes a number of integrated components, with the aim of delivering a credible alternative mode of travel which is safe, inclusive, connected and attractive. This Strategy includes the following elements:

- Active travel facilities identified within the NTA's Greater Dublin Area Cycle Plan.
- Active travel facilities identified within local and regional plans.
- Active travel facilities delivered as part of the N11/ M11 Scheme.

The preferred active travel measures related to Fassaroe, as identified in the N11/M11 Scheme, are shown in **Figure 12-17** and include active travel walking and cycling provision along the new N11 parallel roads and along Upper Dargle Road.

Figure 12-17 - Preferred Active Travel Measures at Fassaroe Included in the N11/M11 Scheme



As the N11/M11 Scheme is still in development the final measures have not been agreed and there are no definite timelines for implementation of any measures. The agreed scheme will be cognisant of the zoned lands at Fassaroe and make appropriate considerations for connectivity.

TII has provided funding to develop an interim measure called the N11/M11 Bus Priority Interim Scheme. This scheme looks to develop proposals for the provision of bus priority measures, in both directions, during peak periods on the N11/M11 corridor that can be used by coaches and/or buses to avoid congestion and delay, improve bus service reliability, increase patronage, and reduce the current unsustainable dependency on private cars. When delivered, this would further enhance the bus services proposed for Fassaroe set out in the PTAS.

12.3.3.9. Bray DART Public Interchange

WCC in partnership with the NTA are currently delivering significant improvements to the public realm in the immediate vicinity of the Bray DART Station that will facilitate improved interchange for commuters between bus and rail services as well as creating a safer environment that prioritises walking and cycling.

12.3.3.10. Other WCC Schemes

In addition to the above measures, WCC is currently undertaking a study to provide enhanced bus priority measures along the Upper Dargle Road to Castle Street. WCC are also undertaking a study to provide the Dargle River Greenway that will provide a segregated pedestrian and cycle route between La Vallee and Bray Town Centre.

12.3.3.11. Summary of Existing Policy for Future Transport Measures

Upon delivery of the above measures and in combination with the proposed measures that will be delivered by the applicant as set out in **Section 12.5**, future residents will be able to avail of a wider range of sustainable travel options for work, education and leisure travel within, to and from the site. The development is therefore being appropriately planned in a coordinated manner between the NTA, TII, WCC and the Applicant as the sustainable expansion of Bray to the west.

Transport characteristics are further set out in the following Atkins documents:

- Fassaroe Engineering Report;
- Fassaroe Public Transport Access Strategy; and
- DMURS Statement;

that accompany this EIAR and planning application.

12.4. Potential Impact of the Proposed Development

The potential impact of the proposed development is considered with reference to the baseline infrastructural and policy context set out at **Section 12.3** and the description of the development set out in Chapter 2 of this EIAR. The assessment also has regard to the development details set out in the following Atkins documents which are provided as part of the wider application documentation, and which describe in more detail various transport characteristics of the development:

- Fassaroe Phase 1 Engineering Planning Report for Roads, Traffic, Transport and Geotechnical;
- Fassaroe Planning Application - Public Transport Access Strategy; and
- Fassaroe Development DMURS Statement.

The potential impacts are considered for the construction and operational phases of the development.

12.4.1. Construction Stage

The traffic that would be generated during construction of the development is predicted on the basis of an outline construction programme and activity schedule for the proposed development provided in Chapter 2 of this EIAR.

Further details of construction activity are set out in the Construction Environmental Management Plan (CEMP) that is included as **Appendix 2B** of this EIAR.

The transport effects of the proposed development during the demolition and construction phases are considered through the following key transportation issues;

- Vehicle routing;
- Demolition and construction traffic impacts;
- Pedestrian and cycle impacts; and
- Public transport impacts.

It is assumed that all demolition and construction vehicles will remain on the strategic road network for as long as possible and that the “last mile” will be undertaken on local roads (i.e.: that all construction traffic will approach the site from the N11 corridor). During the demolition and construction of the proposed development there is the potential for temporary local disruption to pedestrian, cycle and vehicular traffic users because of demolition and construction traffic.

12.4.1.1. Anticipated Construction Traffic

The assessment set out below concentrates on the two peak construction periods associated with remediation of the District Park and the concrete pours as they represent the peak construction movements of the development. There will be other construction activity throughout the construction programme, however, these construction traffic volumes will be considerably less and more spread out than the two peak periods and therefore less impactful.

Based on the construction details outlined in Chapter 2 - including programme, phasing and construction hours – **Table 12-18** shows the anticipated construction activity for the remediation of the historic landfills and development of the park. Based on the outline programme, this construction traffic movement will occur between the fourth quarter of 2022 and the first quarter of 2024.

Table 12-18 - Park Remediation Construction Activity

Fill Import Volume	129,747 cubic metres
Construction Days Per Month	20 days
Park Remediation Programme	16 months
Park Import of Material	10 months
Fill Remedial Per Day	649 cubic metres
Average Truck Capacity	25 tons
Average Soil Density	1.9 kg/m^3
Capacity Per Truck	13 cubic metres
One-Way Truck Trips Per Day (over 10 months)	49
Two-Way Truck Trips Per Day (over 10 months)	99
Hours of Operation	07:00 – 19:00 (12 hours per day)
One-Way Truck Movements Per Hour (assuming an even distribution)	5
Two-Way Truck Movements Per Hour (assuming an even distribution)	10

Based on the above analysis, the average volume of daily truck movements is anticipated to be 99 trucks per day for 10 months.

Table 12-19 shows the anticipated construction activity for the concrete pours associate with Blocks 1-3 and the Neighbourhood Centre. As outlined in the programme, these are expected to commence in the first quarter of 2024 and continue through the second quarter of 2025 for Blocks 1-3 and during the end of the second quarter of 2025 through the third quarter of 2026 for the Neighbourhood Centre. Therefore, if not anticipated that these concrete pours will run concurrently.

Table 12-19 - Concrete Pour Construction Activity

Total Concrete Pour	19,200 cubic metres
Concrete Pour for Blocks 1-3	9,600 cubic metres
Concrete Pour for Neighbourhood Centre	9,600 cubic metres
Daily Pour Volume	400 cubic metres
Bi-Weekly Pour Volume (assuming three pours spread over two weeks)	1,200 cubic metres
Total Number of Pours Required	24
Average Truck Capacity	7.5 cubic metres
Required Number of Trucks Per Pour	53 (one way)
Two-Way Truck Movements Per day	106
Two-Way Truck Movements Per Hour (assuming an even distribution between 0700 and 1800 and no half trucks)	10
Total Number of Truck Movements	1,280
Trucks Per Typical Pour (3 x 2 weeks)	160
Duration of pour	4 months

Based on the above analysis, the average truck movements are anticipated to be 106 trucks per pour which will occur three times over a two week period for four months. If evenly distributed over a typical construction day this equates to approximately 10 vehicles an hour based an even distribution.

Other materials delivered by HGV in significant quantities throughout a project would include stone fill, steel reinforcement, blocks and bricks, mortar, precast concrete floors and balconies, timber and roof trusses, windows and cladding, roof tiles/slates, paving and drainage materials. Materials for general internal finishes would tend to be in smaller vehicles but some of the bulkier items would include timber, plaster slabs, kitchens and wardrobes, bathrooms and plumbing supplies. However, these vehicle movements will be spread out over the entire duration of the programme (four years) with vehicle numbers not anticipated to be as numerous or as prolonged as the two scenarios outlined above. As an estimate, it is assumed that there would be circa 24 two-way vehicle movements over a typical construction day.

In terms of construction personnel, it is anticipated that circa 300 people would be employed on site during peak periods. **Table 12-20** outlines a typical construction profile for this location.

Table 12-20 - Construction Personnel Movements

Number of Construction Staff	300
Average Car Occupancy	3
Percentage Arriving by Public Transport	0%
Daily Number of Public Transport Trips (for construction)	0
Percentage Arriving by Public Car	100%
Daily Number of Car Trips (for construction)	100
Arrival Profile	
0700-0800	80%
0800-0900	20%
Departure Profile	
1600-1700	10%
1700-1800	10%
1800-1900	80%

Based on the above analysis and taking into account that the landfill remediation and park landscaping peak concrete pours will not occur concurrently, an anticipated peak construction activity profile is shown in **Table 12-21**.

Table 12-21 - Anticipated Peak Construction Traffic Movements

	Park Remediation		Concrete Pour		Construction Personnel		Other Construction		Total Vehicles	
	In	Out	In	Out	In	Out	In	Out	In	Out
Time										
0700-0800	5	5	5	5	80	0	1	1	91	11
0800-0900	5	5	5	5	20	0	1	1	31	11
0900-1000	5	5	5	5	0	0	1	1	11	11
1000-1100	5	5	5	5	0	0	1	1	11	11
1100-1200	5	5	5	5	0	0	1	1	11	11
1200-1300	5	5	5	5	0	0	1	1	11	11
1300-1400	5	5	5	5	0	0	1	1	11	11
1400-1500	5	5	5	5	0	0	1	1	11	11
1500-1600	5	5	5	5	0	0	1	1	11	11
1600-1700	5	5	5	5	0	10	1	1	11	21
1700-1800	5	5	5	5	0	10	1	1	11	21
1800-1900	0	0	0	0	0	80	1	1	1	81
Total	55	55	55	55	100	100	12	12	222	222

12.4.1.2. Construction Impacts

Based on the above volumes the number of construction traffic movements through the Junction 6 Fassaroe Interchange in the AM and PM peak periods is shown in **Figure 12-18** and **Figure 12-19**. Figures assume 70% of traffic approaches from the north in the and 30% from the south in the AM period and that is reversed in the PM period. Vehicles have been converted to PCU as follows

- Construction personnel vehicles assumed to be 1 pcu
- all other vehicles 2 pcu.

Peak AM and PM vehicle PCU's is shown in **Table 12-22**.

Table 12-22 - Peak Construction Traffic in PCU

	IN – PCU	Out - PCU
AM Peak 0800-0900	42	22
PM Peak 1700-1800	22	32

Figure 12-18 - AM Construction Traffic Impact

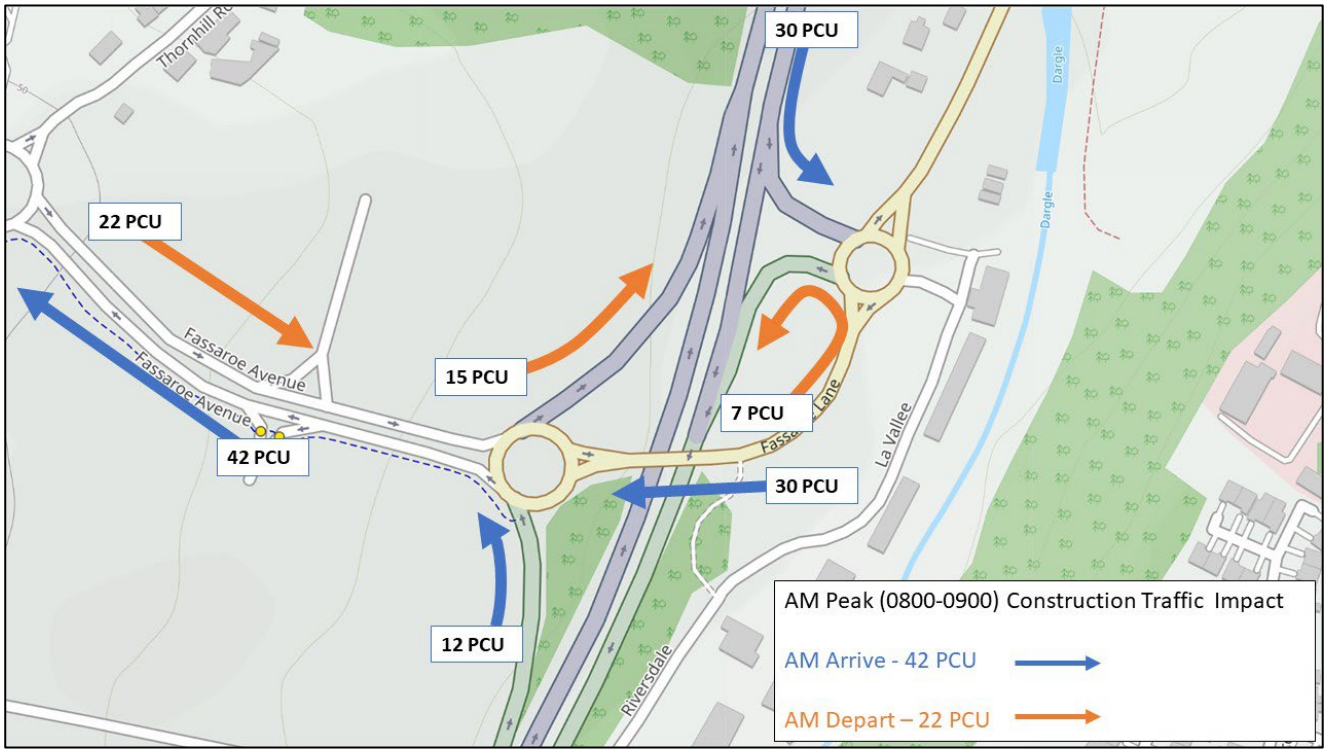
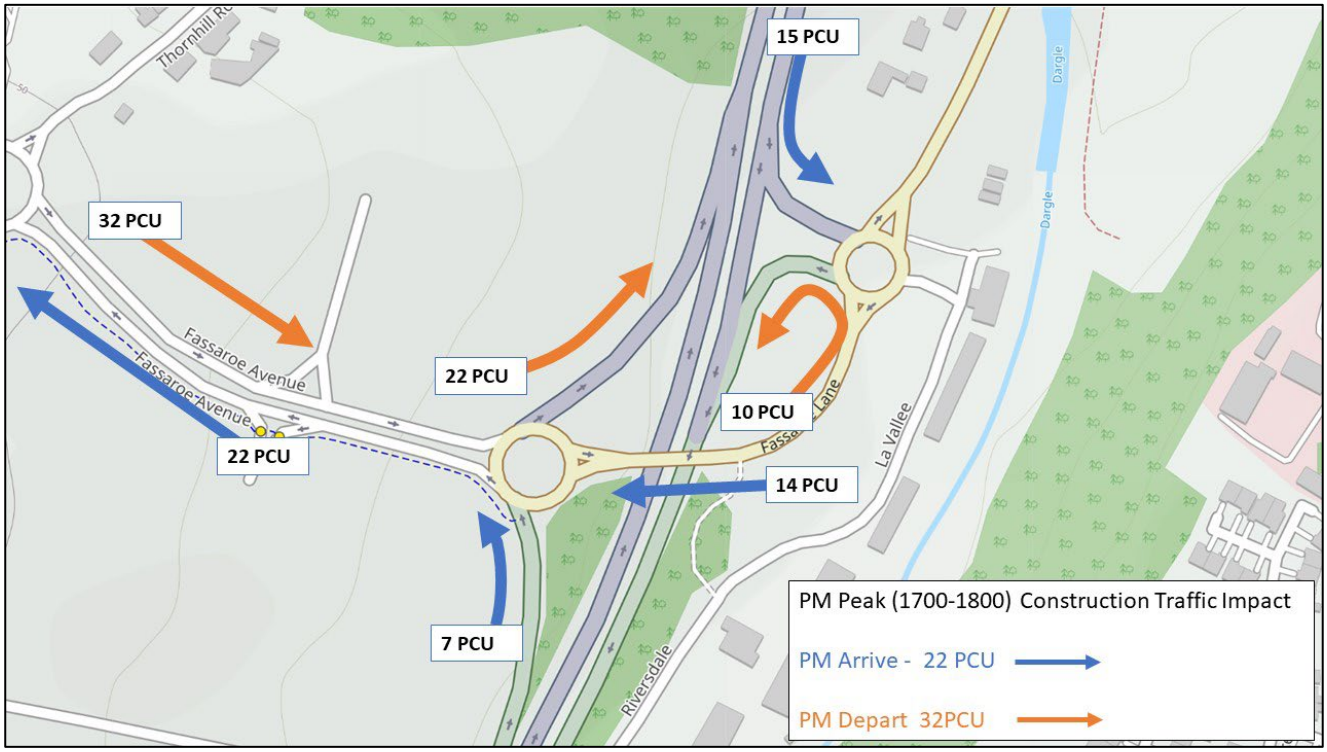


Figure 12-19 - PM Construction Traffic Impact



Based on the construction traffic flows shown above the traffic impacts at both the western and eastern roundabouts at the Junction 6 interchange are shown in **Table 12-23**.

Table 12-23 - Construction Traffic Impact at the N11-Junction 6 Fassaroe Interchange

	Time Period	Existing Traffic Volumes PCU	Construction Traffic PCU	% Impact
N11-Junction 6 Fassaroe Interchange, Eastern Roundabout	AM (0800-0900)	1,079	37	3.4%
	PM (1700-1800)	1,224	25	2%
N11-Junction 6 Fassaroe Interchange, Western Roundabout	AM (0800-0900)	896	64	7.1%
	PM (1700-1800)	840	54	6.4%

As shown in **Table 12-23,** the construction traffic impact at the eastern interchange roundabout adjacent the Upper Dargle Road is negligible with a maximum increase in traffic of 3.4 percent experienced in the AM period. While there is a slightly greater percentage impact on the western interchange (7 percent in AM), this is primarily due to the relatively low existing traffic numbers passing through this junction.

As shown in **Table 12-23,** the potential traffic impact from the development is below the thresholds set out in TII's Transport Assessment Guidelines Table 2.1 Traffic Management Guidelines Thresholds for Transport Assessments that states that assessment is required if:

- Traffic to and from the development exceeds 10 percent of the traffic flow on the adjoining road; and
- Traffic to and from the development exceeds 5 percent of the traffic flow on the adjoining road where congestion exists of the location is sensitive.

Neither junction is considered to be sensitive or experiencing congestion and therefore impacts of less than 10 percent would not need to be assessed based on the above TII guidance. Based on this threshold the construction impacts on Junction 6 of the N11 are considered to be negligible.

Based on analysis of average peak traffic flows on the N11 from TII's traffic monitoring unit (TMU M11 015) between January and March 2022, the construction impact of the development on the M11/ N11 mainline is shown in **Table 12-24.**

Table 12-24 - Construction Traffic Impact on N11 Mainline

	Time Period	Existing Traffic Volumes PCU	Construction Traffic PCU	% Impact
N11/ M11 Southbound	AM (0800-0900)	1,944	30	1.5%
	PM (1700-1800)	3,237	25	0.8%
N11/ M11 Northbound	AM (0800-0900)	3,727	27	0.7%
	PM (1700-1800)	2,251	29	1%

As shown in **Table 12-24,** the percentage impact on the N11/M1 mainline is negligible and in all case well below the thresholds set out in TII Transport Assessment Guidelines Table 2.1 Traffic Management Guidelines Thresholds for Transport Assessments for sensitive roads (5 percent).

The construction traffic impact from the development is therefore considered to be imperceptible / not significant on the Junction 6 (east and west) and on the N11/M11 mainline.

Based on the above analysis, and the current operation of these roundabout junctions being well within their operating capacity, the construction traffic impact at Junction 6 Fassaroe Interchange is expected to be negligible and temporary in nature during peak construction traffic movements associated with cut and fill and concrete pour activity.

As set out in the following section, a detailed analysis of the operation impact of the development that will result in greater traffic flows through these junctions can be accommodated that further shows that the construction traffic impacts will be negligible.

12.4.2. Operational Phase

This section outlines the traffic impact from the zoned lands at Fassaroe on the local and strategic road network surrounding the site during regular operations. A Microsimulation Traffic Model Report (Atkins Ref 5186693DG0058) was produced in March 2020 on behalf of WCC and in conjunction with key stakeholders - including TII and the NTA - that examined the impact of development at Fassaroe and adjoining zoned lands on the N11/M11 mainline and at the Junction 6 Fassaroe interchange. The full report is provided at **Appendix 12A** and contains further details particularly around the impact of the development traffic from Fassaroe on the mainline flow. The main findings of the Microsimulation Traffic Model Report in relation to impacts on the N11/M11 are summarised in this chapter along with an assessment of the impact of development traffic on the Junction 6 interchange at Fassaroe.

The Microsimulation Traffic Model Report has identified a number of measures to ensure the smooth operation of traffic on the mainline of the N11/M11 and at and across the Fassaroe interchange at Junction 6 which form part of the Traffic Management Framework Agreement (TMFA) between WCC, TIII and the NTA (**Appendices 3A – 3D**). The preferred method of control identified in the modelling report and agreed in the TMFA is that the Junction 6 east and west interchanges retain their current method of control and that signals are not introduced due to the significant adverse impact this has on traffic at the two interchange junctions, particularly public transport (bus) services. Further details of the traffic impacts of the development are set out below and details of the TMFA are set out in **Section 12.4.4.4**.

12.4.3. Trip Rate and Trip Generation

The TRICS database was utilised to determine the trip generation for the proposed apartment and house units at Fassaroe. The AM and PM trip rates are shown in **Table 12-25**. The creche and neighbourhood centre trips are considered to be internal trips and/or linked trips and, therefore - in accordance with TII Transport Assessment Guidelines - are not considered as part of this assessment.

Table 12-25 – Trip Generation Rates

Type	07:00 – 08:00		08:00 – 09:00		09:00 – 10:00	
	Arrival	Departure	Arrival	Departure	Arrival	Departure
House	0.091	0.357	0.212	0.712	0.216	0.363
Apartment	0.053	0.317	0.075	0.516	0.075	0.192
Type	**16:00 – 17:00**		**17:00 – 18:00**		**18:00 – 19:00**	
	Arrival	**Departure**	**Arrival**	**Departure**	**Arrival**	**Departure**
House	0.488	0.285	0.609	0.370	0.446	0.353
Apartment	0.204	0.117	0.387	0.133	0.409	0.179
Note: All rates are shown in person trips per housing unit.						

Based on the above trip generation rates, total person trips for Phase1 (650 units) were calculated and are summarised in **Table 12-26**.

Table 12-26 - Fassaroe People Trip Generation

Type	07:00 – 08:00		08:00 – 09:00		09:00 – 10:00	
	Arrival	Departure	Arrival	Departure	Arrival	Departure
Trips Generated by 650 units in Fassaroe (Phase 1) AM						
House	20	78	46	155	47	79
Apartment	23	137	32	223	32	73
Total Trips AM	**43**	**215**	**78**	**378**	**79**	**162**
Type	**16:00 – 17:00**		**17:00 – 18:00**		**18:00 – 19:00**	
	Arrival	**Departure**	**Arrival**	**Departure**	**Arrival**	**Departure**
Trips Generated by 650 units in Fassaroe (Phase 1) PM						
House	106	62	133	81	97	77
Apartment	88	51	167	57	177	77
Total Trips PM	**194**	**113**	**300**	**138**	**274**	**154**

12.4.3.1.1. Mode Share for the Base +4 Design Year Scenarios

For the Base +4 design year scenarios, it has been assumed that all the traffic measures set out in the BETS for Phase 1a will be completed. Therefore, the likely modal split was determined from the 2016 census data for similar areas in the vicinity, namely CSO area codes SA 257051032, SA 257051030, SA 257051024, SA 257051025, SA 257051029. This mode split is shown in **Table 12.27**.

It should be note that the mode share outlined in **Table 12-27** and **Table 12-28** differs from that for the PTAS as set out in **Section 12.4.5**. A more conservative sustainable-travel mode share and a higher car mode share has been used here in order to ensure that the traffic modelled impacts are robust. This ensures that the traffic modelling analysis reflects a “worst-case” scenario with a high level of private care use and, therefore, the greatest impacts to road traffic on the surrounding network. However, as outlined in **Section 12.3.3,** it is expected that the sustainable and active travel mode share will be greater that what has been used for the purposes of this traffic modelling effort due to the level of infrastructure that will be delivered in the vicinity of the site either by the developer or by other stakeholders such as WCC, TII and the NTA.

Table 12-27 - Fassaroe Modal Split for Base + 4 design year scenarios

Mode	Percentage
Active Travel	15%
Public Transport	18%
Car Driver	46%
Car Passenger and Others	22%
Total	**100%**
Note: values may not round to 100 percent due to rounding.	

12.4.3.1.2. Mode Share for the Base +9 Design Year Scenarios

In Base +9 design year scenarios it was assumed that no additional units—beyond the 650 constructed in Phase 1—are built. Therefore, for these scenarios the same mode split percentages as determined in **Table 12-27** were applied.

For the Base +9 design year sensitivity analysis scenarios it was assumed that up to 600 extra units will be developed at Fassaroe (for a total of 1,200 units). Based on the commitment to improve public transport services ahead of the full occupation of the additional units, it was assumed that the proposed development will be better connected by the proposed scheduled bus services to Bray and DART and LUAS stations prior to the occupation of all the residential units in Base +9 design year. Therefore, the modal split for the trips in the Base +9 design year sensitivity analysis scenarios was determined from the 2017 census data for CSO small area codes Sa2017_267097005, Sa2017_267121009, Sa2017_267122001 and Sa2017_257080004.

The CSO small area sites are located adjacent to the R119 Dublin Road and are well served by bus services. Therefore, these areas are similar to the proposed development at Fassaroe once the proposed frequent bus services are in place. **Table 12.28** summarises the modal split undertaken for the sensitivity analysis of scenarios which assume a total of 1,200 units at Fassaroe are constructed.

Table 12-28 – Fassaroe Modal Split for Base + 9 design year scenarios

Mode	Percentage
Active Travel	18%
Public Transport	28%
Car driver	40%
Car passenger and others	14%
Total	**100%**

Based on the respective modal share, the total number of trips for the 1,200 unit sensitivity analysis scenario was calculated and are summarised in **Appendix 12A.**

12.4.3.1.3. Modal Trips

Based on the mode share, the total trips for respective modes are summarised in **Table 12-29 to Table 12.32**.

Table 12-29 - Fassaroe Modal Trip Generation by 650 units (AM Peak)

Mode	07:00 – 08:00		08:00 – 09:00		09:00 – 10:00	
	Arrival	Departure	Arrival	Departure	Arrival	Departure
Active Travel	6	32	12	57	12	24
Public Transport	8	39	14	68	14	29
Cars (Not Car passenger)	20	99	36	174	37	75
Total	**34**	**170**	**62**	**299**	**63**	**128**

Table 12-30 - Fassaroe Modal Trip Generation by 650 units (PM Peak)

Mode	16:00 – 17:00		17:00 – 18:00		18:00 – 19:00	
	Arrival	Departure	Arrival	Departure	Arrival	Departure
Active Travel	29	17	45	21	41	23
Public Transport	35	20	54	25	49	28
Cars	89	52	138	64	126	71
Total	**154**	**89**	**237**	**109**	**216**	**122**

Table 12-31 - Fassaroe Modal Trip Generation by 1,200 units (AM Peak)

Mode	07:00 – 08:00		08:00 – 09:00		09:00 – 10:00	
	Arrival	Departure	Arrival	Departure	Arrival	Departure
Active Travel	14	71	26	126	26	54
Public Transport	22	111	41	195	41	84
Cars	32	159	58	279	59	120
Total	**68**	**341**	**125**	**600**	**126**	**257**

Table 12-32 - Fassaroe Modal Trip Generation by 1,200 units (PM Peak)

Mode	16:00 – 17:00		17:00 – 18:00		18:00 – 19:00	
	Arrival	Departure	Arrival	Departure	Arrival	Departure
Active Travel	65	37	100	46	91	51
Public Transport	101	58	155	71	142	80
Cars	144	83	221	102	202	114
Total	**309**	**179**	**476**	**219**	**435**	**245**

12.4.3.1.4. Trip Distribution & Departure Profile – Development at Fassaroe

Based on the socio-economic profile document, the proposed percentage distribution of the car trips to various zones (as shown in **Table 12-9)** are summarised in **Table 12-33.**

Table 12-33 - Car Trip Distribution

Destination	AM Peak		PM Peak	
	Arrivals	Departures	Arrivals	Departures
Monastery Road North	5.3%	5.8%	5.8%	5.3%
N11 Northbound	34.3%	52.3%	52.3%	34.3%
N11 Southbound	47.8%	30.9%	30.9%	47.8%
Upper Dargle Road	8.8%	7.6%	7.6%	8.8%
Monastery Road South	3.8%	3.4%	3.4%	3.8%
Total	**100%**	**100%**	**100%**	**100%**

Figure 12-20 to **Figure 12-23** summarise the distribution of development trips to/from Fassaroe onto the road network.

Figure 12-20 - Trip Distribution AM Peak - Fassaroe Development (650 units)

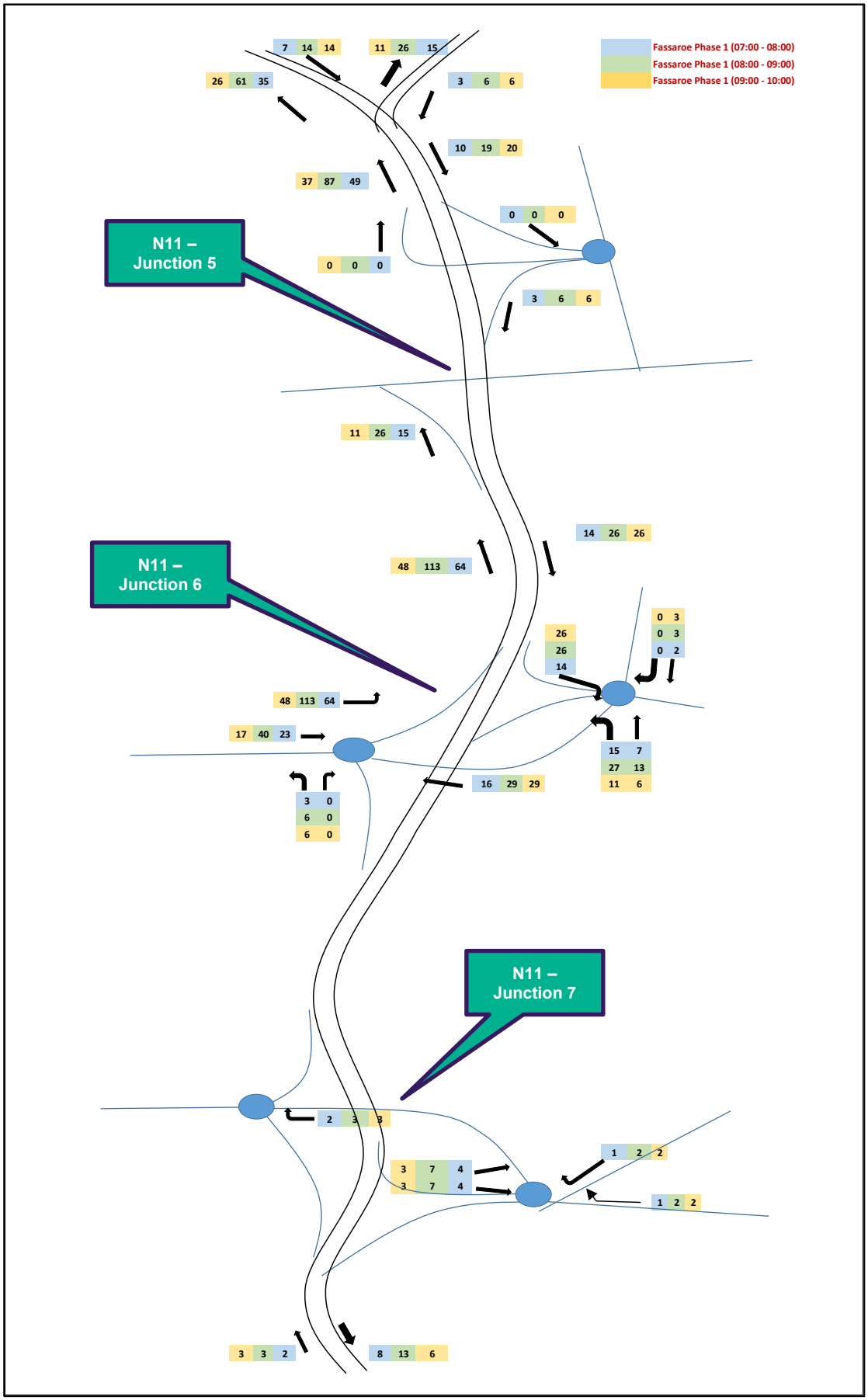


Figure 12-21 - Trip Distribution PM Peak - Fassaroe Development (650 units)

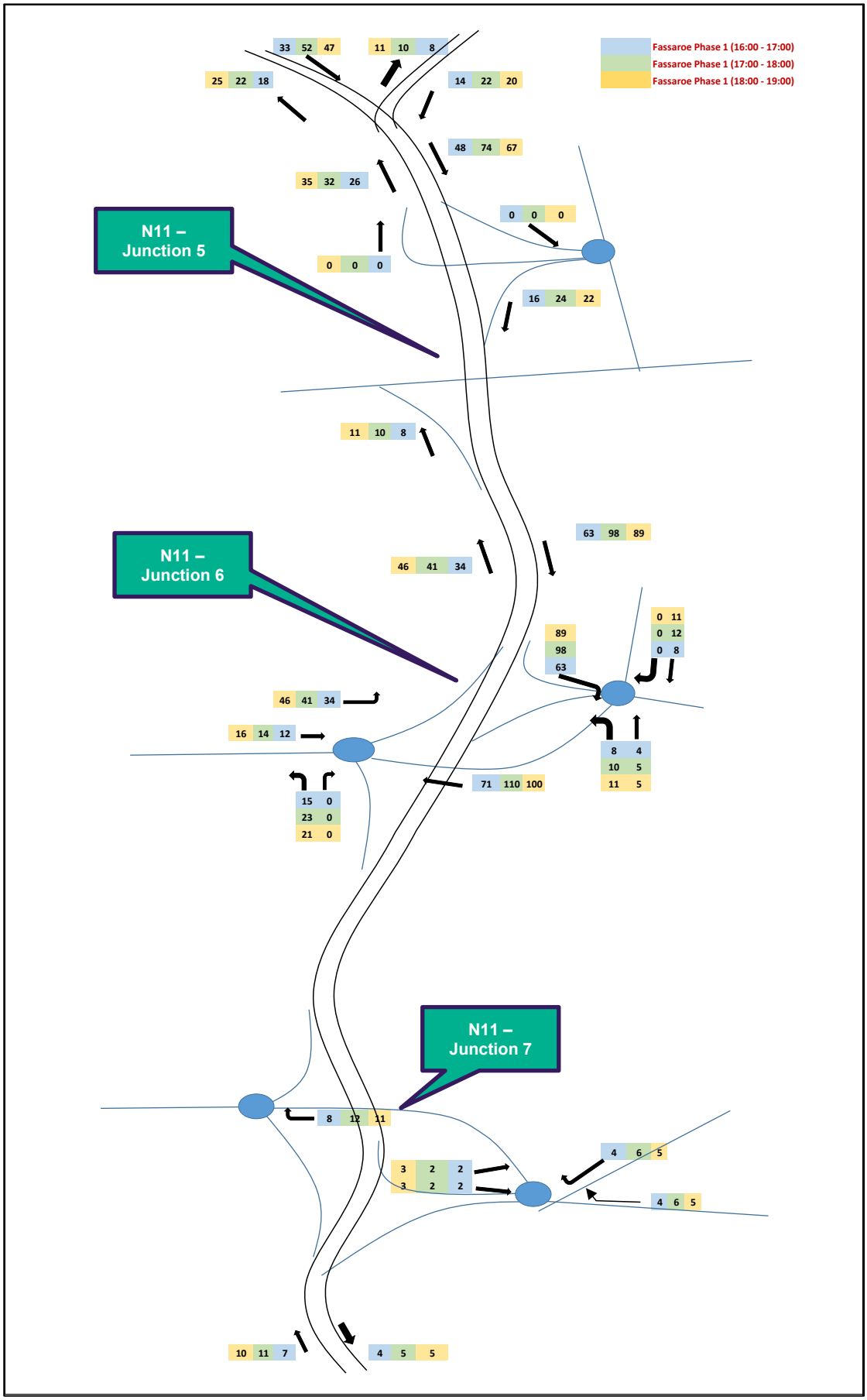


Figure 12-22 - Trip Distribution AM Peak - Fassaroe Development (1200 units)

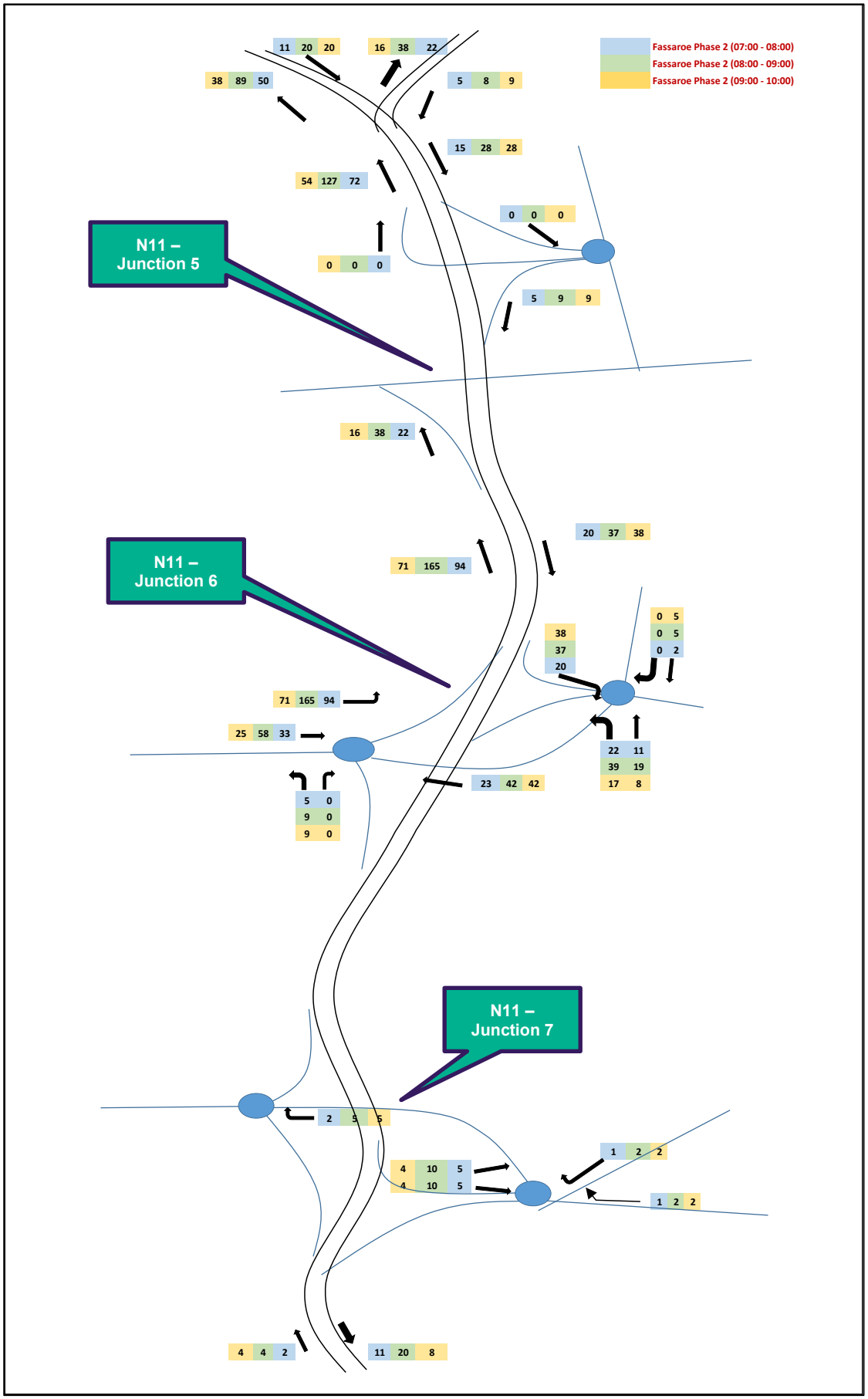
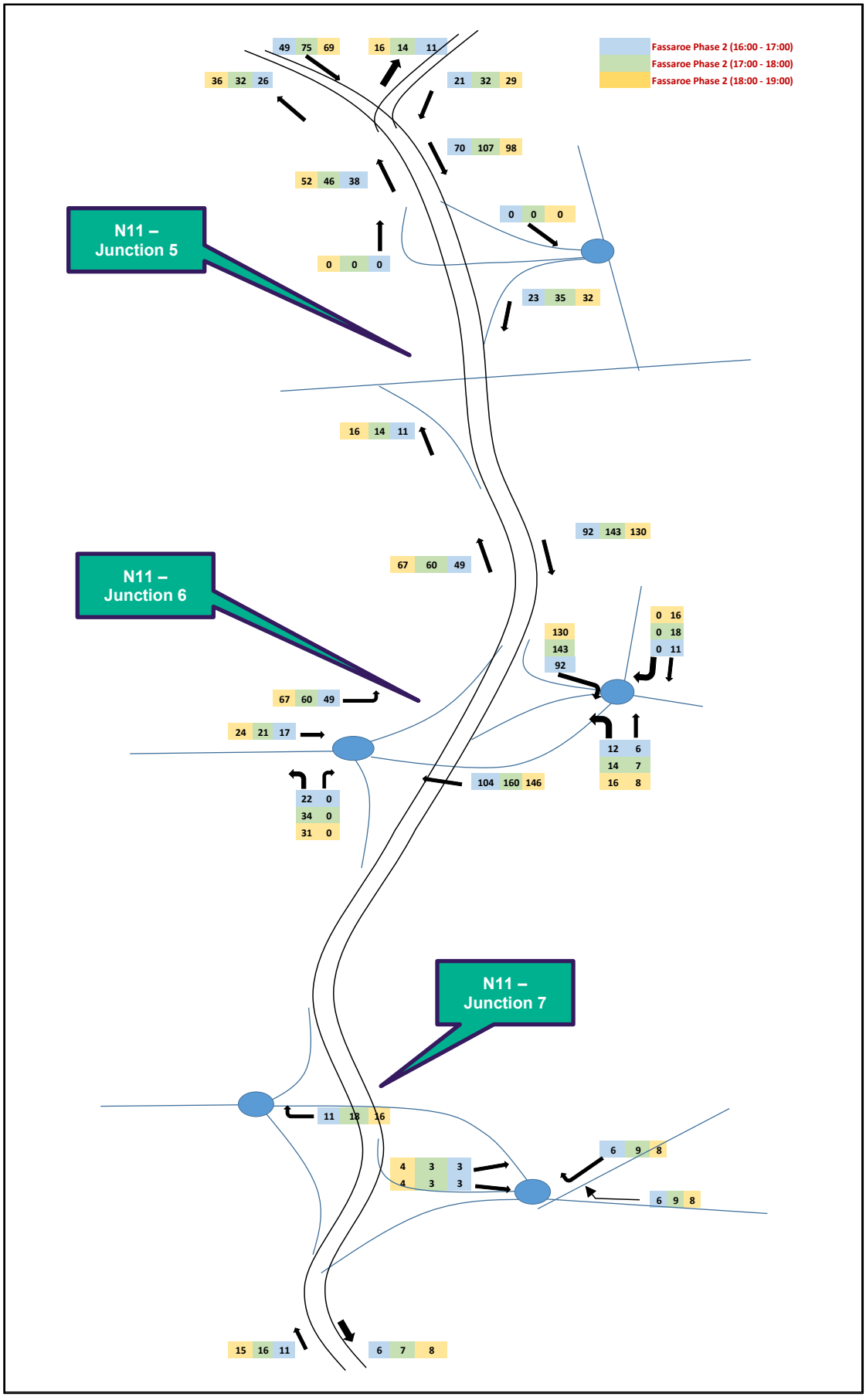


Figure 12-23 - Trip Distribution PM Peak - Fassaroe Development (1200 units)



12.4.3.1.5. Trip Generation and Distribution – Other BETS Development

The scenarios to be modelled, as outlined in the **Table 12-5**, include construction of other developments outlined in the BETS document in addition to the development at Fassaroe. The assumed trip generation and distributions into the modelled network for these developments are detailed in the Traffic Modelling Report (Ref – 5186693DG0058 rev 1.docx) provided at **Appendix 12A** and summarised in the **Figure 12-24** and **Figure 12-27**.

Figure 12-24 - Other BETS Development – Base +4 AM Peak Scenarios

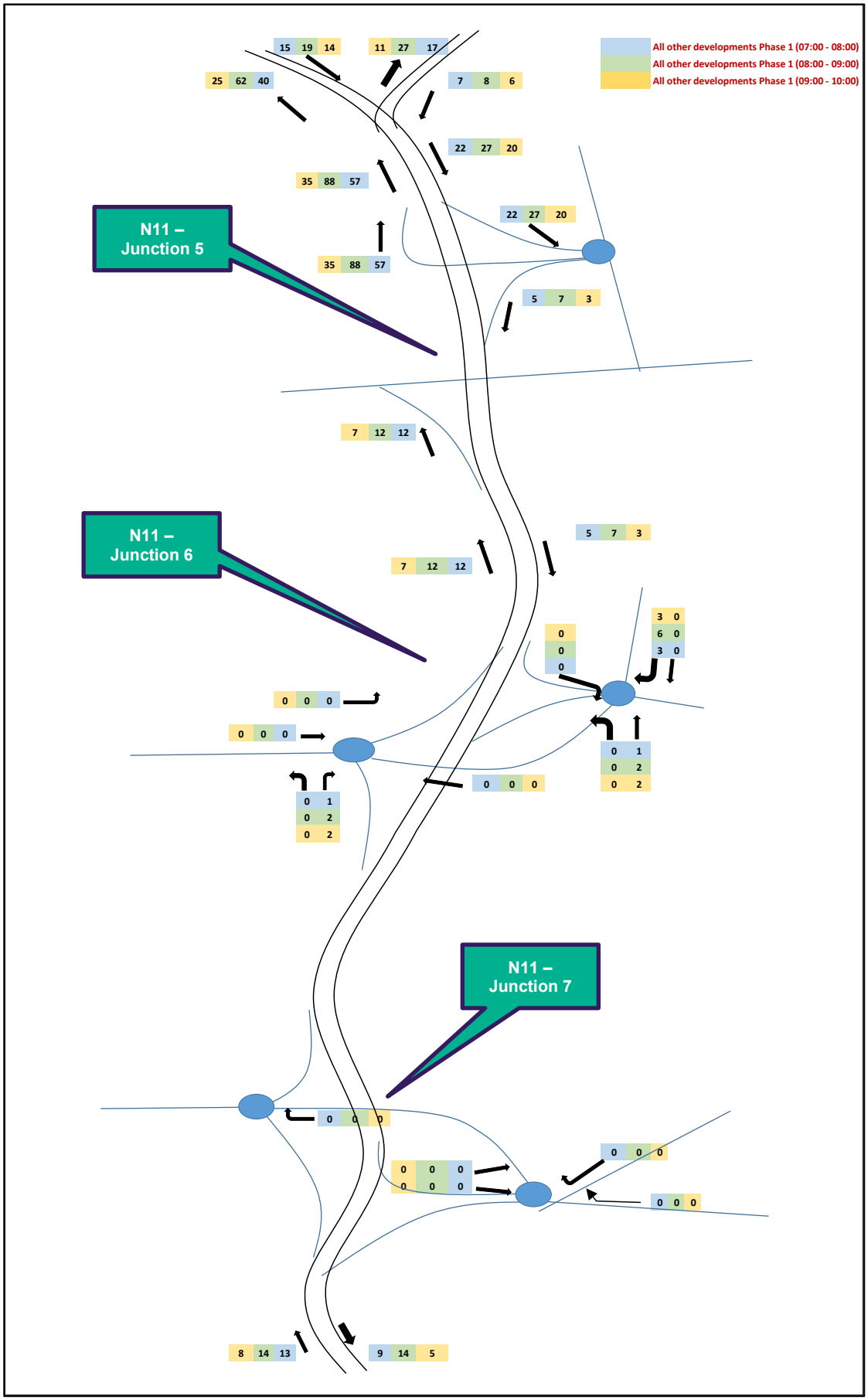


Figure 12-25 - Other BETS Development – Base +4 PM Peak Scenarios

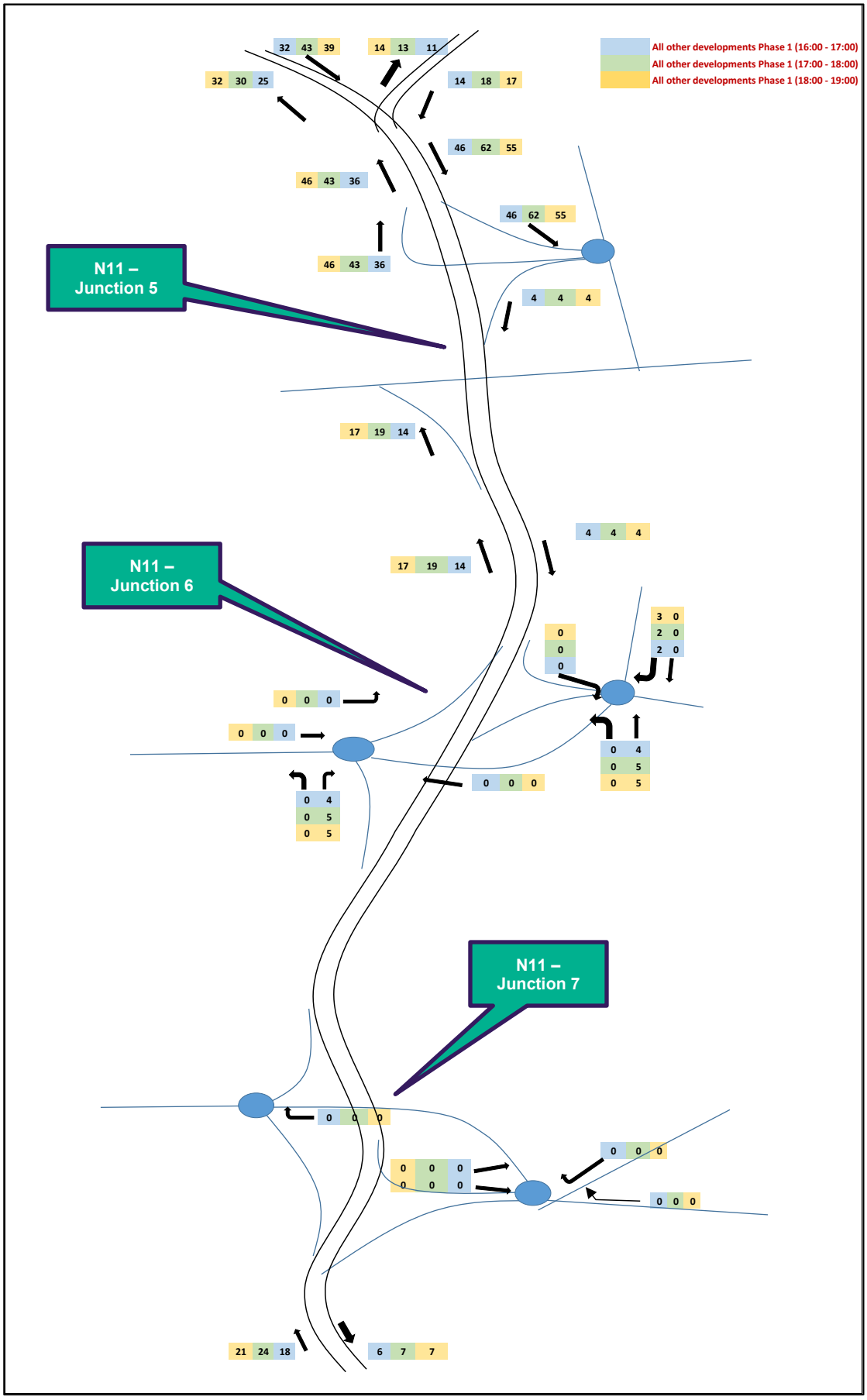


Figure 12-26 - Other BETS Development – Base +9 AM Peak Scenarios

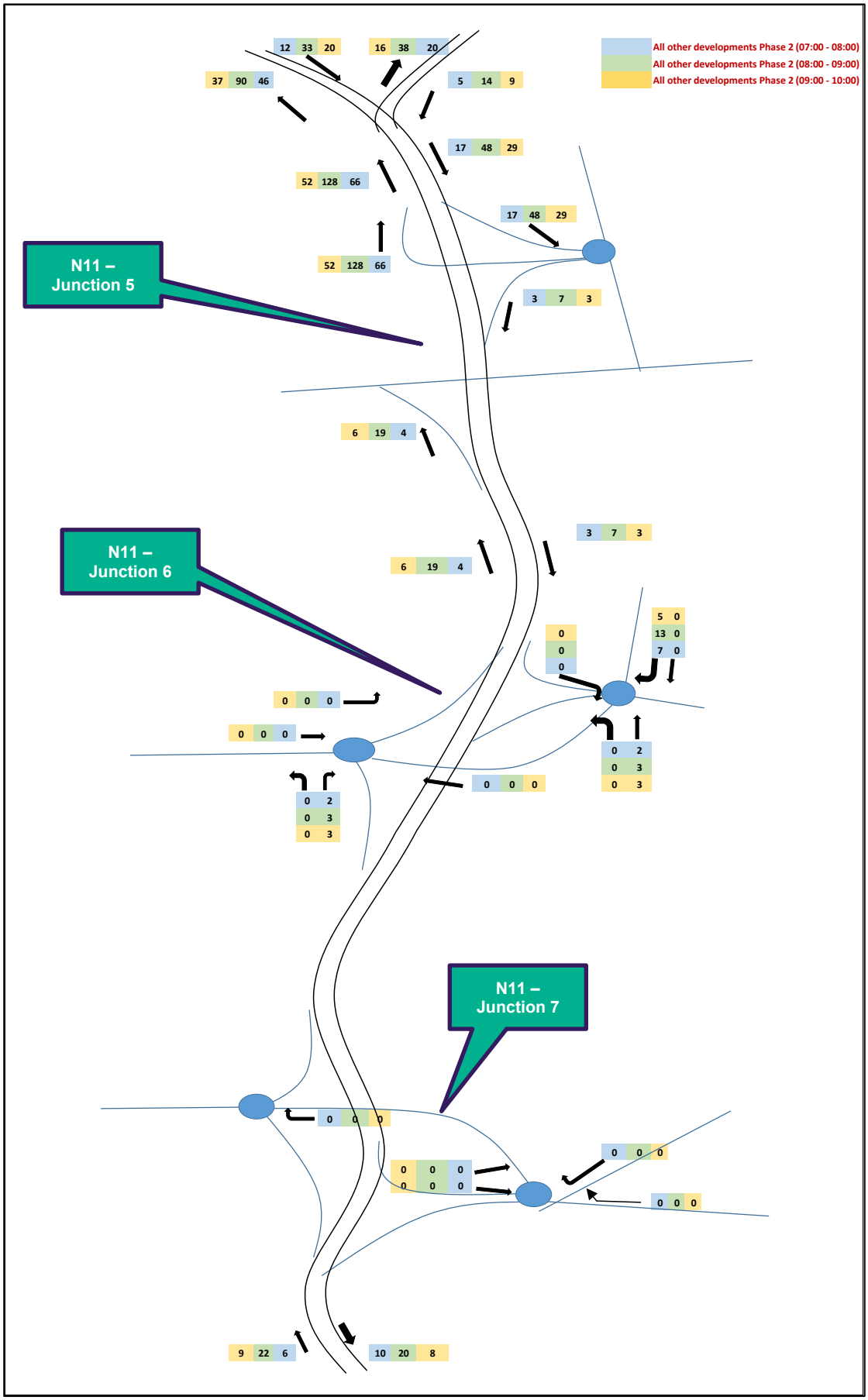
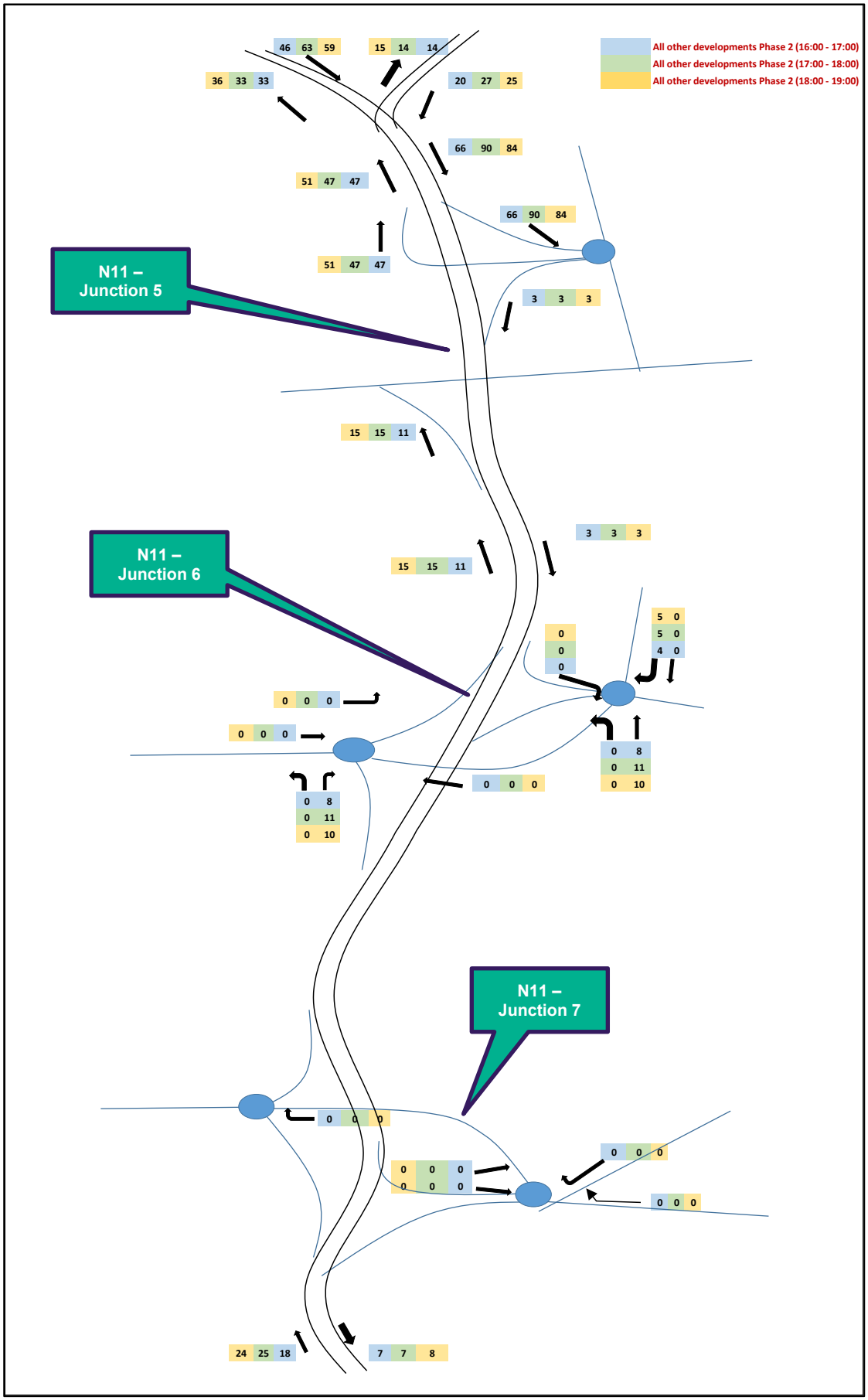


Figure 12-27 - Other BETS Development – Base +9 PM Peak Scenarios



12.4.3.2. Baseline Traffic Growth

For determination of the background traffic growth, traffic data recorded by the three TMU counters located along M11/N11 were taken into the consideration:

- TMU M50 040.0 N – Located between M50 Junction16 Cherrywood and Junction 17 M50/M11, Shankill;
- TMU M11 010.0 N – Located between M50/M11 and Bray North Junction 5 N11; and
- TMU M11 015.0 S – Located between Junction 5 Bray North N11 and Junction 6 Bray Central (Fassaroe) N11.

The data considered for the analysis was taken for the average working day across the whole year from 2014 to 2018 for the peak hours (AM Peak: 07:00 to 10:00 and PM Peak: 16:00 to 19:00). The data for the year 2019 was not considered for the analysis since the traffic volumes for the whole of July were not yet available at the time of the analysis.

Traffic growth along different counters has been summarised in **Appendix 12A**. Analysis of traffic growth shows that during the AM peak hours the maximum growth in the northbound traffic was 0.91 percent while southbound traffic grew by a maximum by 1.13 percent. For the PM peak, over the same time period, northbound traffic decreased along all the three counters while the maximum increase in the southbound traffic was 0.78 percent.

Based on the TMU analysis, and in accordance with the TII guidelines, background traffic has been forecasted to grow in accordance with TII's "Low Sensitivity Growth Rates" for the Dublin Metropolitan Region included in the Project Appraisal Guidelines, published in May 2019. The growth rates used for the analysis are highlighted in **Figure 12-28** and equate to around 1.5 percent growth per year. These growth rates were applied in the model to vehicles travelling along motorways (M50/M11), national roads (N11) and also to vehicles traveling from Bray to N11-Junction 5 and 7. Using these growth rates, the base traffic will increase by 6 percent and 14 percent over the plus four and plus nine years respectively.

This represents a highly conservative approach to the traffic analysis and reflects a "worst-case" scenario in which private car traffic is at its highest. This is due to the following factors:

- An increase in traffic, particularly from the Bray direction, would be dependent on development in these already mostly build-up areas. At this time, growth in these areas is expected to be low and therefore background traffic is unlikely to grow by this amount in these areas. Furthermore, much of the planned growth is already captured in the BETS development which is accounted for separately in the models.
- An examination of average traffic volumes at various TMU counters along the M50/N11 nearby the study area suggests that traffic is tending to grow in the inter-peak hours while traffic in the peak hours is relatively static or declining. This is likely due to changes in travel patterns to avoid congestion which are unlikely to reverse.

In this context, it is reasonable to conclude that the application of the "Low Sensitivity Growth Rates" to all traffic in the modelled cordon represents a conservative assessment of likely traffic volumes and therefore is a potential overestimation of future year traffic impacts.

Figure 12-28 - Link-Based Growth Rates

Table 6.1: Link-Based Growth Rates: Metropolitan Area Annual Growth Rates

Metropolitan Area	Low Sensitivity Growth Rates						Central Growth Rates						High Sensitivity Growth Rates					
	2016-2030		2030-2040		2040-2050		2016-2030		2030-2040		2040-2050		2016-2030		2030-2040		2040-2050	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
Dublin	1.0146	1.0280	1.0034	1.0116	1.0028	1.0144	1.0162	1.0295	1.0051	1.0136	1.0044	1.0162	1.0191	1.0328	1.0087	1.0172	1.0093	1.0256
Cork	1.0153	1.0279	1.0072	1.0128	1.0065	1.0164	1.0169	1.0294	1.0090	1.0149	1.0083	1.0182	1.0202	1.0328	1.0125	1.0185	1.0166	1.0276
Galway	1.0154	1.0201	1.0077	1.0164	1.0079	1.0203	1.0169	1.0217	1.0097	1.0182	1.0095	1.0220	1.0203	1.0250	1.0131	1.0217	1.0178	1.0313
Limerick	1.0158	1.0313	1.0052	1.0113	1.0050	1.0158	1.0174	1.0329	1.0070	1.0134	1.0069	1.0177	1.0218	1.0364	1.0106	1.0171	1.0146	1.0273
Waterford	1.0123	1.0301	1.0031	1.0131	1.0029	1.0175	1.0140	1.0317	1.0052	1.0153	1.0050	1.0194	1.0173	1.0352	1.0091	1.0194	1.0122	1.0300

12.4.3.3. Model Calibration and Validation

As detailed in the N11 Junction 6 Microsimulation Modelling Report (Atkins ref 5186693DG0058) (see **Appendix 12A**) the model has been calibrated and validated in accordance with TII standards. As discussed earlier, the outcome of the report has been agreed with TII, NTA and WCC. Further detail of the validation and calibration of the model can be read in the report itself in **Appendix 12A**.

12.4.3.4. Future Year Traffic Assessment

12.4.3.4.1. Infrastructure Upgrade

In all the future year scenarios the proposed improvements of the N11 between Junctions 7 and 8 were coded into the model. This was considered prudent as these improvements were in construction at the time of modelling and were assumed to be completed prior to the proposed development being implemented. In summary, this includes an additional third auxiliary lane for traffic between the junctions and a removal of the lower speed limit on the mainline of the N11. No other changes to the network were coded along the mainline for any scenario. This ensured a valid like-for-like comparison of the impact of the proposed development traffic volumes and Junction 6 management measures.

12.4.3.4.2. Initial Assessment Scenarios

The model was initially run for the scenarios shown in **Table 12-34** in order to determine the feasible interim Traffic Management Measures required at N11-Junction 6. It should be noted that the Fassaroe Phase 1 development (which included 350 units) was identified as Fassaroe Phase 1a in the modelling exercise.

Table 12-34 - Modelling Scenarios for Initial Assessment

Scenario Number	Name	Development	Traffic Management Measures at N11-Junction 6
2	Do Minimum +4	None	Roundabout priority
3	Fassaroe Phase1a and roundabout priority at Junction 6	Fassaroe Phase 1a	Roundabout priority
4	Fassaroe Phase 1a and traffic signals at Junction 6	Fassaroe Phase 1a	Traffic signal controlled roundabouts
5	Fassaroe Phase1a and improved merges and diverges at Junction 6	Fassaroe Phase 1a	Improvements of merges and diverges at Junction 6

For scenarios 3 to 5, only the development traffic of Phase 1a of Fassaroe was modelled with the following Traffic Measurement Measures at N11-Junction 6:

- **Scenario 3:** The current roundabout traffic management controls were maintained at both junctions
- **Scenario 4:** Traffic signals were coded at both roundabouts at N11 Junction 6 in the model. For the AM peak these were run as fixed time signals with a cycle time of 120 seconds. However, in the PM peak, due the volume of traffic and sensitivity of the southbound mainline, the signals were coded to operate as vehicle actuated allowing for more efficient operation.
- **Scenario 5:** Upgrading of the merges and diverges in accordance with the Geometric Design Parameters of Merging Lanes and Diverging Lanes contained in the TII document: DN-GEO-0030 (Geometric Designs of Junctions) published in June 2017.

In order to compare the impact of all three traffic management options, the journey times along the mainline routes for Scenarios 2 to 5 were compared.

For both peak periods, the model was initially run for a 30-minute warm-up period, then the full three hour peak period and finally a 30-minute cool down period. However, increases in flow indicated that the congestion period during the evening peak would extend beyond 7:00 p.m. and therefore the models for the PM peak scenarios were run for an additional hour in the +4 year scenarios and an additional two hours in the +9 year scenarios.

All the scenarios were run five times with varying random seeds to capture the effects of day-to-day variations in traffic giving a more accurate result.

12.4.3.4.3. Detailed Assessment Scenarios

The model was run for the additional scenarios as shown in **Table 12-35**. It should be noted that in the modelling exercise the Fassaroe Phase 1 development was identified as Fassaroe Phase 1a and Fassaroe Phase 2 was identified as Fassaroe Phase 1b.

Table 12-35 - Modelling Scenarios for Further Assessment

Scenario Number	Name	Development	TMMs at N11-Junction 6
Base + 4 Design Year Scenarios			
6	All Development sites and roundabout priority at Junction 6	Fassaroe Phase1a and first phases of Woodbrook, Shanganagh Castle and Bray Golf Club	Roundabout priority
7	All Development sites and traffic signals at Junction 6	Fassaroe Phase1a and first phases of Woodbrook, Shanganagh Castle Bray Golf Club	Traffic signal controlled roundabouts
Base + 9 Design Year Scenarios			
8	Do minimum +9	None	Roundabout priority
9	All Development sites and roundabout priority at Junction 6	Fassaroe Phase 1a and full build out of Woodbrook, Shanganagh Castle, Bray Golf Club	Roundabout priority
10	All Development sites and traffic signals at Junction 6	Fassaroe Phase 1a full build out of Woodbrook, Shanganagh Castle, Bray Golf Club	Traffic signal controlled roundabouts
11	Sensitivity Analysis: All Development sites and roundabout priority at Junction 6	Fassaroe Phase 1a & 1b, and full build out of Woodbrook, Shanganagh Castle, Bray Golf Club	Roundabout priority
12	Sensitivity Analysis: All Development sites and traffic signals at Junction 6	Fassaroe Phase 1a & 1b, and full build out of Woodbrook, Shanganagh Castle, Bray Golf Club	Traffic signal controlled roundabouts
13	Sensitivity Analysis: All Development sites and roundabout priority and ramp metering at Junction 6	Fassaroe Phase 1a & 1b, and full build out of Woodbrook, Shanganagh Castle, Bray Golf Club	Roundabout priority with ramp metering on N11 merges

12.4.3.4.4. Ramp Metering

Ramp metering is a traffic regulatory method used to control the vehicle flow along the merges at interchanges. Ramp metering may be based on fixed-timing or utilise detector loops. The latter was modelled in Scenario 13 along the merges of the N11-Junction 6.

Three detector loops were incorporated on the north and southbound merges as follows:

- The first detector loop was modelled at the signal head located adjacent the end of the merge lane. This loop turns the signal head green when it detects the vehicles at the signal head and is referred to as the approach detector;
- The second detector head was modelled just after the signal head. Once the vehicle passes this detector loop the signal head turns red. This loop is referred to as the departure loop. The signal remains red until all of the following three conditions have been satisfied simultaneously:
  - A vehicle is detected by the approach detector;
  - There is no vehicle detected on the departure loop; and
  - The signal head has been red for at least three seconds.

- The third detector loop was located upstream of the signal head which detects whether queues along the merge are backing up to the roundabout. Once the queue backs up to this loop the signal head turns green for a minimum 10 seconds, allowing the queue to dissipate.

12.4.4. Operational Phase – Traffic Impact Analysis

The analysis set out below is a summary of the N11 Microsimulation Traffic Modelling Report and the impacts identified for the Phase 1 proposed development on the national and local road network. The Traffic Modelling Report concluded that the retention of the existing road layout at Junction 6, Fassaroe Interchange is the optimal design solution to manage traffic on both the national and local road network.

This approach was agreed to by WCC, TII and NTA and formed the Traffic Management Framework Agreement Measures contained in **Appendix 3A**.

Further detailed summary of the analysis of the impacts on the road network and junctions are set out in the N11 Junction 6 Traffic Management Microsimulation Modelling Results Report (5186693DG0058 rev 1.docx) which is included as **Appendix 12A**.

12.4.4.1. Impact on National Road Network

The results for the impact on the N11/M11 are detailed in the N11 Junction 6 Traffic Management Microsimulation Modelling Results Report (5186693DG0058 rev 1.docx) (**Appendix 12A**) and the impacts are summarised below.

The percentage impact on the N11/ M11 mainline between Junction 5 and Junction 6 for the AM and PM periods is shown in **Table 12-36**.

Table 12-36 - Impact of Development on Mainline - All scenarios

Design Year	Volume	Volume Increase	Percentage Increase	Comments
AM Peak (Northbound)				
Base year	10,990	N/A	N/A	
+4 design year	11,646	656	5.97%	Base year + background growth + BETS development
+4 design year with Phase 1 Fassaroe development (650 units)	11,902	256	2.20%	Base year + background growth + BETS development + Phase 1 Fassaroe development
+9 design year	12,521	1,531	13.93%	Base year + background growth + BETS development
+9 design year with Phase 1 Fassaroe development (650 units)	12,776	255	2.04%	Base year + background growth + BETS development + Phase 1 Fassaroe development
+9 design year with full Fassaroe development build out (1,200 units)	12,916	395	3.15%	Base year, plus background growth, plus full Fassaroe development (1,200 units)
PM Peak (Southbound)				
Base year	9,883	N/A	N/A	
+4 design year	10,473	590	5.97%	Base year + background growth + BETS development
+4 design year with Phase 1 Fassaroe development (650 units)	10,736	263	2.51%	Base year + background growth + BETS development + Phase 1 Fassaroe development
+9 design year	11,260	1,377	13.93%	Base year + background growth + BETS development
+9 design year with Phase 1 Fassaroe development (650 units)	11,519	259	2.30%	Base year + background growth + BETS development + Phase 1 Fassaroe development

Design Year	Volume	Volume Increase	Percentage Increase	Comments
+9 design year with full Fassaroe development build out (1,200 units)	11,674	41	3.68%	Base year, plus background growth, plus full Fassaroe development (1,200 units)

Table 12-36 shows that in the design years due to assumed background growth in traffic. For example, in the +9 design year scenarios background growth in traffic accounts for approximately 13.9 percent growth in current traffic volumes on the N11 mainline whilst development traffic would account for approximately a 2.3 percent increase. This shows that more than three quarters of the increase in traffic volumes would be due to background growth and the remainder due to development related traffic.

It should be noted that growth in traffic demand will result in congestion lasting for a longer duration than is currently experienced during the PM peak period. To capture this extended congestion period, the traffic modelling analysis period for the PM peak was extended in the Base +4 and Base +9 design year scenarios. For the PM peak, the analysis period extended from 16:00-19:00, 16:00-20:00 and 16:00-21:00 for the Base, Base +4 and Base +9 design year scenarios respectively. A similar elongation of congestion was not observed during the AM peak for any of the design year scenarios; therefore, the AM peak analysis was carried out for 07:00-10:00 time period for all scenarios.

Table 12-37 and **Table 12-38** show the travel times through the N11/M11 mainline for each of the scenarios evaluated. For the PM peak, the southbound direction experiences the highest level of congestion. Therefore, for the PM peak, the journey times along the N11 southbound mainline, from M50-Junction 17, Shankill to N11-Junction 8, Kilmacanogue were considered.

For the AM Peak, only the northbound direction is critical due to congested in this direction. Therefore, for the AM Peak, the journey times along the N11 northbound mainline, from N11-Junction 8, Kilmacanogue to M50-Junction 17, Shankill were considered. Additionally, the travel times between the R117 to M50-Junction 17 were assessed as this gives the travel times along the N11 north of Junction 7 where the majority of congestion is experienced in the AM Peak. This latter measure gives a clearer indication of the impact of the traffic management measures at Junction 6 on the passing N11 traffic.

Table 12-37 – AM Peak, Northbound Travel Times (seconds)

Scenario	Scenario Name	07:00 – 08:00		08:00 – 09:00		09:00 – 10:00		Average	
		N11 J8 - M50 J17 NB	R117 - M50 J17 NB	N11 J8 - M50 J17 NB	R117 - M50 J17 NB	N11 J8 - M50 J17 NB	R117 - M50 J17 NB	N11 J8 - M50 J17 NB	R117 - M50 J17 NB
Base Year +4 Scenarios									
2	Do Minimum	642	271.8	619.2	264	561	239.4	607.2	258.6
3	Do minimum with Phase 1 Fassaroe development (650 units)	681	285.6	646.2	277.8	561.6	240.6	629.4	268.2
4	Do minimum with Phase 1 Fassaroe development (650 units) and traffic signals at Junction 6	651	276	644.4	276.6	564	239.4	619.8	264
6	Do minimum with full Fassaroe build out (1,200 units)	660.6	280.2	627	273	564.6	239.4	617.4	264
7	Do minimum with full Fassaroe build out (1,200 units) traffic signals at Junction 6	651.6	281.4	638.4	270	555	239.4	615	263.4
Base Year +9 Scenarios									
8	Do Minimum	777	303.6	777.6	262.2	667.2	237	740.4	267.6
9	Do minimum with Phase 1 Fassaroe development (650 units)	784.2	312.6	808.8	256.2	649.8	238.8	747.6	269.4
10	Do minimum with Phase 1 Fassaroe development (650 units) and traffic signals at Junction 6	699	282	760.8	246.6	646.8	234.6	702	254.4
11	Do minimum with full Fassaroe build out (1,200 units)	818.4	316.8	817.2	255	657.6	236.4	764.4	269.4
12	Do minimum with full Fassaroe build out (1,200 units) traffic signals at Junction 6	724.8	292.8	788.4	253.8	666	233.4	726.6	259.8
13	Do minimum with All Development (Fassaroe – 1200 Units) and Ramp metering at N11-Junction 6	814.2	316.2	789	255	665.4	238.8	756	270

Table 12-37 shows that Scenario 3, Phase 1 Fassaroe development (650 units) with priority roundabouts at Junction 6 (i.e., agreed Traffic Management Framework Agreement Measures) results in a marginal increase in the average journey time of circa 23 seconds through the N11 northbound mainline between N11-Junction 8 and M50-Junction 17 as compared to the Do Minimum scenario. In the +9 year scenarios, the Do Minimum scenario (Scenario 8) journey times along the network increase versus the +4 year scenario (Scenario 2) by 133.2 seconds as a result of an increase in background traffic. In Scenario 9—the +9 scenario with Phase 1

Fassaroe development (650 units)—the increase in travel times is approximately 8 seconds versus the +9 Do Minimum scenario (Scenario 8). With future development at Fassaroe up to a total of 1,200 units (Scenario 11) the increase in travel time versus the Do Minimum scenario (Scenario 8) is 24 seconds. These results show that the AM impact of the development at Fassaroe on the N11/M11 is marginal.

Table 12-38 - PM Peak, Southbound (M50-Junction 17 to N11-Junction 8) Travel Times (seconds)

Scenario	Scenario Name	16:00 – 17:00	17:00 – 18:00	18:00 – 19:00	19:00-20:00	20:00 – 21:00	Average
Base +4 Design Year Scenarios							
2	Do Minimum	819	1,156.8	874.8	479.4	N/A	832.8
3	Do minimum with Phase 1 Fassaroe development (650 units)	814.8	1,151.4	889.2	507.6	N/A	840.6
4	Do minimum with Phase 1 Fassaroe development (650 units) and traffic signals at Junction 6	813.6	1,121.4	875.4	499.8	N/A	827.4
6	Do minimum Phase 1 Fassaroe development (650 units) and BETS development	821.4	1,129.2	891.6	519.6	N/A	840.6
7	Do minimum with Phase 1 Fassaroe development (650 units), BETS development and traffic signals at Junction 6	819	1,129.8	891	510	N/A	837.6
Base + 9 Design Year Scenarios							
8	Do Minimum	992.4	1,325.4	1,030.2	769.2	474	918
9	Do minimum with Phase 1 Fassaroe development (650 units) and BETS development	991.8	1,317	1,044	802.2	481.8	927.6
10	Do minimum with Phase 1 Fassaroe development (650 units), BETS development and traffic signals at Junction 6	976.2	1,267.8	1,047	841.8	478.8	922.2
11	Do minimum with full Fassaroe build out (1,200 units) and BETS development	988.2	1,290	1,029	814.8	481.2	920.4
12	Do minimum with full Fassaroe build out (1,200 units), BETS development and traffic signals at Junction 6	975.6	1,249.8	1,044	811.2	486	913.2
13	Do minimum with full Fassaroe build out (1,200 units), BETS development and ramp metering at N11-Junction 6	982.2	1,266.6	1,032	831	492	920.4

Table 12-38 shows that Scenario 3, Phase 1 Fassaroe development (650 units) with priority roundabouts at Junction 6 (i.e., agreed Traffic Management Framework Agreement Measures) results in a marginal increase in the average journey time of eight seconds, compared to Scenario 2, Do Minimum. In the +9 scenario there is increase in journey time through the N11 southbound mainline as compared to the +4 scenario of circa 85 seconds due to an increase in background traffic. In the +9 scenario with the Phase 1 Fassaroe development (650 units, Scenario 9) the N11 experiences a very marginal increase of circa 9 seconds as compared to the +9 Do Minimum scenario (Scenario 8). With future development at Fassaroe up to a total of 1,200 units

(Scenario 12) the increase in travel time in the +9 scenario versus the Do Minimum scenario (Scenario 8) is two seconds. The results show that the PM peak period impact of the development at Fassaroe on the N11/M11 network is marginal.

12.4.4.1.1. Summary of Impacts of Proposed Development on N11/M11 Mainline

The analysis outlined above shows that the impact of a Phase 1 development at Fassaroe of 650 units result in only marginal increases in average journey times on the N11/M11 mainline in the AM peak (northbound) and PM peak (southbound) versus the Do Minimum scenarios. In the +9 scenario the average journey times on the network only increase marginally in both the Phase 1 development of 650 units and future phases of development of up to 1,200 units versus the Do Minimum scenario. The analysis indicates that the impact is therefore considered to be negligible. Further details and analysis are set out in the full microsimulation report in **Appendix 12A**.

12.4.4.2. Impact on Junction 6 of the N11

The results of the impacts on Junction 6, Fassaroe interchange are summarised below. Full details of this analysis are provided in the traffic modelling report 5186693DG0058 rev 1.docx) (**Appendix 12A**).

12.4.4.2.1. PM Peak

For the Base year PM peak period, congestion occurs in the 4:00 p.m. to 7:00 p.m. period. In the +4 design year this period is indicated to extend beyond 7pm whilst in the +9 year period this congestion period has the potential to extend past 8pm. Therefore, in the +4 design year scenarios, the model was run for a total of 5 hours (3:30pm – 8:30pm) and for the scenarios of +9 design year, the model was run for 6 hours (3:30pm – 9:30pm).

Junction impact analysis for N11-Junction 6 roundabouts have been summarised below.

12.4.4.2.2. Junction Impact Analysis – Base +4 Design Year Scenarios – Eastern Roundabout

The results for the average delay and queue for all the arms of both N11-Junction 6 roundabouts are detailed in the traffic modelling report (5186693DG0058 rev 1.docx) and the impacts are summarised below.

Base+4 Design Year Scenarios

Eastern Roundabout

In Scenarios 2, 3 and 6 with roundabout priority at the Junction 6 eastern roundabout, there are minimal queues and delays at all arms. Queueing is transitory with negligible average queues, maximum queues in the order of 11 to 15 pcus and average delay of generally less than three seconds. This indicates that there is more than sufficient capacity to cater for development in the +4 year scenario. The development traffic has only a minor impact on the roundabout in these scenarios.

In scenarios 4 and 7 which include traffic signals at the roundabout, average queues are generally less than 10 pcus at most arms with a maximum average queue of 11 pcus in Scenario 4 and 11.5 pcus in Scenario 7. As is typical of signal-controlled junctions, maximum queues and average delays are higher than for priority roundabout control with a maximum queue of around 30 pcus seen for both scenarios and average delays of around 45 seconds on the approach from the N11 bridge. The Upper Dargle Road is subjected to a maximum queue of around 32 pcus and delays of 75 seconds. The maximum queue of around 16 pcus on the southbound off-slip suggests that queues may backup to the N11 mainline and thus impact the movement of vehicles along the southbound mainline. Also, the longer queues and delays on the Upper Dargle Road and N11 bridge will affect the operation of bus services to and from Fassaroe.

In summary, the signals at the eastern roundabout have **a very significant impact** on the current priority operation of the roundabout.

Western Roundabout

In Scenarios 2, 3 and 6, there are minimal queues and delays at all arms of the western roundabout. Queueing is transitory with negligible average queues, maximum queues of less than 10 pcus and average delays of generally less than five seconds indicating that there is more than sufficient capacity to cater for development in the +4 year scenario. The development traffic has only a minimal impact on the roundabout in these scenarios as is evident by the small increases in queue lengths and delays for the with and without development scenarios.

In scenarios 4 and 7 which include traffic signals at the roundabout, average queues are generally less than three pcus at most arms with a maximum average queue of 3.28 pcus in Scenario 4 and 3.18 in Scenario 7. As is typical of signal-controlled junctions, maximum queues and average delays are higher than for priority roundabout control with a maximum queue of around 20 pcus seen for both scenarios. Average delays in both scenarios are around 30 seconds across all arms and any such delays would be cumulative to delays at the eastern roundabout, further impacting bus journey times.

The signals at the western roundabout will have **a moderate effect** on the operation of the roundabout as compared to the current priority roundabout configuration.

Base +9 Year Scenarios

Eastern Roundabout

For roundabout priority control, in Scenarios 9 and 11, results are similar to +4 design year scenarios with minimal queues and delays on all arms of the eastern roundabout. Average queues are negligible with maximum queues of around 12 to 20 pcus and average delays of less than seven seconds. This indicates that the junction operates well within capacity for these scenarios.

In Scenarios 10 and 12 which include traffic signals at the roundabout, queueing and delays are increased when compared to Scenarios 9 and 11 (priority roundabout). Similar to +4 year scenarios, the maximum queue on the N11 southbound off-slip was observed to be approximately 16 pcus, which suggests that occasionally queues may backup on the mainline N11 and impede southbound flow. Average queues on the N11 overbridge are expected to be 10 to 15 pcus with maximum queues and delays being significant—around 28 pcus and 50 seconds respectively. Queues and delay on Upper Dargle Road are notably increased with average queues of around 14 to 18 pcus, maximum queues of almost 50 pcus and delays of greater than 2.5 minutes in the 5:00 p.m. to 6:00 p.m. period. The maximum queues on the overbridge would extend back to the western roundabout and in overall terms the delays would significantly impact bus journeys through the roundabout.

In summary, the signals at the roundabout have **a profound** impact on the operation of the roundabout.

For scenario 13, with ramp metering on the southbound merge at N11-Junction 6, the junction is also operating with negligible average queues and delays. This suggest that the ramp meter has **imperceptible impact** on the operation of the roundabout.

Western Roundabout

Operating as roundabout priority control in Scenarios 9 and 11, the western roundabout has minimal queues and delays on all arms. Average queues are negligible with maximum queues of around 8.5 pcus and maximum average delays of six seconds. This indicates that the junction operates well within capacity for these scenarios.

In scenarios 10 and 12, which include traffic signals at the roundabout, the average queues were observed to be around seven pcus with maximum queues of 31 pcus being observed. Delays are around 70 seconds. Queueing and delays are significantly higher than for the +4 year scenarios with additional delays being caused by queueing from the eastern roundabout backing up across the motorway overbridge.

Therefore, unlike +4 year scenarios, the signals at the western roundabout in +9 year scenarios have **a very significant impact** on the operation of the roundabout.

For Scenario 13, with ramp metering in place, queues and delays were observed to be similar to the roundabout priority control scenarios. This suggest that the ramp meter has **imperceptible impact** on the operation of the roundabout.

12.4.4.2.3. Summary – Junction Impact Analysis During the PM Peak

In all scenarios, roundabout priority control operates with marginal queuing and delays. This is further reflected in Scenario 13 (the ramp metering option) wherein both junctions would continue to operate with roundabout priority control.

The traffic signal controls cause significant queues and delays on the arms of eastern roundabout and notable queuing and delay on the western roundabout. The queuing on the N11 overbridge in +9 scenarios also affects the functionality of the western roundabout. These will affect the operation of all traffic, in particular bus services to/from Fassaroe. The latter are key transport interventions to facilitate the development of the Fassaroe lands. Moreover, the queuing on the southbound off-slip arm at the eastern roundabout may affect the movement along the N11 southbound mainline.

Therefore, the signals at the roundabouts have **a very significant to profound impact** on the operation of the roundabout whereas the ramp meters have **imperceptible impact** on the operation of the roundabout.

12.4.4.3. AM Peak

For the morning peak all the scenarios in the +4 and +9 design year were run with the 30-minute cooldown period. Junction impact analysis for N11-Junction 6 roundabouts have been summarised below.

12.4.4.3.1. Junction Impact Analysis

The results for the average delay and queue for all the arms of both N11-Junction 6 roundabouts are detailed in the traffic modelling report (5186693DG0058 rev 1.docx) (**Appendix 12A**) and the impacts are summarised below.

Base +4 Year Scenarios

Eastern Roundabout

In Scenarios 2, 3 and 6 where no signals are in place at the N11 Junction 6 eastern roundabout, there are minimal queues and delays at all arms. Queueing is transitory with negligible average queues, maximum queues in the order of seven to eight pcus and average delays of less than 1.5 seconds. This indicates that there is more than sufficient capacity to cater for development in the +4 year scenario. The development traffic has little impact on the roundabout in these scenarios as can be seen by the similar results for queue lengths and delays for the with and without development scenarios.

In Scenarios 4 and 7, which include traffic signals at the roundabout, average queues are generally of order of two to six pcus for most of the arms with a maximum average queue of 6.62 pcus in Scenario 4, and 7.66 pcus for Scenario 7. As is typical of signal-controlled junctions, maximum queues and average delays are higher than for priority roundabout control with a maximum queue of around 26 to 27 pcus seen for the two scenarios and average delays of around 50 seconds to 80 seconds on the critical arms. Despite these delays, the relatively low average queue lengths and reasonable maximum queue lengths indicates that the junction performs adequately with the signals in place. Therefore, the traffic signals have **moderate impact** on the operation of the roundabout.

Western Roundabout

In Scenarios 2, 3 and 6, similar to the eastern roundabout, there are minimal queues and delays at all arms. Queueing is transitory with negligible average queues, maximum queues of less than 9 pcus and average delays of generally less than 5.5s indicating that there is more than sufficient capacity to cater for development in the +4 year scenario. The development traffic has only a minimal impact on the roundabout in these scenarios as can be seen by the small increases in queue lengths and delays when comparing the with and without development scenarios.

In Scenarios 4 and 8 with the signals in place, average queues are generally less than 5 pcus at most arms with a maximum average queue of 4.44 pcus in Scenario 4, and 6.2 pcu for Scenario 7. Maximum queues and average delays are higher than for the priority roundabout control with a maximum queue of around 24.4 pcus seen for Scenario 4 and 32.8 pcus for Scenario 7. The delays for Scenarios 4 and 6 were observed to be around 40 seconds and 60 seconds respectively. Despite these delays, the relatively low average queue lengths and reasonable maximum queue lengths indicates that the junction performs adequately with the signals in place. Therefore, the traffic signals have **moderate impact** on the operation of the roundabout.

Base +9 Year Scenarios

Eastern Roundabout

Similar to +4 year, in scenarios with no signals or ramp-metering in place at Junction 6, minimal queues and delays were observed on all arms. Maximum queues were observed to be less than 10 pcus with average delays were observed to be less than 5 seconds suggests that the junction operates well within capacity for these scenarios.

In Scenario 9 and 11, similar to PM peak long queues and delays were observed on Upper Dargle Road and the motorway overbridge with average queues observed to be around 17 pcus and delays of more than 2 minutes. Maximum queues of 30 and 40 pcus were observed on the overbridge and Upper Dargle Road arms. This suggests that the junction is operating **close to capacity**. These delays would notably impact bus journey times through the junction.

For scenario 13, with ramp metering on the Junction 6 merges, the delays and queues were found to similar to scenarios roundabout priority. The maximum queue was observed to be around 7.85 pcus with average delays observed to be around 7.7 seconds. This suggests that the junction is operating within the capacity.

These suggests that the traffic signals have **significant** impact on the operation of the roundabout, whereas the ramp metres have **imperceptible impact** on the operation of the roundabout.

Western Roundabout

Similar to the eastern roundabout, minimal queues and delays are seen on all arms when roundabout priority is maintained. Maximum queues of around 5 pcus and average delays of less than 4 seconds suggest that the junction operates well within capacity for these scenarios.

In Scenario 9 and 11, with the signals in place, the average and maximum queues were observed to be around 5 pcus and 32 pcus respectively. The maximum delays were observed to be just over a minute for both the scenarios. The results suggest that the junction operates within capacity for this scenario.

For scenario 13, with ramp metering in place on the Junction 6 merges, the delays and queues are similar to the scenarios with roundabout priority.

Summary of AM Peak Junction Results

The junction results suggest that in both design years, the junction will be operating well within capacity for all scenarios where traffic signals are not in place at the roundabouts. As expected, the signals at the roundabouts increase the delays and queues at the junction. For Base+4 design years, the junctions are working just within capacity and while for Base+9 design year scenarios the junctions are operating close to the capacity and would cause delays for bus services travelling through them.

Therefore, the signals at the roundabouts have **moderate to significant impact** on the operation of the roundabout whereas, the ramp meters have **imperceptible impact** on the operation of the roundabout.

12.4.4.4. Summary of N11-Junction 6 Traffic Management Measures

Based on the results of the future year scenarios, the recommendations set out within are included in and inform the recommendations below. The measures form the basis of the Traffic Management Measures Framework Agreement agreed with key stakeholders TII, NTA and WCC contained in **Appendix 3A**.

12.4.4.5. CCTV Camera and Traffic Counters

A CCTV camera will be provided at the interchange which will be connected to the Dublin Traffic Management and Incident Centre. The preferred location for this will be agreed prior to installation. Detection loops will be provided on both on-ramps in conjunction with traffic signals as part of the installation and operation of ramp metering. These loops will also be used as traffic counters to monitor traffic movements entering the N11 at Junction 6.

12.4.4.6. Queue Detection and Traffic Monitoring Units

TMUs will be installed on the N11 mainline on the approach to the junction in both directions. The location of these will be agreed with TII, noting the presence of an existing TMU 500m north of the southbound off-ramp at Junction 6.

The recommended option for traffic management at N11 Junction 6 is to maintain the existing priority operation of the two roundabouts. The results of the modelling for all scenarios including priority operation indicate that there are minimal queues and delays on all arms of the roundabouts at Junction 6 and therefore the installation of queue detection on the N11 off-ramps is not required.

12.4.4.7. Appropriate Traffic Signals at N11 Junction 6

The results of the modelling for all scenarios ultimately conclude that traffic signals are not recommended at Junction 6. Whilst signals have a small benefit to travel times on the N11, the installation of signals would have a significant negative impact on traffic travelling through the two Junction 6 junctions, including ultimately significant queues and delays on multiple arms with potential to impact on the N11 mainline. These queues and delays would also have a corresponding **very significant impact** on the public transport bus routes travelling across the N11 through Junction 6.

In all modelled scenarios, the results indicate that there is more than sufficient capacity at the existing roundabout to cater for predicted traffic volumes with minimal queues and delays. These minimal queues and delays also determine that no further measures are required to prioritise bus movements through the two junctions across the N11. It is therefore recommended to retain the two priority-controlled roundabouts in their current layout.

In order to provide the ability to control traffic accessing the N11 when necessary, ramp metering signals will be introduced on the northbound and southbound on-ramps at Junction 6 with associated traffic detection and control equipment to allow demand management to be employed if necessary. These measures, in coordination with the CCTV cameras and traffic monitoring and equipment will allow for appropriate control of traffic at N11 Junction 6 when required.

12.4.4.8. Assessment of Potential for Additional Storage on Diverge Lanes

In all modelled scenarios with the retention of the current roundabout priority control there is minimal queueing and delays on all arms of the Junction 6 roundabouts, including the N11 diverge lanes. Therefore, no additional storage on these lanes is not required.

12.4.4.9. Appropriate Safety Standards

No changes to existing road geometry or junction controls are proposed. Ramp metering signals, CCTV cameras and traffic monitoring equipment will be installed. There will, therefore, not be any significant changes to the operation or safety of the junction when compared to the existing scenario. The proposed traffic management measures will be further subject to a Road Safety Audit process.

The above N11 Junction 6 Traffic Management Measures have been agreed with key stakeholders including TII, NTA and WCC as the preferred strategy at the Fassaroe interchange. The Traffic Management Measures Framework Agreement (TMMFA) confirming the agreed measures, as per the above text, and is attached in **Appendix 2B**.

12.4.4.10. Impact on Local Road Network

It is anticipated that the majority of trips to and from the development will move through the eastern junctions of the site and via the N11 corridor. However, it is anticipated that some limited traffic will travel on the road network to the west of the CPG lands. Below is an assessment of the impact of this traffic on the local road network consisting of Berryfield Lane and Ballyman Road.

The Bray Municipal District Local Area Plan requires a connection through the site to the Ballyman Road. It is anticipated that all traffic going or coming from the west will utilise this link road and therefore will not travel along the existing Berryfield Lane. The main impact to the west is therefore anticipated to be on Ballyman Road.

Table 12-39 shows the expected traffic to utilise Ballyman Road from the development for:

- Base years;
- Opening year with and without development;
- Opening year +5 with and without development; and
- Opening year +15 with and without development.

This is in line with TII Transport Assessment Guidelines.

For the opening year it has been assumed that:

- A full build out of phase 1 (i.e.; 650 units) will be in place;
- For opening year +5 900units, all phase 1 and 50% future phase 2; and
- For opening year +15 1200units, all phase 1 and all future phase 2.

Table 12-39 - Ballyman Road Traffic Impact

	Base	Opening Year	Opening Year +5	Opening Year +15
Without Development	**1459**	**1674**	**1788**	**1860**
With Development	**N/A**	**1708**	**1839**	**1929**
Difference in Traffic Volumes	**N/A**	**34**	**51**	**69**
Traffic Impact %	**N/A**	**2%**	**3%**	**4%**

As shown in **Table 12-39,** the potential traffic impact from the development is below the thresholds set out in TII Transport Assessment Guidelines Table 2.1 *Traffic Management Guidelines Thresholds for Transport Assessments* that states that assessment is required if:

1. Traffic to and from the development exceeds 10% of the traffic flow on the adjoining road;
2. Traffic to and from the development exceeds 5% of the traffic flow on the adjoining road where congestion exists of the location is sensitive.

Ballyman Road is not considered to be a congested or sensitive road receptor. Regardless the impact shown in **Table 12-39** is below the 5% threshold. The impact from the development is therefore considered to be imperceptible / not significant on the road network to the west.

12.4.5. Operational Phase – Public Transport Impact

The analysis set out below outlines the impact on public transport, bus services, from the proposed development. development summary of the Microsimulation report and the impacts identified for the Phase 1 proposed development on the National Road Network. Further detailed analysis of the impacts and strategy to provide regular bus services to and from the development are detail in the Public Transport Access Strategy (PTAS) submitted in support of this planning application. This Strategy is grounded in the provision of enhanced public transport (bus) services to and from Fassaroe to Bray and Luas services at Brides Glen / Cherrywood from the opening year of the development that meet anticipated demand for work, education and leisure based trips to and from Fassaroe.

The optimal solution would be that from the first phase of development all scheduled bus services will operate PSO contract(s) under the management of the National Transport Authority.

The commitment remains from the Applicant to provide a private bus service option, if necessary, as an interim solution to ensure certainty that Phase 1 residents will be facilitated with these bus services in the short term in the unlikely potential scenario that the public bus services to Fassaroe are delayed in commencing.

In relation to the School Bus Services this interim facility would be provide by and operated by the developer, similar in nature to the School Transport Scheme operated by Bus Éireann on behalf of the Department of Education.

12.4.5.1. Provision of Bus Services in Line with Demand

In line with the requirements of BETS and to reflect the increase in demand for bus services from Fassaroe as the lands are built out it is proposed that the frequency of the identified bus services above would increase with demand.

- Public Transport Service – via an increase in the frequency of No.185A and Luas XP service;
- School Transport Service – via a dedicated primary school bus service from Fassaroe to Bray schools.

Further details of the proposed bus measures are outlined in the following sections.

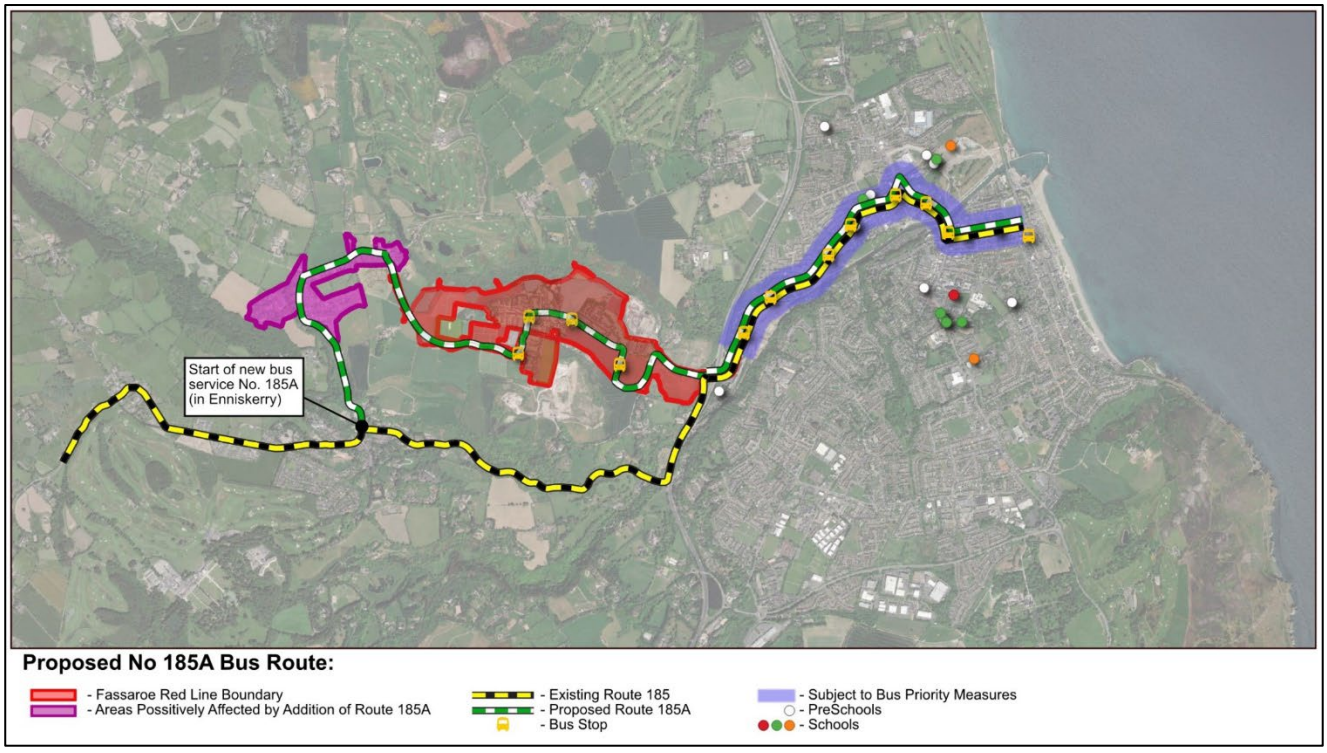
12.4.5.2. Increase in Frequency of Rerouted Public Transport Service

To meet the additional identified demand towards Bray town centre, Bray DART station and bus interchange, the developer proposes that both the new No.185A and Luas XP bus services would run at an increased frequency as the population increases in Fassaroe. The increase in frequency of this both these bus services service will increase over time to reflect the increasing demand as outlined below.

As a public transport service this would provide enhanced connectivity not just for future residents of Fassaroe but also for any existing and future residents along the proposed No.185A and Luas XP bus corridor as identified in **Figure 12-29** and **Figure 12-30**. This has the potential to improve bus patronage along the route, increase bus mode share and reduce single occupancy car use in line with sustainable transport policies.

The proposal is that the new bus service No.185A would run at a higher frequency in line with demand. Initially the frequency of services would increase in peak periods with a greater frequency of service provided along the route as demand justifies it.

Figure 12-29 - Potential Route f Bus Services No.150A



Similarly, the strategy proposes that new bus services (Luas XP) towards the Luas as Brides Glen / Cherrywood would run during the AM and PM peak periods. Over time as demand increases the frequency of services during the AM & PM peak periods and at other times throughout the day can be increased as population and demand at Fassaroe increases. This increased level of service would meet increasing demand for work based commuting trips as well as other leisure trips from the development along the Luas Green Line corridor to Dublin City Centre.

Figure 12-30 - Potential Route of Luas XP

12.4.5.3. School Bus Services

To meet the identified school demand outlined above, the developer is proposing to provide a dedicated school bus service(s) from Fassaroe towards Bray where there are several primary and secondary schools which can serve demand from the development. It is proposed that this school bus service would be for primary school students only as secondary school students will be able to avail of regular services provided via the new bus services No.185A from the site into Bray.

This scheme would be run by the applicant but would be similar in nature to the School Transport Scheme operated by Bus Éireann on behalf of the Department of Education.

This service would operate on a limited AM and PM basis to coincide with school opening and closing times to meet the anticipated demand of school based trips. The number of services in the AM and PM period will increase over time to reflect the increasing demand.

This school bus service would largely operate along the No.185A and No.185 route towards Bray and onwards along a pre-designated route that would be defined according to pupil school destinations and would need to be agreed with all relevant stakeholders prior to commencement of this service.

12.4.5.4. Timetabling of Service

Outlined in **Table 12-40** is a provisional timetabled bus service below based on the bus services outlined in the sections above.

Wicklow County Council has confirmed that they will be submitting the revised Public Transport Access Strategy to the NTA, and the development of this strategy will be subject to future engagement between WCC, NTA, Atkins and other relevant stakeholders as required and appropriate.

The final timetabling of services would be subject to further discussion with the NTA, WCC and other Stakeholders.

Table 12-40 - Outline Fassaroe Bus Service Provision - Timetable

Fassaroe Bus Services Timetable		Weekday Frequency per hour																	
Route No.	To and from	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Year 1																			
185A	Enniskerry - Fassaroe - Bray	1	1	2	1	1	1	1	1	1	1	1	1	2	1	1	1		
Luas XP	Fassaroe – Luas Brides Glen / Cherrywood	1	1	1	1							1	1	1					
School Bus	Fassaroe - Bray Schools			1						1									
Year 2																			
185A	Enniskerry - Fassaroe - Bray	1	1	2	1	1	1	1	1	1	1	1	1	2	1	1	1		
Luas XP	Fassaroe – Luas Brides Glen / Cherrywood	1	1	1	1							1	1	1					
School Bus	Fassaroe - Bray Schools			1						1									
Year 3																			
185A	Enniskerry - Fassaroe - Bray	1	2	3	1	1	1	1	1	1	1	1	2	3	2	1	1		
Luas XP	Fassaroe – Luas Brides Glen / Cherrywood	1	1	2	1							1	2	2					
School Bus	Fassaroe - Bray Schools			2						2									
Year 4																			
185A	Enniskerry - Fassaroe - Bray	1	2	3	1	1	1	1	1	1	1	1	2	3	2	1	1		
Luas XP	Fassaroe – Luas Brides Glen / Cherrywood	1	1	2	1	1	1	1	1	1	1	1	2	2	1	1	1		
School Bus	Fassaroe - Bray Schools			2						2									

Fassaroe Bus Services Timetable		Weekday Frequency per hour																	
Route No.	To and from	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	Year 5																		
185	Enniskerry - Fassaroe - Bray	1	3	4	1	1	1	1	1	1	2	2	3	4	2	1	1	1	
Luas XP	Fassaroe – Luas Brides Glen / Cherrywood	1	2	2	1	1	1	1	1	1	1	2	2	2	1	1	1	1	
School Bus	Fassaroe - Bray Schools			3						3									
Year 6																			
185	Enniskerry - Fassaroe - Bray	2	3	4	2	1	1	1	1	1	2	2	3	4	2	1	1	1	
Luas XP	Fassaroe – Luas Brides Glen / Cherrywood	1	2	2	1	1	1	1	1	1	1	2	2	2	1	1	1	1	
School Bus	Fassaroe - Bray Schools			3						3									
Year 7																			
185	Enniskerry - Fassaroe - Bray	2	3	5	2	2	2	2	2	2	2	3	4	5	3	1	1	1	
Luas XP	Fassaroe – Luas Brides Glen / Cherrywood	1	2	2	1	1	1	1	1	1	1	2	2	2	2	1	1	1	
School Bus	Fassaroe - Bray Schools			3						3									
Year 8																			
185	Enniskerry - Fassaroe - Bray	2	3	5	2	2	2	2	2	2	2	3	4	5	3	2	1	1	
Luas XP	Fassaroe – Luas Brides Glen / Cherrywood	1	2	3	2	2	2	2	2	2	2	2	3	3					
School Bus	Fassaroe - Bray Schools			2						2									

12.4.5.5. Identification of Need

In order to identify public transport services, it was necessary to understand population projections and likely distribution of trip ends from the site, most notably for work and educational reasons as these typically represent the majority of trips and tend to occur during peak periods. A number of steps were undertaken in the PTAS outlined below:

1. Phasing and Population projects were identified based on 2016 Census data to understand the future population dynamics and age profiles to understand the number of pre-school, school and working age to understand demand for bus services;
2. Mode share targets were set that work and educational bus usage based on the demand linked to provision of regular bus services. This mode share is shown in **Table 12-41.**

Table 12-41 - Public Transport Mode Share for Fassaroe

Mode	Work	Education – Primary	Education Secondary & College
Active Travel	7%	1%	7%
Public Transport	42%	59%	53%
Car	51%	40%	40%

3. Wicklow County Council Socio Economic Profile (2015) was used to understand work commuting patterns and destinations with trips allocated via public transport corridors reflective of key destinations served via Bray / Bray Dart and or N11/ Luas. The travel patterns along these corridors are show in **Table 12-42**.

Table 12-42 - Fassaroe Work Destinations - Public Transport

Fassaroe Employment split	
Towards Bray / Bray DART	63%
Towards Luas / N11	37%

4. The 2016 Census data provide a departure profile for public transport trips in the Bray settlement to understand when work trips would depart from the site and hence when services would be required.
5. For Educational trips it was assumed that 95% of bus journeys would occur between 08:00-0900 reflective of school opening times.
6. The number of buses required is based on a standard bus capacity of 74No.seat and assumes that an additional service is required when capacity on a bus is 80% or greater.

Based on the above steps a profile of work and school bus trips was developed with an outline timetable shown in **Table 12-40**.

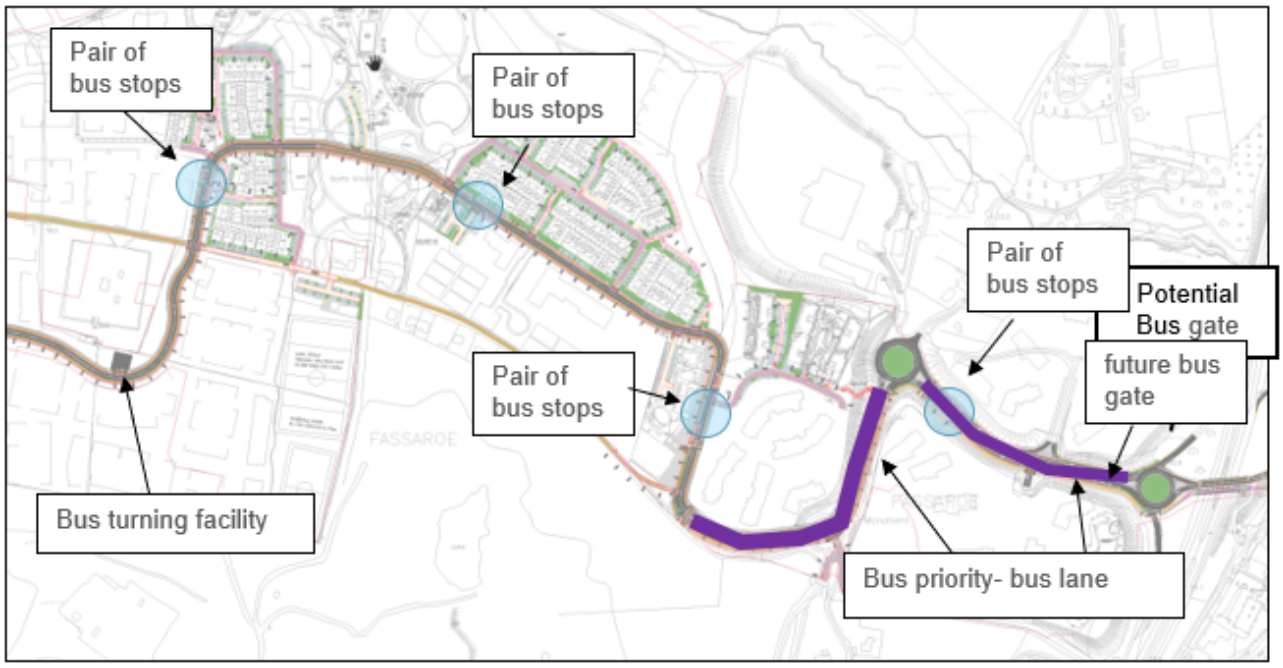
12.4.5.6. Bus Priority Measures

services operate with minimal delay to ensure journey time reliability and viability of services through patronage. Bus priority measures include:

- A bus lane in each direction from the Greenstar roundabout to Junction 6 at the N11;
- An outbound bus lane from the Neighbourhood centre to the Greenstar roundabout;
- Bus priority measures at the Greenstar roundabout junction; and
- Bus gate provision at junction 6 of the N11 6 to provide priority access for public transport services.

The measures outlined above can be seen in **Figure 12-31**.

Figure 12-31 - Bus priority Measures within the development



12.4.5.7. Impact on Bus Services

The frequency and timetabling of bus services to and from Fassaroe will provide both future residents of the development as well as other users along the proposed bus routes with a regular high capacity bus services. As set out above the proposed bus serves provides connections to and from the development to wide range of catchments within the Bray and Greater Dublin areas. Travelling to and from the site by means of public transport will therefore be a realistic option for all future users.

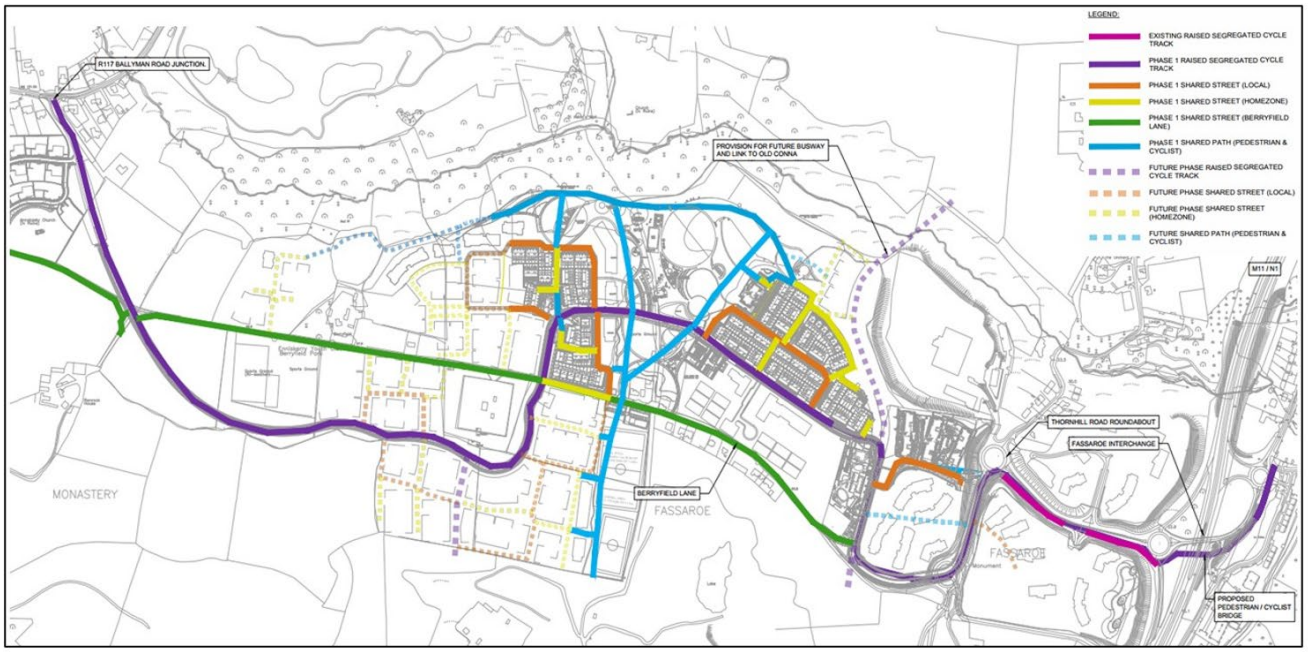
It is recognised in transport policy that provision of and demand for public transport services is linked to creating more compact neighbourhoods and encouraging higher building densities and mixed land use to make public transport service viable. The development of this mixed use development at this scale and density will encourage the further usage of public transport for employees, residents and visitors to the site.

The proposal will, therefore, have a positive permanent and beneficial impact on public transport bus services.

12.4.6. Operation Phase - Pedestrian and Cycle Impact

As detailed in **Chapter 2 Sections 2.5.4 -2.5.5** the proposed development will provide a comprehensive interconnected network of pedestrian and cyclist facilities as shown in **Figure 3-32**.

Figure 12-32 - Pedestrian and Cycle Facilities within the Masterplan



The mixed use nature of the site and proximity of a range of services interconnected by a network of streets encourages the use of active travel. The urban realm within the development has been designed as an attractive landscaped environment that is overlook with good lighting that facilitates movement through the development.

The masterplan layout has been designed in accordance with DMURS and NCM to encourage active travel by being permeable and provide a range of cyclist facilities for all ages and abilities including fully segregated cycle tracks.

In addition to the internal network external connections from the site to Bray via a new pedestrian can cycle bridge over the N11 to La Valle provides a high quality capacity link for all future residents and visitors to access the site via active travel means. This link from La Valle will connect up to other plans by WCC for improvements in Bray including Upper Dargle Road Improvement scheme and Dargle River Greenway that will facilitate the delivery of the Greater Dublin Area Cycle Network facilities as identified in the Bray and Enniskerry Area, namely route W2a, as shown in **Figure 12-33**.

Figure 12-33 - GDA Cycle Network in Bray Fassaroe Area

The development incorporates a mix of cycling parking facilities to encourage and promote that use. Long stay secure sheltered and accessible cycle parking will be provided within the development site for residents. Short stay cycle parking will be provided at various locations within and around the development to facilitate visitor cycle parking.

Based on the above factors the proposed development will deliver significant permanent benefits impacts to pedestrian and cyclist.

12.5. Mitigation Measures

12.5.1. Construction Stage Mitigation

The following mitigation measure shall apply during the construction stage:

All construction activities will be managed and directed by a Construction Traffic Management Plan (CTMP). The details of the CTMP will be agreed with the roads department of the Local Authority in advance of construction activities commencing on-site. The CTMP will as a minimum detail such as:

- Location of site and materials compound;
- Location of areas for construction site offices and staff facilities;
- Details of site hoarding and security;
- Construction traffic will be limited to certain routes and times of the day, with the aim of keeping disruption to pedestrians, cyclist, general traffic and public transport to a minimum;
- During peak network hours (0800 – 0900 and 1700-1800) construction traffic movements will be discouraged;
- The daily construction programme will be planned to minimise the number of disruptions to the local highway network by staggering HGV movements to avoid site queueing;
- Measures to prevent spillage of spoil or materials on the public highway including the use of on-site wheel washing facilities and street cleaning measures;
- Any traffic management plans that may be required for a road closure or pedestrian footpath closure, including appropriate signage advance public notice procedures;
- Details of appropriate monitoring and mitigation measures to minimise noise, dust and vibration impacts on any identified sensitive receptors;
- Details of how the contractor will be encouraged to promote sustainable travel to and from the site by its employees.

12.5.2. Operational Stage Mitigation

No additional operational mitigation is required for the proposed development.

12.6. Residual Impacts

12.6.1. Construction Stage

During demolition and construction phase the proposed project will result in a temporary increase in traffic volumes along the construction route. However, as set out in **Section 12.4.1.2,** these increases will be negligible and temporary in nature.

As no significant adverse effects have been identified in the assessment of the demolition and construction phase of the development, no additional mitigation is necessary over and above the Construction Traffic Management Plan (CTMP) which forms part of the mitigation measures outlined in this chapter.

12.6.2. Operational Stage

Once operational the proposed development will result in changes to traffic flows on several road links within the study area. However, as set out in **Section 12.4.4** of this chapter these increases are in the range of moderate to slight and not significant.

The impact of the proposed development on pedestrians, cyclists and public transport users (buses and Luas) is predicted to be significant and beneficial.

The residual impacts in terms of traffic are considered further in Chapters 8 Air Quality and Chapter 9Noise and Vibration which are the direct environmental impacts because of increased traffic.

12.7. Difficulties Encountered in Compiling Information

None.

12.8. Cumulative Impacts

The traffic modelling presented in **Section 12.4.4** includes the traffic impacts of the 13 other development scenarios as shown in **Table 12-5 – Model Scenarios.** The modelling outputs shows that the development of Fassaroe Phase1 with the 13 scenarios, including additional phases at Fassaroe for up to 1200 units, does not result in any adverse impacts on the local or strategic road network or that those impacts that are experienced can be mitigated against such as the N11 Traffic Management Measures at junction 6. As outlined in **Section 12.3.3,** there is a range of future transport infrastructure planned for the greater Bray area which when operational will significantly improve sustainable travel choice which taken in conjunction with the proposed infrastructure and public transport measures delivered during Phase 1 at Fassaroe is likely to result in a reduction in vehicle mode share from the development resulting in positive impacts at junction 6 interchange.

12.9. Monitoring

The following measures can be monitored to help smooth operation of the proposed development:

- Potential implementation of Bus Gate and Ramp Metering at N11 junction 6, western gyratory; and
- Bus service operations and roll out of services (in conjunction with the NTA).

12.10. Reinstatement

Not applicable.

13 INTERACTIONS OF IMPACTS

13.1 Introduction

This chapter identifies the interrelationships of impacts which were identified throughout the EIAR. An impact and mitigation measure from one environmental topic may indirectly cause a secondary impact on another topic. While indirect impacts have been assessed within the relevant chapters of this EIAR, the overall purpose of this chapter is to highlight the main areas of interrelated impacts.

The *Draft Advice notes for preparing Environmental Impact Statements* (EPA, 2015) state that "*all environmental factors are inter-related to some extent. This heading draws attention to significant interaction and interdependencies in the existing environment*". This clearly advises of the importance of checking and cross referencing environmental effects and impacts against all environmental topics. To support this, the *Draft Revised Guidelines on the Information to be contained in Environmental Impact Statements* (EPA, 2017) advise that "*It is general practice to include a matrix to show where interactions between effects on different factors have been addressed*". In this regard, a matrix has therefore been provided in **Table 13.1** of this chapter.

Table 13.1 identifies the interactions and cumulative impacts which could result as identified in the EIAR if no mitigation measures are put in place for any impacts identified. They are described briefly below and dealt with in detail in the relevant chapters.

13.2 Interactions between Traffic and Transportation and Noise and Vibration

Traffic generated by the development in both operational and construction phases will interact with Noise and Vibration impacts as traffic generates noise.

13.3 Interactions between Traffic and Transportation and Air Quality and Climate

Traffic generated by the development in both operational and construction phases will interact with Noise and Vibration impacts as traffic can generate air emissions.

13.4 Population and Human Health, Traffic and Transportation, Noise and Vibration, Air Quality and Climate and Soils, Geology and Hydrogeology

There is potential for considerable interaction between these factors during the construction phase of the development in particular. Construction will generate traffic which can have implications for existing local residents in a number of ways; delays on local road network, increased air emissions and increased noise.

The construction activities themselves can result in noise and generate dust etc which can indirectly impact on human beings – on-site workers and existing nearby residents.

The construction stage of landfill remediation proposals can have interacting impacts on soils and geology, air quality and human health.

The operational phase impacts on noise and air quality interact with impacts on human health also.

These various interacting impacts are identified and discussed in more detail in the relevant chapters.

Table 13-1: Interaction of Impacts

	Population and Human Health	Traffic & Transportation (Material Assets)	Noise and Vibration	Air Quality and Climate	Soils, Geology and Hydrogeology	Water Services, Hydrology, and Flood Risk	Biodiversity	Landscape and Visual Impact	Cultural Heritage
Population and Human Health		X	X	X	X			X	
Traffic & Transportation (Material Assets)			X	X					
Noise and Vibration									
Air Quality and Climate									
Soils, Geology and Hydrogeology						X	X		
Water Services, Hydrology, and Flood Risk							X		
Biodiversity									
Landscape and Visual Impact									
Cultural Heritage									

13.5 Interactions between Population and Human Health and Landscape and Visual Impacts

As the 'receptors' for Landscape and Visual Impacts are human beings, impacts on landscape and visual impact will in turn impact also on population.

13.6 Interactions between Water Services, Hydrology and Flood Risk and Soils Geology and Hydrogeology

There can be considerable interactions between hydrology and soils, geology and hydrogeology. Potential soil contamination could negatively impact surface water quality. Surface water run-off may also have the limited potential to enter soil and groundwater. These interactions are discussed within each of these chapters.

There will be no potential cumulative impacts on the bedrock as excavations are relatively shallow with no large-scale dewatering required.

13.7 Interactions between Soils, Geology and Hydrogeology and Biodiversity

Potential impacts on the underlying hydrogeology at this site could also impact on biodiversity conditions present within the Ballyman Glen in particular. The implications of impacts on hydrogeology are considered as appropriate in the Biodiversity chapter and also in the NIS which is referenced in the Biodiversity chapter.

13.8 Interactions between Water Services, Hydrology and Flood Risk and Biodiversity

Impacts on surface water and overland flow can also have implications for biodiversity, where sediment laden surface water can enter receiving waters. These are considered in the Biodiversity chapter.

14 REFERENCES

This chapter lists documents, websites and various other information sources references in the preceding chapters of this EIAR.

14.1 Chapter 1 (Need and Scope of EIAR) References

Department of Housing, Planning and Local Government (2017), Circular Letter PL 8/2017 – 'Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive) - Advice on electronic notification requirements'.

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Environmental Protection Agency (EPA) (2017) 'Draft Guidelines on Information to be contained in Environmental Impact Assessment Reports';

National Roads Authority (NRA) (2008) 'Environmental Impact Assessment of National Road Schemes - A Practical Guide';

European Communities (environmental Impact Assessment) Regulations / European Union (Environmental Impact Assessment) Regulations from 1989 to 2019;

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Glasson, J., Therivel, R, and Chadwick, C. (2001) Introduction to Environmental Impact Assessment. Routledge;

Planning and Development Act 2000 as amended;

Planning and Development Regulations 2001-2022.

14.2 Chapter 2 (Description of Development) References

AGS 2012, Interim Guidance ' Site Investigation Asbestos Risk Assessment for the Protection of Site Investigation and Geotechnical Laboratory Personnel';

Building Regulations (Amendment) Regulations 2006

BS 8485:2019 – Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (BSI, 2019)

CIRIA 2014, C733 A Guide to Understanding and Managing Risks;

Code of Practice for Wastewater Infrastructure, Connection and Developer Services, Design & Construction Requirements for Self-Lay Developments, December 2020 (Revision 2) IW-CDS-5030-03.

Code of Practice for Water Infrastructure, Connection and Developer Services, Design & Construction Requirements for Self-Lay Developments, July 2020 (Revision 2) IW-CDS-5020-03.

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Safety Health and Welfare at Work Act 2005 as amended;

Safety Health and Welfare at Work (Construction) Regulations 2013 to 2020

Safety Health and Welfare at Work (Exposure to Asbestos) Regulations 2006 and 2010.

Waste Management (Certification of Historic Unlicenced Waste Disposal and Recovery Activity) Regulations 2008

Wastewater Infrastructure Standard Details, Connection and Developer Services, Construction Requirements for Self-Lay Developments, July 2020 (Revision 04) IW-CDS-5030-01.

Water Infrastructure Standard Details, Connection and Developer Services, Construction Requirements for Self-Lay Developments, July 2020 (Revision 04) IW-CDS-5020-01;

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