UNSHINAGH WIND FARM

Volume 2 - Main Report

power for good

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Introduction & Proposed Development

1 Introduction & Proposed Site

Background

1.1 This Environmental Statement (ES) has been prepared by RES Limited (RES) to accompany a planning application that has been made to the Department for Infrastructure (DFI) for permission to construct, operate and decommission a wind farm known as Unshinagh Wind Farm, hereinafter referred to as 'the Development'. The purpose of the ES is to inform DFI in the assessment of the likely significant environmental effects resulting from the Development and to establish the need for mitigation measures to reduce such effects.

1.2 The application site is located in the townlands of Drumourne, Unshinagh Mountain, Unshinagh South, Ticloy, Slane, Cregcattan (part of Galdanagh) and Aughareamlag, approximately 4km South West of the village of Carnlough Village, Co. Antrim as shown in **Figure 1.1: Site Location** and **Figure 1.2: Planning Application Boundary.**

1.3 This chapter is supported by:

- Technical Appendix 1.1: Letter of Intention to Submit an Environmental Statement;
- Technical Appendix 1.2: Department for Infrastructure (DFI) response to Intention to Submit an Environmental Statement.
- Technical Appendix 1.3: UL9540A standard

The Applicant

1.4 The application for planning permission is made by RES ('the Applicant').

1.5 RES is the world's largest independent renewable energy company. At the forefront of the industry for 40 years, RES has delivered more than 22GW of renewable energy projects across the globe and supports an operational asset portfolio exceeding 7.5GW worldwide for a large client base. RES is active in 10 countries working across onshore and offshore wind, solar, energy storage and transmission and distribution.RES has developed 22 onshore wind farms in Northern Ireland totalling 246 MW, which equates to nearly 20% of Northern Ireland's operational onshore wind capacity. RES currently operates over 88.7 MW of wind capacity across Northern Ireland, has secured planning permission for a further 109.9 MW awaiting construction and has 80 MW in the planning system.

EIA Process

Scope of Environmental Statement

The Environmental Impact Assessment (EIA) has assessed the environmental impacts associated with the construction, operation and decommissioning the Development, comprising 14 three bladed wind turbines, each up to a maximum of

180m tip height, associated external electricity transformers; underground cabling; a newly created site entrance (150m north of Doonan Leap Car park); access tracks; turning heads; crane hardstanding's; control buildings and substation compound, battery energy storage containers, tree felling, off-site areas of widening to the public road and all ancillary works. During construction and commissioning there would be a number of temporary works including a construction compound with car parking; temporary parts of crane hardstanding's; welfare facilities.

1.6 RES has undertaken informal scoping with Department of Infrastructure regarding the Development and a letter of Intention to Submit an ES was lodged, which is included in **Appendix 1.1**. An Intention to Submit response from Department of Infrastructure is included in **Appendix 1.2**. Consultation responses from consultees have been considered in the individual chapters of this ES.

1.7 An EIA has been undertaken in accordance with the Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2017, (the "EIA Regulations"), to identify and assess the likely environmental effects of the Development and establish an appropriate range of mitigation measures in order to reduce adverse impacts where possible. This ES contains the findings of the EIA.

1.8 The Development will represent a 'Schedule 2' development, as defined under the "EIA Regulations". Development that is listed in Schedule 2 requires an EIA if it is likely to have an impact on the environment by virtue of factors such as its size, nature or location. Therefore, any potential effects of the construction, operation and decommissioning of the Development deemed to have significant environmental effects are subject to an EIA.

1.9 The scale of the Development means that there is the potential for significant environmental effects to arise. Consequently, it was deemed appropriate to undertake an EIA.

1.10 EIA is a process by which information about the environmental impacts of a project is collected, evaluated and taken into account in its design and the decision as to whether it should be granted planning permission. The applicant presents the information on the project and its likely environmental impacts in an ES. This enables decision-makers to consider these impacts when determining the related planning application. The EIA process has a number of key characteristics:

- It is systematic, comprising a sequence of tasks defined both by regulation and by practice;
- It is analytical, requiring the application of specialist skills from the environmental sciences;
- It is impartial, its objective being to inform the decision-maker rather than to promote the project;
- It is consultative, with provision being made for obtaining information and feedback from statutory agencies and key stakeholders; and
- It is iterative, allowing opportunities for environmental concerns to be addressed during the planning and design of a project.

1.11 This final point is particularly important with respect to the design of the Development where a number of design iterations have taken place in response to environmental factors identified during the EIA process (**Chapter 3: Design Evolution and Alternatives**).

1.12 The EIA for the Development has been carried out in accordance with the latest regulations, guidance and advice on good practice, comprising:

- Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2017;
- Environmental Impact Assessment: A guide to procedures (Department for Communities and Local Government, amended reprint 2001); and
- Guidelines for Environmental Impact Assessment (Institute of Environmental Management and Assessment, 2004).

1.13 Individual technical assessments have been undertaken in accordance with a variety of legislation, guidance and best practice. Relevant details are contained within the Legislation and Policy Framework section where applicable to each technical chapter.

The Assessment Method

1.14 Appropriate methodologies have been used to assess the effects relating to each of the environmental topics that have been investigated as part of the EIA. These methodologies are based on recognised good practice and guidelines specific to each subject area, details of which are provided within each individual technical section.

1.15 The design team employed an iterative approach to the design of the Development where the design evolved throughout the EIA process as different constraints and potentially adverse impacts were identified and evaluated. This method is considered best practice as mitigation measures can concurrently be integrated into the design throughout the EIA process. This approach allowed the design team to alleviate or remove potentially adverse impacts and incorporate measures into the design to enhance positive impacts. The final evaluation of significance assesses the residual impacts assuming all mitigation measures are applied.

1.16 Each technical chapter assesses the impacts that could arise as a result of the Development. Impacts are assessed as being either adverse, beneficial, permanent, temporary or reversible. Significance is determined by assessing the magnitude and sensitivity of each likely impact.

1.17 The ES complies with current planning policy and will be submitted in conjunction with a planning application. This report is a formal ES as required by Department for Infrastructure under the Planning (EIA) Regulations (Northern Ireland) 2017. The ES is designed to provide information for the purpose of assessing the likely impact upon the environment.

Structure of the Environmental Statement

1.18 Schedule 4 of the "EIA Regulations" states that the following must be included within the ES:

- A description of the development (description of the physical characteristics (site, design and size of the development), land-use requirements, production processes) and an estimate of expected residues and emissions resulting from the operation of the proposed development.
- An outline of the alternatives studied by the applicant and explanation of why the particular option was chosen.
- A description of the aspects of the environment likely to be significantly affected by the development (including population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage and landscape) and the inter-relationship between the above aspects.
- A description of the likely significant effects of the development on the environment (to include direct, indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, beneficial and adverse effects of the development).
- A description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment.
- The data required to identify and assess the main effects that the development is likely to have on the environment.
- An indication of any difficulties (technical deficiencies or lack of know-how) encountered.
- A non-technical summary of the information contained within the ES.

1.19 This ES has been prepared in accordance with the "EIA Regulations" described above. The ES comprises the following volumes:

- **Volume 1**: Non-technical Summary (NTS) of the ES
- **Volume 2**: Main Text
- **Volume 3**: Figures (the illustrations that accompany the ES)
- **Volume 4**: Technical Appendices (technical information relating to the environmental topics such as detailed methodologies, baseline data information and data analysis).

1.20 Volume 2 is organised as follows:

- **Chapter 1**: Introduction & Proposed Development
- **Chapter 2**: Planning Policy
- **Chapter 3**: Design Evolution and Alternatives
- **Chapter 4:** Landscape and Visual
- **Chapter 5:** Archaeology and Cultural Heritage
- **Chapter 6**: Ecology

- **Chapter 7:** Ornithology
- **Chapter 8:** Fisheries
- **Chapter 9:** Geology and Water Environment
- **Chapter 10**: Acoustic
- **Chapter 11:** Traffic and Transport
- **Chapter 12:** Shadow Flicker
- **Chapter 13:** Socioeconomics
- **Chapter 14:** Summary of Effects.

1.21 Biodiversity is covered under Chapters 6, 7, 8 & 9; Human Health is covered under Chapters 10 & 12 and Climate Change is covered within Chapter 13. A summary of effects is described in Chapter 14.

1.22 Chapters 1, 3, 10, 11, 12 & 14 have been authored by RES using their in-house professionally qualified expertise in respect of these topics. The Environmental Statement has been compiled by RES, primarily by Jennifer McCorry (Senior Development Project Manager) who is a Chartered Planner (MIPI) with over 12 years' experience of assessing, planning and developing renewable energy projects.

1.23 In general, for each environmental topic, the following format has been adopted with regard to the presentation of information:

- Introduction
- Scope of Assessment
- Legislation and Policy Framework
- Consultation
- Assessment Methodology
- Baseline Assessment
- Assessment of residual impacts
- Design Evolution and Mitigation Measures
- Residual Impacts
- Cumulative Impacts
- Summary and Conclusions
- References.

1.24 A number of individual disciplines have adopted variations from this format as a result of specific assessment methodologies and appropriate reporting structure.

Planning Application

1.25 In July 2021, Department of Infrastructure confirmed that the planning application should be submitted to the Department of Infrastructure, in accordance with Section 26 of the Planning Act (Northern Ireland) 2011, regarding the Department's jurisdiction in relation to developments of regional significance.

Proposed Development

1.26 The Development comprises 14 three bladed wind turbines, each up to a maximum of 180m tip height, associated external electricity transformers; underground cabling; a newly created site entrance (150m north of Doonan Leap Car park); access tracks; turning heads; crane hardstanding's; control buildings and substation compound, battery energy storage containers, tree felling; off-site areas of widening to the public road and all ancillary works. During construction and commissioning there would be a number of temporary works including a construction compound with car parking; temporary parts of crane hardstanding's and welfare facilities.

1.27 The Planning Application Boundary (red line boundary) is shown on **Figure 1.2**. This boundary contains the main wind farm site, including positions of the turbines and associated infrastructure, with 50 m micrositing. The Planning Application Boundary lies fully within Land under the Applicant's Control (blue line boundary), as shown in **Figure 1.2.** The measures contained in the Outline Habitat Management Plan (Appendix 6.6) are contained within the blue line boundary.

- A detailed plan of the Development showing the position of the turbines and other infrastructure is shown on **Figure 1.3**: **Infrastructure Layout**.
- This chapter provides a description of the physical characteristics of the Development for the purpose of identifying and assessing the main environmental impacts of the proposal.
- In this chapter in order to differentiate between land take and infrastructure that will be present for the wind farm life time, and land take and infrastructure which is only required for short term works during the construction period, the term 'permanent' is used to describe the former and 'temporary' used to describe the latter. However, it should be noted that the Development would have a temporary operational lifetime of approximately 35 years from the date of commissioning, after which the above ground infrastructure would be removed and the land remediated. Therefore, the effects are largely long-term temporary as opposed to permanent.

- Planning permission is being sought for the Development comprising the following:
  - 14 three-bladed horizontal axis wind turbines of up to 180 m tip-height
  - Associated external electricity transformers
  - A newly created site entrance
  - Access tracks
  - Turning heads
  - Control buildings and substation compound
  - Battery energy storage containers
  - Off-site areas of widening to the public road and all ancillary works
  - Turbine foundations
  - Hardstanding areas at each turbine location for use by cranes erecting and maintaining the turbines
  - Electricity transformers
  - Approximately 12.07 km of new access track and 0.46 km of upgraded access track
  - On-site electrical and control network of underground (buried) cables
  - Connection from the substation to the local grid network
  - Temporary construction compound
  - Permanent and temporary drainage works
  - Associated ancillary works
  - Forestry Felling

Site Layout and Flexibility

1.28 Although the design process and evolution seeks to combine environmental and economic requirements, the Applicant would nevertheless wish some flexibility, where necessary, in micrositing the exact positions of the turbines and routes of on-site access tracks and associated infrastructure (50 m deviation in plan from the indicative design). Any repositioning would not encroach into environmentally constrained areas. Therefore, 50 m flexibility in turbine positioning would help mitigate any potential environmental effects: e.g. avoidance of unfavourable ground conditions or archaeological features not apparent from current records. See **Figure 1.3: Infrastructure Layout** for details.

Land Take

1.29 The turbines need to be spaced a suitable distance apart (taking into account the prevailing wind direction), so as not to interfere aerodynamically with one another (creating array losses). The actual land developed is limited to the substation, wind turbine towers, transformers, permanent crane hardstandings, battery energy storage hardstanding and the access tracks, which account collectively for about 4.71 % of the total area within the Planning Application Boundary.

1.30 The area of infrastructure created following construction of each turbine (including temporary areas) will be approximately 2736 m^2. Of this, approximately 630 m^2 would be temporary hardstanding (see **Table 2.1** under crane pads and laydown areas). The turbine foundation formation level is approximately 20 m diameter in area and 3.50 m below ground level. The walls of the excavation will be battered to approximately 1:2, yielding a ground level excavation area of approximately 34m diameter.

1.31 The excavation area around each turbine is significant in terms of both its scale and duration of the works and as such requires consideration. Ancillary excavation works and material storage around other parts of development, such as those for cable trenching, would have a negligible impact on environmental receptors due to the very minor scale of the excavation, or duration of the works and are not considered further in the ES.

1.32 Following completion of the turbine installation, the permanent hardstanding would be approximately 181 m^2 at each turbine site, which includes the concrete plinth to which the steel tower is attached, and a 5 m wide maintenance track/path around the base of the turbine (**Figure 1.14**). The external transformer (if required) would take an additional 28 m^2 of land at each turbine. The completed foundation is covered with soil approximately 1.5 m deep, leaving only the concrete plinth exposed at ground level, to which the steel tower is attached. Movement of livestock around the tower would be unrestricted.

1.33 Additionally, crane hardstanding areas would be constructed adjacent to each wind turbine. **Figure 1.15** shows the general hardstanding arrangement at each turbine. The permanent hardstanding of each turbine for the life of the Development is 1925 m^2, with a temporary hardstanding of 630 m^2 during construction, if required by the final choice of turbine supplier. If constructed, the temporary hardstanding areas would be reinstated following construction.

1.34 The Development would result in the construction of approximately 12.07 km of new track and 0.46 km of upgraded access track. The running width of the track would be 4.5 m on straight sections, with 0.25 m wide shoulders on each side, totalling 5 m. The permanent hardstanding area for the new track would be approximately 60,350 m^2, 2,300 m^2 of upgraded access track, totalling 62,650 m^2.

1.35 The total area taken up by the control building and associated infrastructure is expected to be 4,000 m^2. This is to include the building, rear compound, all associated welfare, access and parking (**Figure 1.5**).

1.36 A temporary construction compound (**Figure 1.12**) measuring 4,000 m^2 will be constructed. On completion of the wind farm construction, 750m2 of temporary construction compound will be utilised permanently for Energy Storage and the remaining 3,250m2 will be reinstated to their original form following construction.

Table 2.1 - Summary of Temporary and Permanent Hardstanding

Wind Farm Element	Temporary hardstanding[1] in m^2	Permanent Hardstanding[2] in m^2
Turbines and transformer pads	-	2,534
Crane pads and laydown areas	8,820	26,950
On-site access tracks (new)	-	60,350
On-site access tracks (upgraded)	-	2,300
Control building & substation compound	-	4,500
Energy storage hardstanding	-	750
Construction compound	3,400	-
Total hardstanding in m^2	12,220	97,384
Total Hardstanding in ha	1.22	9.74
Total Hardstanding as % of total area within the Planning Application Boundary (206.65ha).	0.59	4.71

1.37 Thus, in summary, the Development would require approximately 9.74 ha of hardstanding lasting throughout the life of the project. An estimated further 1.22 ha would be occupied by hardstanding on a temporary basis.

Habitat Management

1.38 An Outline Habitat Management Plan (HMP) has been developed to enhance habitats on site. Please see **Chapter 6: Ecology**, for further details.

Project Description

Wind Turbines

1.39 The wind turbine industry is evolving at a remarkable rate. Designs continue to improve technically and economically. The most suitable turbine model for a particular location can change with time and therefore a final choice of machine for the Development has not yet been made. The most suitable machine will be selected before construction, with a maximum tip height of 180 m.

1.40 For visual and acoustic assessment purposes, the most suitable candidate turbine available in the marketplace (currently of 4.2 MW nominal capacity and with an overall tip height of 180 m) has been assumed. Most of the dominant wind turbine manufacturers are now producing turbines that are classed as suitable for the wind

[1] Temporary hardstanding: this refers to ground which will be occupied by hardstanding / built structures during the construction of the Development. However, once the Development has been constructed this land will be reinstated and available for grazing.

[2] Permanent hardstanding: this refers to ground which will be occupied by hardstanding / built structures throughout the lifetime of the Development.

regimes typical of Northern Ireland and many are also producing turbines that meet the up to 180 m tip height specification being suggested for the Development. Exact tower and blade dimensions vary marginally between manufacturers. A diagram of a typical 180 m tip height turbine is given in **Figure 1.4.**

1.41 Turbines begin generating automatically at a wind speed of around 3 to 4 metres per second (m/s) and have a shut-down wind speed of about 25 m/s. It is proposed to install infrared lighting on a turbine(s) in a pattern that is acceptable to the Ministry of Defence (MoD) for aviation visibility purposes. Infrared lighting allows military aircraft with night vision capability to detect and avoid wind farms. Infrared lighting cannot be detected with the naked eye, thereby reducing visual impact.

1.42 Each turbine would have a transformer and switchgear. The transformer's function is to raise the generation voltage from approximately 690 volts to the higher distribution level that is required to transport the electricity from the turbines to the grid connection point substation on the site. Depending on the turbine supplier, the transformer and switchgear may be located inside or outside each turbine.

Battery Energy Storage

What is Energy Storage?

1.43 Energy Storage is a means of storing electrical energy just like a rechargeable battery, mobile phone or electric car. These are means by which power can be stored and released. The Proposed Development includes 4 no. energy storage containers which is of a larger scale, but the basic principle is the same.

1.44 According to SONI statistics, the electricity demand in Northern Ireland, day to day, for instance during 2018 the lowest demand ranged from as low as 437MW to as high as 1648 MW. Therefore, power generation and grid must deal with large transitions between lows and highs, not only over the course of a day or week but second by second. One of the basic roles of energy storage is to act as a power reserve, when electricity generation drops below demand. Its importance then is linked to its ability to ensure a constant supply of electrical energy to our homes and business. That improves efficiency and reduces prices for consumers.

1.45 Energy storage can absorb energy at times of high generation and low demand, and release energy at times of peak demand. Customers offering Energy Storage Services (ESS) therefore have the potential of deferring network reinforcement and accommodating the connection of further demand or generation which would otherwise be constrained by thermal capacity. ESS can also play in the System Services market helping to balance demand and generation.

The Need for Energy Storage – why is it Important?

1.46 The Proposed Development is intended to be used to provide cost effective flexible services to the electricity network, such as adding electricity to, or removing electricity from the system, when this is useful to the operation of the system.

SONI, the System Operator in charge of ensuring stable secure power for the Ireland's homes and businesses, procures such services from grid connected energy systems and the flexibility they provide is critical to achieving national decarbonisation targets and a stable supply of electricity at least cost to consumers.

1.47 Energy provision in Northern Ireland is undergoing a transition from one designed primarily around a number of large thermal power stations such as Kilroot, Ballylumford and Coolkeeragh to one which now includes a number of renewable generators such as wind farms. Renewable generation is now supplying over 40% of the total annual electrical requirement in Northern Ireland. With the Minister of the Economy announcing recently that the Renewable Energy target for Northern Ireland will be 70% by 2030 this transition will be even more important.

1.48 There are, however, technical constraints on the transmission network which are limiting the amount of renewable energy which can be delivered from these renewable generators to the main demand centres in the east of the province.

1.49 Energy Storage is an innovative solution, which is being deployed across the world, to facilitate the shift from traditional thermal generation to low/zero carbon generation. The energy storage containers will help match generation produced from intermittent renewable generation with the peaks and troughs in electricity demand.

1.50 The need for battery energy storage systems has been identified by SONI under their DS3 programme. The delivery of the DS3 programme is required to allow Northern Ireland to meet its renewable energy targets, which the Minister for the Economy has recently suggested should be 70% by 2030.

1.51 The proposal provides an opportunity to support innovative technology, contribute towards renewable energy targets, ensure a secure electricity supply to its population and play its part in reducing electricity costs for consumers.

1.52 In particular, the Proposed Development will deliver frequency response service to enable the necessary balancing of the emerging low carbon electricity system. The frequency at which the electricity system operates is an indication of the balance between supply and demand and a failure to maintain this frequency within strict boundaries would lead to catastrophic system failure and blackouts. Normally, the system runs at a frequency of 50Hz. If there is not enough supply to meet demand the frequency drops below 50Hz. If there is too much supply for the current demand, the frequency rises above 50Hz. The Proposed Development will be able to respond within a fraction of a second to frequency deviations away from 50Hz (by increasing supply or demand as appropriate) to help keep the system in balance.

1.53 The Energy Storage element of the Proposed Development could also provide distribution, reinforcement and deferral services. These enable existing electrical network assets such as substations and overhead lines to have their capacity increased without the need for building new infrastructure. All of these uses of the Proposed Development involve charging the battery system with electricity, storing electricity for a period, or discharging electricity. The Proposed Development will make a valuable contribution to Ireland's secure, low carbon and affordable electricity system.

Foundations and Hard Standing

1.54 The wind turbines would be erected on reinforced concrete foundations. It is anticipated that the foundations would be of gravity base design, but there may be the requirement to use piled foundations where ground conditions dictate. Final base designs will be determined after a full geotechnical evaluation of each turbine location. **Figure 1.14** provides an illustration of a typical gravity base wind turbine foundation design.

1.55 During the erection of the turbines, crane hardstanding areas would be required at each turbine base **(Figure 1.15).** Typically, these consist of one main permanent area of 1925 m^2 adjacent to the turbine position, where the main turbine erection crane will be located. The other areas, totalling 630 m^2, will be temporary and used during the assembly of the main crane jib. The hardstanding will be constructed using the same method as the excavated access tracks. This involves the topsoil being replaced with suitable structural fill to finished level.

1.56 After construction operations are complete, the temporary crane pad areas, shown on **Figure 1.15**, will be reinstated. There will be a requirement to use cranes on occasion during the operational phase of the Development, so the main crane hardstanding (1925 m^2) will be retained to ease maintenance activities. This approach complies with current best practice guidance[3] which recommends crane hardstandings are left uncovered for the lifetime of the Development.

Site Tracks

1.57 The on-site access track layout has been designed to minimise environmental disturbance by maximising the use of upgraded site track and avoiding sensitive habitats where possible and keeping the length of track commensurate with the minimum required for operational safety. The track route also takes cognisance of the various identified environmental constraints. Approximately 12.07 km of new access tracks and 0.46 km of upgraded access tracks are proposed to access the various turbine locations totalling approximately 12.53 km in length. Typical access track designs are shown in **Figure 1.11**.

1.58 Twenty new watercourse crossings will be required as part of the track layout. These crossings would be designed to ensure that fish movements are not restricted (where applicable) in addition to ensuring the crossing size is adequate for potential flood flows. An example of the watercourse crossing design is shown in **Figure 1.18**.

[3] SNH, Scottish Renewables, SEPA and the Forestry Commission Scotland (2010) "*Good Practice during Wind Farm Construction*"

Electrical Connection

1.59 Assuming the use of the currently available models, each wind turbine would generate electricity at low voltage and would have an ancillary transformer located either within or outside the base of the tower to step up the voltage to the required on-site distribution voltage. Each turbine would be connected to any adjacent turbines by underground cables.

1.60 The wind farm substation is proposed to be located on the central part of the site as shown in **Figure 1.3: Infrastructure Layout**. All power and control cabling on the wind farm will be buried underground in trenches located, where possible, along the route of site access tracks. These trenches will be partially backfilled with topsoil. The vegetation soil tuft will be stripped and laid beside the trench and used to reinstate the trench to the original ground level immediately after the cables have been installed.

1.61 The connection of wind farms to the electrical grid typically follows a separate consenting process and it is normally the responsibility of the network operator to progress the relevant consent, where required. The Best Practice Guidance to PPS 18 states that whilst the routing of such lines by Northern Ireland Electricity (NIE) is usually dealt with separately to the application for the wind farm, developers will generally be expected to provide details of indicative routes and method of connection.

1.62 RES considers connection to the grid system via a combination of overhead line and underground cables following the public road to either the existing Kells or Ballymena Substations as the most likely options available. Although not a part of the planning application for the Development, proposed grid connection route is illustrated and the environmental effects have been assessed and these are presented in **Appendix 2.1**.

Control Building & Substation Compound

1.63 The Control Buildings & Substation Compound will comprise of a High Voltage Air Insulated Substation (AIS) compound with various electrical plant and up to two control buildings as per Vol 2 Fig 1.7. The electrical plant within the substation compound will include:

- NIE 110kV grid connection plant comprising of structures supporting circuit breakers, disconnectors, post insulators, current transformers, voltage transformers, surge arrestors and cable sealing ends. The equipment, to be installed in the NIE section of the compound, will be used by SONI and NIE for the electrical control and protection of the site and for measuring relevant electrical quantities associated with the wind farm site.
- Grid Transformer which will transform the medium distribution voltage (33kV) used within the wind farm to a higher transmission voltage (110kV)

used for the grid connection circuit to export the electrical power from the site.

- Neutral Earthing Resistor which will control electricity current arising from earth faults to safe levels.
- Lightning Protection Columns required to protect the equipment in the substation compound from lightning strikes.
- Pre-Insertion Resistor, which may be installed to meet grid compliance requirements for power quality (studies during detailed design phase will identify if it is required)
- Harmonic Filter and Resistor, which may be installed to meet grid compliance requirements for power quality (studies during detailed design phase will identify if they are required).
- Capacitor Banks and associated Capacitor Circuit Breakers and Capacitor Switches, which may be installed to meet grid compliance requirements for power quality (studies during detailed design phase will identify if they are required).
- Reactor and associated Reactor CB which may be installed to meet grid compliance requirements for power quality (studies during detailed design phase will identify if it is required)

1.64 The wind farm control building Vol 2 Figure 1.6 will be designed and constructed to the standard required by NIE for the accommodation of NIE substation equipment and wind farm equipment. Where possible, local building materials and finishes will be used to ensure that the appearance is in keeping with other buildings in the area.

1.65 The control building will accommodate metering equipment, switchgear, the central computer system and electrical control panels. A spare parts store room, and welfare facilities will also be located in the control building. The building will be attended by maintenance personnel on a regular basis.

1.66 Following an assessment of foul treatment options through a review of Pollution Prevention Guidelines 4, it was determined that both the toilet, wash hand basin and sink should drain to a small package treatment plant located adjacent to the control building, which would follow the Controlled Activities Regulations (CAR) guidelines and be constructed and located in accordance with the relevant Building Standards and agreed with the Council.

1.67 A permanent external environmental waste storage area will be provided with a minimum of 6 m clearance from the buildings. The area will consist of a concrete plinth surrounded with a palisade fence and double gate.

Energy Storage

Power Conversion Systems and transformer units

1.68 One or more of the battery containers are connected to a PCS and transformer unit, these may be separate pieces of equipment or one combined PCS and transformer. The PCSs are inverters which convert the Direct Current (DC) from the batteries to Alternating Current (AC) when the batteries are exporting electricity into the grid. The system works in reverse when the batteries are being charged or importing electricity from the grid. Power transformers will step up the PCS AC voltage from a low voltage to a higher voltage as required by the electricity grid connection.

1.69 The batteries will operate on average for up to 8 hours per day to support the grid network, times of operation will depend on the grid parameters and requirements. There shall be no emissions from the site with the exception of noise from cooling fans. All noise associated with the Battery Storage has been assessed in Vol 2 Chapter 10 of the ES with the full technical details supplied in Vol 4 Appendix 10.1.

Description of Access

1.70 The proposed access route for the delivery of large turbine components, known as abnormal indivisible loads (AILs), is shown in **Figure 11.1 - Turbine Delivery Route**. The site entrance is located at the end of and directly accessed off the Ballymena/Carnlough road (A42).

1.71 **Appendix 11.1** shows a swept path analysis of all points along the turbine delivery route that require either overrun or oversail beyond the road edge.

1.72 At the end of the construction period and in consultation with DfI Roads, any reinstatement required to any street furniture which may be removed on a temporary basis will be undertaken. In the unlikely event that a replacement blade is required during the operational phase of the wind farm, any works will be undertaken following consultation with DfI Roads.

1.73 Further details are in Chapter 11: Traffic and Transport.

Typical Construction Activities

1.74 Prior to commencement of construction, detailed method statements will be prepared to address best practice working methods. As a minimum, the following best practice construction methods will be adhered to:

- Where possible and in order to minimise impacts of earthworks, excavations will be kept to a minimum with granular material being reused where appropriate
- Consideration will be given to weather conditions when stripping soil. For example, during periods of heavy rain (>25 mm in 24 hours), significant snow

event (>75 mm lying) or an extended period of freezing conditions (ground penetration >100 mm), soil stripping works will be reviewed to take in account any adverse weather conditions and where deemed applicable, works will cease until site conditions prevail that are compatible with this activity

- Vegetated turves shall be stripped and stockpiled separately prior to excavation of topsoil/peat in all work areas
- Vegetated turves will be reused as quickly as possible
- Excavations will be monitored for changing soils types to prevent cross mixing of soils in stockpiles
- Topsoil shall be stripped and stored carefully for use in reinstatement works, which shall be carried out as soon as possible after sections of work are complete. Topsoil will be stripped prior to excavation of subsoil in all work areas
- Any remaining subsoil will be excavated down to a suitable bearing stratum and set-aside for later use in landscaping, backfilling around structures and verge reinstatement
- Reinstatement will be ongoing as the works are constructed to minimise the amount of time in which any material will be stockpiled
- Where required, all stockpiled material will be sited in areas with shallow peat depths, negligible peatslide risk and avoiding all 50 m watercourse buffer zones, ecological and cultural heritage constraints
- All stockpiles shall be shaped to promote run-off. Detailed SUDS drainage and silt control methods shall be designed for each stockpile
- Additionally, a “toolbox talk” will be provided by the site management team to highlight possible events causing slope instability and provide guidance on best practice when operating in areas of peat and/or increased slopes. In addition, a workforce engagement event shall be performed at least once for the project and shall be organised by the project team and be attended by RES and project contractor’s workforce. The event will set and communicate the required safety culture and working practices for the project.

Access Tracks

1.75 In areas of peat with a depth greater than 1.0 m consideration has been given to the use of floating tracks. The feasibility of a floating road construction is dependent upon a number of factors, namely: the geomorphology of the peat; topography; length of road section; wind farm layout; number of vehicle movements for each option; restoration requirements; peat re-use considerations. All parameters noted above will be assessed at detailed design stage post consent and the best practice road construction type will be inferred from the various design constraints.

1.76 The access track itself will be constructed of inert material of suitable grade to withstand the expected traffic loading. Road construction techniques and roadside ditches will be designed to minimise the effect on natural hydrology as much as possible.

1.77 The depths of the ditches will be kept to the minimum required for free drainage of the road. Individual drain lengths will be minimised to avoid significant disruption of natural drainage patterns and avoid accumulation of large volumes of water within an individual drain.

1.78 Drains will not directly flow into watercourses, but into a buffer zone. Buffer zones are used to allow filtration of suspended solids in the water and reduction of runoff velocities. This reduces the flashiness of response, encourages deposition of sediments and allows pollutants to be filtered out.

Construction of Temporary Compound and Battery Energy Storage

1.79 A temporary construction compound will be located on the site, as illustrated in **Figure 1.3: Infrastructure Layout.** Details of the temporary compound layout are included in **Figure 1.12.** The compound will include the following:

- Temporary portable cabins for office accommodation, monitoring of incoming vehicles and welfare facilities
- \- Self-contained toilets with provision for waste storage and removal
- \- Containerised storage areas for tools, small plant and parts
- \- An area for site vehicle parking and storage of larger material items
- \- A standing and turning area for vehicles making deliveries to the site
- \- A bunded area for storing fuels, oils and greases.

1.80 On completion of the construction work these facilities will be removed and the areas not being used for energy storage will be reinstated.

1.81 The location of the temporary compound has been selected to avoid environmental constraints and for reasons of security, practicality and to obtain suitable ground conditions. The proposed temporary compound area will be constructed by top soil excavation in a similar manner to the access tracks, laying stone over a geotextile membrane.

1.82 During construction, temporary fencing will be erected as required, around the construction compound. This is illustrated in **Figure 1.12 and Figure 1.13.**

1.83 On completion of the construction phase work on the wind farm, 3,250m2 of the temporary construction compound will be removed and reinstated to agriculture with the remaining 750m2 utilised for Energy Storage devices.

Energy Storage

1.84 The construction phase will be aligned and incorporated into the general construction of the Wind farm. The Energy Storage container area will be constructed at the later part of the overall construction programme as the containers and their compound will be located within an area which will be used as the temporary construction compound for the wind farm.

1.85 The lithium ion batteries will be manufactured off site and will be delivered to site as fully sealed modules. The batteries will be tested to all the required standards including the UL9540A standard (see Appendix 1.3).

1.86 The lithium ion batteries will be enclosed in steel ISO shipping containers, designed and manufactured to a bespoke design for lithium-ion batteries. The enclosures will be mounted on concrete foundations with dc cables connecting the batteries to the power conversion systems (changes the electricity from dc to ac) then ac cables connecting the power conversion systems to the substation.

1.87 The compound area would be constructed by laying stone over a geotextile membrane. During the construction phase temporary drainage measures will be installed to control sediment run-off in line with the SUDS measures outlined in Vol 4, Appendix 9 of the ES.

1.88 The Energy Storage will comprise four permanent containers housing energy storage devices, associated inverters and ancillary equipment. Permanent fencing will enclose the containers. These are illustrated in **Figure 1.8: Energy Storage Compound Plan & Elevation** and **Figure 1.9: Energy Storage Container Elevation.**

Sustainable Drainage System

1.89 The drainage measures and Sustainable Drainage System (SuDS) designs have been directed by recommendations in **Chapter 9: Geology and Water Environment**

1.90 The runoff drainage system will be designed to mimic natural conditions to mitigate against increased flashiness in water courses and reduced groundwater recharge. The SuDS will protect the status of water courses and ground waters. A proposed SuDS Design Statement is included within the Water Framework Directive Assessment in **Appendix 9.1.**

1.91 Construction will be carried out according to Department of Agriculture, Environment & Rural Affairs (DAERA) and Construction Industry Research and Information Association (CIRIA) guidance for site works. Pollution control measures during the construction phase will be included in the Construction & Decommissioning Method Statement (CDMS), which will be agreed with the Planning Authority before starting construction work on site.

1.92 Mitigation measures to minimise the hydrological effect of constructing the access tracks have been proposed in **Chapter 9: Geology and Water Environment** of this ES.

Crane Hardstanding Construction

1.93 **Figure 1.15** shows the crane hardstanding layout configuration in plan. The hardstanding would be constructed using the same method as the excavated access tracks. This involves the topsoil and subsoil being replaced with suitable stone, ensuring an adequate bearing capacity has been achieved to carry the anticipated loads. The final position of the hardstanding would be decided at detailed design stage and prior to construction and shall be based on a number of considerations, including; size of crane required, depth of excavation required, hydrological/ecological features in the vicinity, local topography (it is preferable to position the crane hardstanding on the same level, or higher level to the turbine foundation level since this eases lifting operations).

Turbine Foundation Construction

1.94 The turbine towers are fixed to a concrete foundation. The foundation proposed in Figure 1.14 comprises a gravity base design. Each foundation typically consists of a tapered octagonal block of concrete, and formation will be approximately 3.5 m below ground level. The volume of concrete used to make each foundation is approximately 500 m^3, which is reinforced by approximately 60 tonnes of steel bar. The sub formation depth of the foundation varies for each turbine location according to the depth to suitable sub formation level. The excavation area for each foundation will be approximately 910m^2. The foundation is typically poured in two parts, with a suitable construction joint between them. This will be detailed in the CDMS. Following the pouring and curing of the concrete, the foundation is backfilled with material which is initially excavated and meeting the density requirements, leaving only the tower plinth, typically 4.5 m – 5.5 m diameter, sitting at or close to ground level. Surplus excavated material will be stored in appropriate areas identified in the Peat Management Plan (PMP), produced as part of CDMS prior to construction. The proposed plan will calculate generated excavated material and identify space for the excess volume of material. An Outline Peat Management Plan is provided in **Appendix 9.5**.

1.95 The exact quantities of concrete, reinforcement, depth and dimensions will vary on the final choice of turbine model. In the detailed pre-construction design of each foundation, geotechnical tests are carried out to determine the strength of the subsoil layers beneath the turbines and the soil behaviour under loading over time. This information is used to confirm a final design and incorporates factors for safety.

1.96 An earthing mat or electrode consisting of up to three interconnected concentric rings of bare stranded copper conductor is laid around the foundation of each tower and transformer, approximately 0.5 m below the finished ground level. In addition, earthing rods padded by bentonite (a water retaining clay mineral) are required at set locations around the foundation, and are positioned vertically below the earth mat. The number of rods and length is dependent upon the electrical resistivity of the soil which is confirmed during the site investigation, prior to construction.

1.97 Sulphate resistant cement, or higher cement content, within the concrete will be used if the site is identified to have waters with potentially low pH. This is so that they do not have a corrosive effect on turbine bases.

Wind Turbine Erection

1.98 Wind turbine towers, nacelles and turbine blades will be transported to the site as abnormal loads as described in **Section 1.70**. The tower sections and other turbine components will be stored at each turbine hardstanding until lifted into position.

1.99 The components would be lifted by adequately sized cranes and constructed in a modular fashion. Assembly, in general requires only fixing of bolts, torquing of nuts and electrical and hydraulic connections.

Cabling, Substation and Control Building

1.100 The location of the substation and control building is shown in **Figure 1.3: Infrastructure Layout**. Layout and elevation drawings for these buildings are presented in **Figures 1.5 -1.7**. All cabling between the turbines and the substation on the site will be connected using underground trenched cables. Where excavated, the top layer of soil will be removed and used to reinstate the excavation following the installation of the cables. Where cables are being laid in areas of peat, the various different layers will be separated and replaced appropriately. Cabling would generally run parallel to the adjacent site tracks. **Figure 1.16** presents a typical underground cable cross-section. In addition and in an effort to ensure that the cable trench does not act as a preferential drain, impermeable bunds will be installed perpendicular to the cable direction at suitable intervals (taking into account local ground conditions and topography).

Re-instatement

1.101 A programme of reinstatement would be implemented upon completion of construction. This would relate to the construction compound, temporary areas of the crane hardstandings, cable trenches and track shoulders where appropriate. There remains a potential to use cranes during the operational phase of the Development, therefore the main crane hardstanding will remain uncovered.

1.102 It is essential that the access track width is retained during the operation of the Development to allow occasional access if required. Therefore no works to reduce the track width, post turbine erection, are proposed.

Construction Programme

1.103 It is anticipated that the construction would take approx. 18 months. The indicative construction programme shown in **Diagram 2.1** shows the anticipated scheduling of construction activities.

Diagram 2.1 – Indicative Construction Programme

TASK	CONSTRUCTION MONTH																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Mobilisation & setup construction compound																		
Site entrance and tracks																		
Crane hardstandings																		
Turbine foundations																		
Control building & substation																		
Cable installation																		
Turbine deliveries																		
Turbine erection																		
Operational take over																		

Hours of Work

1.104 Construction work will take place between the hours of 0700-1900 Monday to Friday and 0700 – 1300 on Saturdays. Outside these hours, work at the Site shall be limited to turbine erection, testing/commissioning works and emergency works. Deliveries may occur outside these times to minimise disruption to local residents.

Construction Traffic and Plant

1.105 In addition to staff transport movements, construction traffic will consist of heavy goods vehicles (HGVs) and abnormal load deliveries.

1.106 As outlined in **Chapter 11: Traffic and Transport**, taking into account forecast vehicle numbers from construction activities (6707 trips) and forecast staff vehicle numbers (9500 private car, mini bus or land rover trips), the total number of two-way vehicle movements generated during the construction period would therefore be 16,207 journeys. Approximately 98 abnormal load deliveries would be generated for the turbine erection stage which would typically result in three deliveries per day. However, the actual number will be determined in the development of the Traffic Management Plan (TMP) which will be written in consultation with Department for Infrastructure (DfI), post-consent.

1.107 Turbine components will be supervised during their transportation using appropriate steerable hydraulic and modular trailer equipment where required. Axle loads would be appropriate to the roads and access tracks to be used. The transportation of turbine components would be conducted in agreement with the relevant roads authorities and local police. RES will notify the police of the movement of abnormal length (e.g. turbine blade delivery) and any abnormal weight (e.g. crane) vehicles and obtain authorisation from DfI prior to any abnormal vehicle movements.

1.108 Vehicle escorts will be used where necessary and the appropriate permits obtained for the transportation of abnormal loads, to ensure that other traffic is aware of the presence of large, slow moving vehicles. Where long vehicles have to use the wrong side of the carriageway, or have potential to block the movement of any vehicles travelling in the opposite direction, a lead warning vehicle will be used and escort vehicles will drive ahead to hold oncoming traffic. Vehicles will also be marked as long/abnormal loads. For return journeys, the extendible trailers used for wind turbine component delivery will be retracted to ensure they are no longer than that of a normal HGV.

Construction and Decommissioning Method Statement

1.109 A Construction and Decommissioning Method Statement (CDMS) will be prepared once planning consent has been gained. This will be submitted Department for Infrastructure (DfI) prior to any construction works taking place. This will describe the detailed methods of construction and working practices, work to reinstate the site following completion of construction activities and methods to reinstate the site post operation.

Operation and Management

Life of the project

1.110 The expected operational life of the wind farm is 35 years from the date of commissioning. At the end of this period, a decision is made whether to refurbish, remove or replace turbines. If refurbishment or replacement were to be chosen, relevant planning applications will be made. Alternatively, if a decision is taken to decommission the Development, this would entail the removal of all of the turbine components, transformers, the substation and associated buildings. Specific sections of the access tracks may remain on-site to ensure the continued benefit of improved access for the landowners. The concrete foundations will normally remain in place to avoid the unnecessary intrusion to the ground. The exposed concrete plinth may be removed to a specified depth, but the entire foundation will be graded over with topsoil and replanted appropriately to restore the land to its original conditions.

Maintenance Programme

1.111 Wind turbines and wind farms are designed to operate largely unattended. Each turbine at the Development would be fitted with an automatic system designed to supervise and control a number of parameters to ensure proper performance (e.g. start-up, shut-down, rotor direction, blade angles etc.) and to monitor condition (e.g. generator temperature). The control system would automatically shut the turbine down should the need arise. Sometimes the turbines would re-start automatically (if the shut-down had been for high winds, or if the grid voltage had fluctuated out of range), but other shut-downs (e.g. generator over temperature) would require investigation and manual restart.

1.112 The Development itself would have a sophisticated overall Supervisory Control and Data Acquisition system (SCADA) that would continually interrogate each of the turbines and the high voltage (HV) connection. If a fault were to develop which required an operator to intervene then the SCADA system would make contact with duty staff via a mobile messaging system. The supervisory control system can be interrogated remotely. The SCADA system would have a feature to allow a remote operator to shut down one or all of the wind turbines. This is monitored 24 hours a day, 7 days a week.

1.113 An operator would be employed to operate and maintain the turbines, largely through remote routine interrogation of the SCADA system. The operator would also look after the day-to-day logistical supervision of the Development and would be on-site intermittently.

1.114 Routine maintenance of the turbines would be undertaken approximately twice yearly to ensure the turbines are maintained to Industry Standard. This would not involve any large vehicles or machinery.

1.115 If a fault should occur, the operator would diagnose the cause. If the repair warranted the Development being disconnected from the grid then the operator would make contact with NIE. However, this is a highly unlikely occurrence as most fault repairs can be rectified without reference to the network utility. If the fault was in the electrical system then the faulty part or the entire Development would be automatically disconnected until the fault is rectified.

1.116 Signs would be placed on the Development giving details of emergency contacts. This information would also be made available to the local emergency services and NIE.

Decommissioning

1.117 One of the main advantages of wind power generation over other forms of energy production is the ease of decommissioning and the simple removal of components from the site. The residual impact on the site is limited to the continued presence of the foundations and access tracks. All above ground structures can be removed from the site.

1.118 If the Development obtains planning approval it is expected that a planning condition would be set to provide for the decommissioning and restoration of the site in accordance with a scheme agreed in writing with Department for Infrastructure (DfI), which would consider the long term restoration of the site at the end of the lifetime of the Development.

1.119 The Development will be decommissioned in accordance with best practice at that time and/or in compliance with any planning conditions. Current best practice includes the removal of all above ground structures (e.g. turbines, substation etc); the removal of certain underground structures where required (e.g. cables); and reinstatement of disturbed areas all of which will be subject to any necessary consents. Consideration will be given to the retention of wind farm access tracks if they utilise pre-existing farm infrastructure or are not located on sensitive habitats if such continued use could lead to the long term degradation of these habitats.

Construction and Environmental Management Plan (CEMP)

1.120 This section details the environmental management controls that would be implemented by RES and its contractors during the construction of the Development to ensure that potential significant adverse effects on the environment are, wherever practicable, prevented, reduced and where possible offset.

1.121 A CEMP will be agreed with the relevant statutory consultees prior to construction commencing. The purpose of the CEMP is to:

- Provide a mechanism for ensuring that measures to prevent, reduce and where possible offset potentially adverse environmental impacts identified in the ES are implemented;
- Ensure that good construction practices are adopted and maintained throughout the construction of the Development;
- Provide a framework for mitigating unexpected impacts during construction;
- Provide a mechanism for ensuring compliance with environmental legislation and statutory consents;
- Provide a framework against which to monitor and audit environmental performance.

1.122 The CEMP will, as a minimum, include details of the following:

- Pollution prevention measures
- Peat slide, erosion and compaction management
- Control of contamination/pollution prevention
- Drainage management
- Control of noise and vibration
- Control of dust and other emissions to air.

Energy Storage

1.123 At the end of life, the battery enclosures, power conversion systems, substation, foundations and cables will be removed from site and appropriately disposed of and recycled where possible.

1.124 The battery modules will be removed from the site fully intact (they are sealed units) and sent for recycling. As part of the battery supply agreement the manufacturer shall have an obligation to take the battery enclosures back to their factory for onward recycling at an approved facility. The battery enclosures, PCS's and cables will be recycled more locally at an authorised metal recycling centre.

Site Induction

1.125 The principal contractor would ensure that all employees, sub-contractors, suppliers and other visitors to the site are made aware of the content of the CDMS and its applicability to them. Accordingly, environmental specific induction training would be prepared and presented to all categories of personnel working on and visiting the site.

1.126 As a minimum, the following information would be provided to all inductees:

- Identification of specific environmental risks associated with the work to be undertaken on site by the inductee
- Summary of the main environmental aspects of concern at the site as identified in the CDMS

- Environmental Incident and Emergency Response Procedures (including specific Environmental Communication Plan requirements).

1.127 A conveniently sized copy of an Environmental Risk Map or equivalent would be provided to all inductees showing all of the sensitive areas, exclusion zones and designated washout areas. The map would be updated and reissued as required. Any updates to the map would be communicated to all inductees through a tool box talk given by specialist environmental personnel. Regular tool box talks would be provided during construction to provide ongoing reinforcement and awareness of environmental issues.

Pollution Prevention, Water Quality Monitoring and Emergency Response Plan

1.128 The CEMP will detail a number of measures to deal with pollution prevention, including RES' policies and procedures such as 'Environmental Requirements of Contractors', 'Water Quality Monitoring Procedure' and 'Procedure in the Event of a Contaminant Spill'.

1.129 Contractors and sub-contractors would be required to follow all pertinent Pollution Prevention Guidance. The following pollution control measures will be incorporated into the CEMP:

- Equipment shall be provided to contain and clean up any spills in order to minimise the risk of pollutants entering watercourses, waterbodies or flush areas
- Trenching or excavation activities in open land shall be restricted during periods of intense rainfall and temporary landscaping shall be provided as required to reduce the risk of oil or chemical spills to the natural drainage system
- Sulphate-resistant concrete[4] shall be used for the construction of turbine bases to withstand sulphate attack and limit the resultant alkaline leaching into groundwater
- All refuelling will be undertaken at designated refuelling points. There will be no refuelling within catchments contributing to water supply points
- Equipment, materials and chemicals shall not be stored within or near a watercourse. At storage sites, fuels, lubricants and chemicals shall be contained within an area bunded to 110%. All filling points shall be within the bund or have secondary containment. Associated pipework shall be located above ground and protected from accidental damage
- Any on-site concrete wash-out shall occur in allocated bunded areas

[4] BS EN206:1 : 2000 Concrete Part 1: Specification, performance, production and conformity and BS 8500 – 1 : 2006 Concrete – Complementary British Standard to BS EN 206 – 1 Part 1

- Drip trays shall be placed under machinery left standing for prolonged periods
- All solid and liquid waste materials shall be properly disposed of at appropriate off site facilities
- Routine maintenance of vehicles shall be undertaken outwith the site
- There shall be no unapproved discharge of foul or contaminated drainage from the Development either to groundwater or any surface waters, whether direct or via soakaway
- Sanitary facilities shall be provided and methods of disposal of all waste shall be approved by regulatory bodies
- A programme of surface water quality monitoring would be undertaken during the construction phase to provide assurances as to the absence of water quality impacts
- RES has a policy that no wind turbines, auxiliary and electrical equipment would contain askarels or Polychlorinated biphenyls (PCBs).

1.130 In the unlikely event of an environmental pollution incident, there will be an emergency response procedure to address any accidental pollution incident. For example, a procedure requiring the use of spill kits to contain the material and procedures to ensure that NIEA is notified on their Pollution Hotline number (0800 807060) within 30 minutes of an incident (unless unsafe to do so), will be applied.

General Drainage Design

1.131 As set out in **Chapter 9:** Geology and the Water Environment, buffers to watercourses have taken account of and infrastructure designed in accordance with best practice guidance.

1.132 The potential impact of preferential routing of drainage and associated erosion and sediment wash-off within the sub-catchments draining the site would be mitigated through the following measures which would be incorporated into the SuDS Design:

- Maintaining existing overland flow routes and channels. Existing natural flow paths lateral to access roads will be maintained through the use of piped crossings under road alignments at natural depressions and at regular intermediate intervals. The spacing of cross drains will be specified at detailed design stage;
- Avoiding transporting rainfall runoff in long linear drainage swales by providing regular channel “breakouts”, whereby water is encouraged to flow overland, thus maintaining existing natural hydrological patterns;
- Reducing surface water flow rates and volumes by attenuating runoff from tracks and hard standings “at source” by providing check-dams in swales, whereby the flow velocity and rate of discharge is artificially reduced to mimic natural properties;

- Providing settlement ponds at turbine hard standing areas and other main surface water discharge locations, where runoff from significant new impermeable areas is treated and attenuated before being released overland;
- All swales, crossings and other hydraulic features will be engineered to ensure that dimensions are suitable to convey predicted flows and so prevent build-up of surface water and / or flooding.

Runoff and Sediment Control Measures

1.133 The following measures would be used to mitigate any potential impacts on the water quality of the sub-catchments through peat erosion, stream acidification and metals leaching during construction. These are incorporated into the CDMS:

- Appropriate sediment control measures (silt fences, attenuation ponds, etc.) would be used in the vicinity of watercourses, springs or drains where natural features (e.g. hollows) do not provide adequate protection
- Sediment control measures (e.g. check dams, silt fences etc.) would be employed within the existing artificial drainage network during construction. These would be regularly checked and maintained during construction and for an appropriate period following completion
- Watercourses would be monitored throughout the construction period by the ECoW to identify any enhanced scouring of the catchment surface. If sediment from disturbed peat is excessively mobilised through the minor channels network these would be mitigated by temporary sediment control measures (e.g. geotextiles/straw/bales/brash)
- The extent of all excavations would be kept to a minimum and during construction activities surface water flows shall be captured through a series of cut-off drains to prevent water entering excavations or eroding exposed surfaces. If dewatering of excavations is required, pumped discharges would be passed through attenuation ponds and silt fences to capture sediments before release to the surrounding land
- Where there is a permanent relocation of peat, the ground would be reinstated with vegetation as soon as practicable
- Where practicable, vegetation over the width of the cable trenches would be lifted as turfs and replaced after trenching operations to reduce disturbance
- The movement of construction traffic would be controlled to minimise soil compaction and disturbance. Vehicle movements outside the defined tracks and hardstandings would be avoided
- Trenching or excavation activities in open land would be restricted during periods of intense rainfall and temporary landscaping would be provided, as

required, to reduce the risk of sediment transport to the natural drainage system

- Construction of the track and cable crossings will cease during periods of heavy rain (>25mm in 24 hours), significant snow event (>75mm lying) or extended period of freezing conditions (ground penetration>100mm). If necessary, upstream of the crossing would be dammed and water pumped around the construction zone. The construction period would be minimised as far as practicable.

Peat Slide, Erosion and Compaction Management

1.134 Management of the risk of peat slides and storage is now recognised in literature, and a range of measures have now become standard engineering practice for construction of roads over peat.

1.135 These measures would be adopted, as appropriate, on site, ensuring that:

- Concentrated loads, such as those arising from stockpiling of material from turbine foundation excavations, would not be placed on marginally or potentially marginally stable ground
- Concentrated water flows arising from any aspect of construction or operation of the Development would not be directed onto peat slopes and unstable excavations
- Construction would be supervised on a full time basis by engineers fully qualified and experienced in geotechnical matters
- Robust drainage plans would be developed
- Work practices would be reviewed, modified as necessary and adopted to ensure that existing stability is not compromised
- Appropriate ground investigation and movement monitoring practices would be adopted.

1.136 Preliminary peat investigations on site indicated that there is minimal peat coverage on the proposed development area. Where peat exceeds 1.5m locally, infrastructure has been designed to avoid these where practicable.

1.137 In consideration of the above and the minimal peat disturbance anticipated, particularly where infrastructure is planned on steeper topography, it is considered that the risk from peat slide and instability is low. Should a detailed ground investigation provide further evidence of deep peat, consideration will be given to the production of a Peat Stability Risk Assessment.

Traffic Management Plan

1.138 As detailed in **Chapter 11: Transport and Traffic**, a Traffic Management Plan (TMP) would be developed to ensure road safety for all users during transit of development loads. The TMP would outline measures for managing the convoy and would set out procedures for liaising with the emergency services to ensure that police, fire and ambulance vehicles are not impeded by the loads. The TMP would be developed in consultation with DfI, the police and the local community and agreed before deliveries to the Development commence.

Potential Construction and Decommissioning Phase Environmental Impacts

1.139 Construction is predominantly a civil engineering operation and would be phased over an approximate 12-18 month period. Construction of tracks and foundations would be progressive, minimising the number of simultaneously active locations and ensuring that traffic density is kept low. Erection would span approximately nine weeks toward the end of the work programme.

1.140 A programme of site reinstatement and enhancement would be put in place to minimise the visual and ecological impacts on the land, in accordance with the Outline Habitat Management Plan (Appendix 6.6).

1.141 The Development would operate for approximately 35 years and would require only limited maintenance and inspection visits.

1.142 A detailed restoration plan / Decommissioning Method Statement would be prepared and agreed with the relevant authorities towards the end of the Development's operational life.

List of Figures and Appendices

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Appendices

2

PLANNING POLICY

2 PLANNING POLICY

Introduction

2.1. This Planning Policy chapter has been prepared by Turley on behalf of the applicant, RES Ltd. Turley are a full service national planning and development consultancy with experience of over 30 years of working in planning and property from a network of offices across the UK and Ireland.

2.2. This chapter demonstrates how energy and planning policy considerations have been addressed in the development proposal. The chapter opens by describing the high level policy context within which the project has been conceived and falls to be determined. It then assesses the project's compliance with operational planning policy on a policy by policy basis.

Scope of Assessment

Legislation and Policy Framework

UN GLOBAL POLICY

Rio Earth Summit

2.3. Since the Earth Summit in Rio de Janeiro in 1992 there has been a global trend in the search for more sustainable energy production. A number of key documents, including the Rio Declaration on Environment and Development and the Framework Convention on Climate Change, were developed as a result of the summit. The Rio Declaration (UNEP, 1992) set out 27 guiding principles for sustainable development and emphasised that long term growth needed to be grounded in the environment.

2.4. Since the 1992 Earth Summit, the subject of renewable energy has been at the forefront of UN policy with a goal to increase the uptake of renewable technologies. The main driver behind this goal has been the increasing greenhouse gas (GHG) emissions and their climate change consequences.

Kyoto Protocol

2.5. The Kyoto Protocol of the United Nations Framework Convention on Climate Change (UNFCCC, 1998) originated from the Rio Earth Summit. The Protocol was adopted in Kyoto, Japan in 1997 and came into force in February 2005. It sets binding targets for reducing GHG emissions that apply to 37 industrialised countries (including the European Community), which have a target to reduce GHG emissions from 1990 levels by 5% over the period of 2008 to 2012. Within this, the European Community has a reduction target of 8% which is distributed across the member states. The United Kingdom's reduction target is 12.5% (European Union, 2002).

2.6. The Kyoto Protocol sets out measures by which countries can meet their reduction targets. As a result, the Protocol resulted in the creation of a 'Carbon Market' where GHG emissions are tracked and traded as a commodity. It can be seen as the main catalyst for the development and promotion of renewable technologies.

The Paris Agreement

2.7. The Paris Agreement establishes a framework for global climate action including the mitigation of and adaption to climate change, support for developing nations and the transparent reporting and strengthening of climate goals. The European Union signed The United Kingdom of Great Britain and Northern Ireland up to the Agreement on 22 April 2016 and it came into force on the 18 December 2016.

COP26

2.8. The 26th UN Climate Change Conference of the Parties (COP26) took place in Glasgow on 21 October – 12 November 2021, attended by the countries that signed the United Nations Framework Convention on Climate Change. At COP 26, Nations adopted the Glasgow Climate Pact, aiming to turn the 2020s into a decade of climate action and support. Key outcomes included strengthened efforts to build resilience to climate change, to curb greenhouse gas emissions and to provide the required necessary finance. Nations reaffirmed their duty to fulfil the pledge of providing $100 billion annually to developing countries. They collectively agreed to reduce the gap between existing emission reduction plans and what is required to reduce emissions in order to limit the rise in the global average to 1.5 degrees. Nations were called upon to phase down unabated coal power and inefficient subsidies for fossil fuels.

2.9. As part of the package of decisions, nations also completed the Paris Agreement's rulebook relating to market mechanisms and non-market approaches and the transparent reporting of climate actions. This set of rules lays out how countries are held accountable for delivering on their climate action promises and self-set targets under their Nationally Determined Contributions (NDCs). At COP26, Nations reached new agreements for market mechanisms, essentially supporting the transfer of emission reductions between countries while also incentivising the private sector to invest in climate-friendly solutions.

Strategic European Energy Review

2.10. The Strategic Energy Review was first published in 2007 to establish a core energy policy for all of Europe (Commission of the European Communities, 2007). An agenda was agreed in order to achieve the key energy objectives of:

- Sustainability;
- Competitiveness and security of supply;
- Reducing GHG emissions by 20%;

- Obtaining 20% of energy consumed from renewable energy sources; and
- Improving energy efficiency by 20%.

2.11. The Review was updated in 2008 (Commission of the European Communities, 2008), in order to propose an Energy Security and Solidarity Action Plan, which focused on diversification of energy supply, energy efficiency and making the best of the European Union’s indigenous energy resources.

2.12. Development of renewable energy reserves, including wind, solar, hydro, marine and biomass energy are seen as the main sources of indigenous energy.

The Energy Road Map 2050

2.13. The Road Map (Commission of the European Communities) sets out a long-term vision for renewable energy sources in the European Union and it forms an integral part of the Strategic European Energy Review. The Energy Roadmap 2050 sets out the transition and cost effective pathways for key economic sectors for achieving an 80-95% reduction in EU emissions by 2050. To achieve this goal, significant investment is needed in new low-carbon technologies and infrastructure, energy efficiency and renewable energy.

2.14. The 2050 target will not be shifted into national targets via EU legislation, but allows more flexibility for Member Countries to meet their greenhouse gas emission reduction targets in the most cost effective method in regards to their own specific circumstances.

EU Directive 2009/28/EC on the Promotion of the use of Energy from Renewable Sources

2.15. In 2009, EU Directive 2009/28/EC (European Union, 2009) came into force in order to update Directive 001/77/EC in promoting the use of energy from renewable sources. Goals of the Directive are to improve the security and diversification of energy supply and to provide environmental protection and social and economic cohesion. The 2009 Directive further establishes this framework for promoting energy from renewable sources and it updates national targets relating to this goal. It also requires each member state to have a national renewable energy action plan in place and ready for adoption by 30 June 2010. The updated goals of the 2009 Directive are:

- A 20% target for electricity from renewable sources by 2020; and
- The UK to achieve 10% of electricity from renewables by 2010, and 15% by 2020.

2.16. The Directive was revised in 2016 to make the EU a global leading in renewable energy and ensure that the target of the final energy consumption being at least 27% renewables is met by 2030.

UK ENERGY POLICY

UK Climate Change Programme

2.17. The UK government developed a Climate Change Programme in 2000 (DECC, 2000) in response to its commitment at the 1992 Earth Summit at Rio de Janeiro. The Programme was updated in 2006 (DECC, 2006). It sets out the UK's policies and priorities for action to reduce greenhouse gas emissions. Broadly, the targets for the UK are as follows:

- Reducing GHG emissions to 12.5% below 1990 levels by 2008-2012; and
- Moving towards a domestic UK goal of 20% cut in CO2 emissions below 1990 levels by 2010.

UK Climate Change Act 2008

2.18. The UK government in June 2019 set out amendments to the Climate Change Act 2008 in the Climate Change Act 2008 (2050 Target Amendments) Order 2019. This is to ensure net greenhouse gas emissions in 2050 are at least 100% lower than the 1990 baseline. The targets set out in the Act, which cover all sectors of the economy, are legally binding and came into effect on 27 June 2019. The 'net zero' target represents a significant step-change in the commitment to addressing the climate crisis.

UK Renewable Energy Strategy 2009

2.19. The UK Renewable Energy Strategy, published by the Department of Energy and Climate Change (2009), forms the basis of the UK National Renewable Energy Action Plan required under the terms of the Renewable Energy Directive (2009/28/EC). The Strategy sets out the path required for the UK to meet its legally binding target, in order to ensure that 15% of our energy (across electricity, heat and transport) comes from renewable sources by 2020. This is a seven fold increase in the share of renewable energy sources in scarcely more than a decade.

2.20. It makes it clear that achievement of such a target will only be possible with strong co-ordinated efforts by central, regional and local government as well as public groups, the private sector and dedicated communities. It clearly sets out the role Government will adopt and the specific actions it will take in order to deliver the strategy.

UK National Renewable Energy Action Plan 2010

2.21. This National Renewable Energy Action Plan provides details on a set of measures that would enable the UK to meet its 2020 target (Department of Energy and Climate Change (DECC), 2010). The 2009 Renewable Energy Directive sets a target for the UK to achieve 15% of its energy consumption from renewable sources by 2020. This compares to only 1.5% in 2005.

NORTHERN IRELAND ENERGY POLICY

Strategic Energy Framework for Northern Ireland 2010

2.22. The aim of the Framework (DETI, 2010) is to set out the direction for energy policy for the region. It is an update to the 2004 Strategic Energy Framework which recognises that significant changes have taken place since the publication of the 2004 framework, setting out a goal for Northern Ireland to increase to 40% of electricity consumption from renewable sources by 2020.

2.23. The Strategic Energy Framework recognises the importance of renewable energy and onshore wind in particular in helping Northern Ireland secure its energy supply and meet European and national targets.

2.24. The Framework is committed to supporting and developing the industry.

Northern Ireland Energy Strategy – Path to Net Zero Energy

2.25. In part due to the recognition that the 40% target set in the existing Strategic Energy Target has been met, the Department for the Economy commenced work to developing a new Energy Strategy for Northern Ireland. The publication of a Call for Evidence was undertaken in 2019 and was part of an on-going public engagement process to inform and shape the strategy. The Call for Evidence was the first stage in a programme of work aimed at developing a new long-term strategy for decarbonisation of the Northern Ireland energy sector by 2050 at least cost to the consumer.

2.26. The Department for Economy set out intentions of an Energy Strategy Options public consultation issued by the end of March 2021, with the responses from this informing the final Energy Strategy.

2.27. The work by the Department for Economy on the Energy Strategy is set in the context of their Analytical Services Unit data published on 4 June 2020 which confirms that for the 12 month period April 2019 to March 2020, 46.8 per cent of total electricity consumption in Northern Ireland was generated from renewable sources located in Northern Ireland. This represents an increase of 3.9 percentage points on the previous 12 month period (April 2018 to March 2019) and is the highest rolling 12 month proportion on record.

2.28. In terms of the volume of electricity consumption between April 2019 and March 2020, some 7,695 Gigawatt hours (GWh) of total electricity was consumed in Northern Ireland. Over the same period, some 3,604 GWh of electricity was generated from renewable sources within Northern Ireland.

2.29. Of all renewable electricity generated within Northern Ireland over the 12 month period April 2019 to March 2020, 85.4 per cent was generated from wind. This compares to 84.7 per cent for the previous 12 month period (April 2018 to March 2019).

2.30. The new Energy Strategy – The Path to Net Zero Energy was published in December 2021. It outlines a roadmap to 2030 aiming to deliver a 56% reduction in energy-related emissions, on the pathway to deliver the 2050 vision of net zero carbon and affordable energy. The Energy Strategy sets three main targets to drive these changes including delivering energy savings of 25% from buildings and industry by 2030; doubling the size of the low carbon and renewable energy economy to a turnover of more than £2bn by 2030; and meeting at least 70% of electricity consumption from a diverse mix of renewable sources by 2030. Such provisions would be in alignment with the Republic of Ireland's aim of 70% renewable electricity by 2030 as set out within the Region's Renewable Electricity Support Scheme (RESS). The Energy Strategy recognises that meeting this 70% target likely means doubling renewable energy capacity in order to meet new demands from heating our homes and powering our vehicles.

Northern Ireland Executive Programme for Government

2.31. The 2011-2015 Programme for Government (OFMDFM Economic Policy Unit, 2011) underlined the Northern Ireland Executive's commitment to the principles of an open and accountable government. The Programme established a key commitment seeking the achievement of 20% of electricity consumption from renewable sources and 4% renewable heat by 2015 in Northern Ireland and introduced milestones to reach in the intervening years to meet these targets. Priorities of the Executive included:

2.32. Growing a Sustainable Economy and Investing in the Future;

- Creating Opportunities, Tackling Disadvantage and Improving Health and Wellbeing;
- Protecting Our People, the Environment and Creating Safe Communities;
- Building a Strong and Shared Community; and
- Delivering High Quality and Efficient Public Services.

2.33. The Executive reported that it will continue to work towards a reduction in greenhouse gas emissions by at least 35% on 1990 levels by 2025 (DOE).

2.34. A new draft Programme for Government Framework was consulted on during 2016 and uses an outcomes-based approach. These outcomes are things with which people can identify, such as living longer and healthier lives or attracting better jobs - and are designed to stay in place for a generation rather than a single Assembly term.

2.35. Since June 2018 and in the (then) absence of an Executive and continued absence of a final Programme for Government, the NI Civil Service Outcomes Delivery Plan (ODP) became a key strategic document, setting out the actions that departments had put in place to give effect to the objective of improving wellbeing for all by tackling disadvantage and driving economic growth. The development of the new Energy Strategy was identified as contributing to a Key Strategic Area within

Outcome 1 – 'We prosper through a strong, competitive, regionally balanced economy.' Outcome 2 – 'We live and work sustainably – protecting the environment' references reductions in greenhouse gas emissions. The expansion of onshore wind capacity in Northern Ireland provides a clear route to delivering required long term reductions in greenhouse gas emissions.

Onshore Renewable Electricity Action Plan 2011-2020

2.36. The Department of Enterprise, Trade and Investment (DETI) published the Onshore Renewable Electricity Action Plan 2013-2020 (OREAP) for Northern Ireland in November 2013. The overarching aim of the OREAP is to optimise the amount of electricity sustainably generated from onshore renewable resources in order to enhance diversity and security of supply, reduce carbon emissions, contribute to Northern Ireland's target of 40% of electricity consumption to come from renewable energy sources by 2020 and to develop business and employment opportunities for Northern Ireland companies.

2.37. The OREAP states that with a lack of indigenous fossil fuel, no nuclear power stations and a wealth of potential renewable resources such as wind, the development of renewable technologies will play a vital role in the diversification of the future energy mix in Northern Ireland and could deliver significant investment and employment opportunities.

2.38. OREAP focuses on renewable assessments undertaken by DETI and concludes from such reports that onshore wind still has significant deployment potential. However, deployment rates are slower than previously modelled. The results of the Strategic Environmental Framework (SEF) which support the plan provide "there is still capacity for additional development to be accommodated in existing locations, for example, in the northwest". Furthermore, it is maintained that clustering development in existing locations could reduce potentially significant adverse effects occurring in other undeveloped locations.

2.39. Development should also be targeted to areas where there is already access to the grid or where grid upgrades or the provision of new infrastructure has already been planned and assessed. The plan concludes that in order to manage or limit potential adverse effects, the preferred option would be to allow onshore wind developments to continue, where possible, to cluster in existing areas of development, before moving into new areas.

Sustainable Energy Action Plan 2012 - 2015

2.40. The Action Plan was published by the DETI in May 2012 with the primary aim of clearly showing what the Northern Ireland Executive was doing to promote sustainable energy in Northern Ireland. The Plan recognises the importance of decarbonising energy production in Northern Ireland and working towards the target of 40% consumption of electricity from renewable sources by 2020.

2.41. A key action of the Plan is that the Northern Ireland Executive will work closely with developers, planners and those responsible for environmental consents to ensure the need for renewable energy to address the environmental impact of climate change is recognised and that procedures are in place for consenting of renewable installations.

Everyone's Involved - Sustainable Development Strategy 2010

2.42. This Sustainable Development Strategy (OFMDFM May 2010) aims to bring viability, stability and opportunity to all of our social, economic and environmental activities and programmes. The vision for sustainable development echoes the Programme for Government. It is intended to reinforce the commitment to ensuring that the principles of sustainability reach into all activities of Government and that everyone is involved in achieving the objectives of the Sustainable Development Strategy.

2.43. The Strategy sets out the themes of economic prosperity, social cohesion, environmental protection and meeting our national and international responsibilities and there are two guiding principles that express the overarching ambitions of the Strategy:

- living within environmental limits; and
- ensuring a strong, healthy, just and equal society.

2.44. There are four principles that describe the necessary conditions for the achievement of sustainable development:

- Achieving a sustainable economy
- Promoting good governance
- Using sound science responsibility
- Promoting opportunity and innovation.

2.45. Six Priority Action Areas are then expressed providing the framework for the actions each department will take in support of achievement of sustainable development:

- Building a dynamic, innovative economy that delivers the prosperity required to tackle disadvantage and lift communities out of poverty.
- Strengthening society such that it is more tolerant, inclusive and stable and permits positive progress in quality of life for everyone
- Driving sustainable, long term investment in key infrastructure to support economic and social development.
- Striking an appropriate balance between the responsible use and protection of natural resources in support of a better quality of life and a better quality environment.
- Ensuring reliable, affordable and sustainable energy provision and reducing our carbon footprint.

- Ensuring the existence of a policy environment which supports the overall advancement of sustainable development in and beyond government.

2.46. Priority Action Area 5 is of particular relevance and a set of Strategic Objectives have been identified that will be pursued in this area. These are the biggest and most urgent challenges in this Priority Area. The objectives are as follows:

- Reduce greenhouse gas emissions;
- Increase the proportion of energy derived from renewable sources;
- Implement energy efficiency measures particularly for vulnerable groups;
- Increase energy security; and
- Adapt to the impacts of climate change.

2.47. The strategy recognises that the Private Sector has a role to play, contributing innovation, focus and responsiveness in the move towards a 'sustainability focused' society. The strategy seeks to champion pro-activity and innovation across the private sector in support of the sustainability vision, creating a pathway to accelerate implementation of new technologies and solutions.

Tomorrow's Energy Scenarios Northern Ireland 2019 (TESNI 2019)

2.48. The System Operator for Northern Ireland (SONI) launched a consultation document - Tomorrow's Energy Scenarios Northern Ireland 2019 (TESNI 2019) in September 2019. This sets out scenario planning as a means to create a range of possible energy futures that capture the impact of changes in moving to low carbon electricity for NI.

Strategic Assessment Summary:

2.49. The rationale for the project is clear. Making an energy infrastructure contribution of the scale proposed (58.8MW) will assist in the achievement of NI strategic energy targets and objectives, consistent with a wide range of International, European, UK and Regional level priorities.

2.50. The proposal will offer job creation and economic activity to the regional economy providing significant benefits to and investment in Northern Ireland.

2.51. Given the 35-year lifetime of the development it is expected that direct operational impacts equate to 35 jobs, £1.32 million direct wages and £8.32 million of direct Gross Value Added over the operational phase.

2.52. Both the construction and operational phases will generate increased tax and business rates revenue and the proposal is estimated to involve a capital spend of £61.71 million.

2.53. The amount of electricity that could be produced by the proposed development is estimated at 236.9gWh per year which is enough electricity to meet the needs of 62,800 homes each year, over 6,000 more than the current housing stock (of approximately 56,500) in the local area.

2.54. The proposed development is also estimated to reduce CO_2 emissions by 104, 300 tonnes each year.

Northern Ireland Planning Policy

Regional Development Strategy 2035 Building for a Better Future

2.55. The revised RDS was prepared under the Strategic Planning (Northern Ireland) Order 1999. It is an overarching strategic planning framework for the future development of Northern Ireland to 2035 and the spatial strategy of the Executive. The Order requires Departments to have regard to the RDS in exercising any functions in relation to development and it influences investment by the private sector. It represents the top tier in the hierarchy of planning policy and guidance in Northern Ireland and aims to provide a long term policy direction with a strategic spatial perspective. It is material to decisions on individual planning applications and planning appeals and is an important consideration in determining major planning applications of strategic importance. It was agreed by the Executive on 26 January 2012 following a 12 week public consultation exercise and stakeholder meetings.

2.56. The revised RDS sets out a vision and eight aims intended to support the Programme for Government. It also contains two types of Strategic Guidance – Regional Guidance of relevance everywhere in the region and Spatial Framework Guidance which is drafted specifically for each of five separate components based on functions and geography. The component of relevance to this project is the Rural Area.

2.57. The Regional Guidelines (RG) relevant to the project are RG4 (Promote a sustainable approach to the provision of tourism infrastructure) and RG5 (Deliver a sustainable and secure energy supply). RG4 states that tourism can make a step change in the economy and emphasises the quality of our natural assets. RG5 states that new energy generation or distribution infrastructure must be carefully sited to avoid adverse environmental effects, particularly on or near protected sites. It goes on to say that decision makers will have to balance impacts against the benefits from a secure renewable energy stream. There is a clear commitment to increasing the contribution that renewable energy can make to the overall energy mix: *"There will need to be a significant increase in* all types of renewable electricity installations...., including a wide range of renewable resources for electricity generation both onshore and offshore to meet the Region's needs."

2.58. RG9 (reduce our carbon footprint.....) picks up the same theme of increasing the use of renewable energies and refers to the targets set in the Strategic Energy Framework. Having stated the targets RG9 confirms that "this {meeting the 40% target} will require increasing numbers of renewable electricity installations and the grid infrastructure to support them. These must be appropriately sited to minimise their environmental impact." The same RG emphasises the need to protect and extend the ecosystems and habitats that can reduce or buffer the effects of climate change. Peat bogs are identified as sinks or stores for carbon if undisturbed.

2.59. RG11 (Conserve, protect and, where possible, enhance our built heritage and our natural environment) states that the environment is one of Northern Ireland's most important assets and emphasises the responsibility we have to protect it for the benefit of future generations. Specific objectives are set for the built and natural heritage including references to protecting archaeological sites/monuments, historic buildings/landscapes, priority species, designated habitat sites, landscape character, scenic quality and protected landscapes.

2.60. The Spatial Framework Guidance relates to each of the five key components of the Spatial Framework.

2.61. SFG13 (Sustain rural communities living in smaller settlements and the open countryside) refers to the need for development to be sensitive to the ability of landscapes to absorb development. Industries such as tourism and renewable energy are identified as being able to provide jobs and opportunities in rural areas so long as they are integrated appropriately within the rural landscape.

2.62. Section 4 of the revised RDS specifically addresses the matter of regionally significant infrastructure.

2.63. Paragraph 4.4 identifies 'Strategic Projects' capable of contributing to economic infrastructure development as including those that contribute to the achievement of renewable energy targets.

2.64. Paragraphs 4.15 to 4.18 refer specifically to renewable energy.

2.65. Paragraph 4.15 refers to the 40% SEF target and states that "this is likely to mean an increase in the number of wind farms both on and off shore..." Paragraph 4.16 refers to the need to strengthen the electricity grid. Paragraph 4.17 refers to the importance of interconnection. Paragraph 4.24 refers again to the need to increase the use of renewable energy sources to address climate change targets.

2.66. **Assessment:** Delivering a new installation for the generation of renewable energy is consistent with the imperative to meet the strategic energy targets and in line with the RDS' expectation that this will mean an increase in the number of wind farms. This ES provides sufficient information on each of the interests of acknowledged planning importance identified in the RDS to conclude that the benefits of the scheme outweigh the mitigated environmental impacts.

Planning Policy Statements

Strategic Planning Policy Statement for Northern Ireland (SPPS)

2.67. The SPPS was published by the Department of the Environment on 28 September 2015 as a statement of policy on important planning matters. Agreed by the NI Executive and judged to be in general conformity with the RDS, its provisions apply to the whole of Northern Ireland and are material to all decisions on individual planning applications.

2.68. The existing suite of Planning Policy Statements (PPS) and the remaining provisions of the Planning Strategy for Rural Northern Ireland (PSRNI) will be cancelled when all eleven Councils have adopted a new Plan Strategy (para 1.9).

2.69. A transitional period will apply until such times as a Council's Plan Strategy has been adopted. Paragraph 1.10 states:

2.70. 'A transitional period will operate until such times as a Plan Strategy for the whole of the council area has been adopted. During the transitional period planning authorities will apply existing policy contained within the documents identified below together with the SPPS. Any relevant supplementary and best practice guidance will also continue to apply.'

2.71. Paragraph 1.12 sets out the approach which will be taken where there is conflict between the SPPS and retained policy:

2.72. Any conflict between the SPPS and any policy retained under the transitional arrangements must be resolved in the favour of the provisions of the SPPS. For example, where the SPPS introduces a change of policy direction and/or provides a policy clarification that would be in conflict with the retained policy the SPPS should be accorded greater weight in the assessment of individual planning applications. However, where the SPPS is silent or less prescriptive on a particular planning policy matter than retained policies this should not be judged to lessen the weight to be afforded to the retained policy.

2.73. Paragraph 1.13 identifies retained policy as including the following PPSs relevant to this project:

- PPS 2: Natural Heritage (considered within Chapters 4, 6, 7, 8 & 9)
- PPS 3: Access, Movement and Parking (considered within Chapter 11)
- PPS 3 (Clarification): Access, Movement and Parking (considered within Chapter 11)
- PPS 6: Planning, Archaeology and The Built Heritage (considered within Chapter 5)
- PPS 10: Telecommunications (Policy TEL 2 is cancelled) (considered within Chapter 3)
- PPS 15 Revised: Planning and Flood Risk (considered within Chapter 9)
- PPS 16: Tourism (considered within Chapters 4 & 13)
- PPS 18: Renewable Energy (considered within Chapters 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 & 13)
- PPS 21: Sustainable Development in the Countryside (considered within Chapters 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 & 13).

2.74. As per SPPS paragraph 1.12, in this period before the Council adopts its Plan Strategy, it is necessary to assess whether there is a conflict between the SPPS and any retained policy. Paragraph 1.12 provides an example of such a circumstance –

where the SPPS contains a change in policy direction and/or a policy clarification in conflict with retained policy.

2.75. In his written statement dated 28 September 2015, introducing the SPPS, the Minister made the following comments:

2.76. There are a number of subject policies that are likely to be of particular interest to Assembly Members.

2.77. The first of these is Renewable Energy. Having taken into account all the comments received on the draft SPPS and following additional engagement with the Committee and others in relation to this particular policy area, the SPPS has been revised and improved.

2.78. There is a greater acknowledgement of the contribution the renewable energy industry makes towards achieving sustainable development, as a provider of jobs and investment across the region, and an acknowledgement of wider government policy support for the use of renewable energy sources. This includes reference to DETI's Strategic Energy Framework.

2.79. Furthermore, the SPPS seeks to more closely reflect PPS 18 by making it clearer that development that generates energy from renewable resources will be permitted where the proposal and any associated buildings and infrastructure, will not result in unacceptable adverse impacts on interests of acknowledged importance.

2.80. In relation to how the wider environmental, economic and social benefits are to be assessed the SPPS clarifies that planning authorities will give such considerations 'appropriate' weight in determining whether planning permission should be granted.

2.81. It is also considered appropriate that a cautious approach in designated landscapes, as per the current best practice guidance, is reflected in strategic policy and therefore this approach has been carried forward in the SPPS.

2.82. Where appropriate, the SPPS also takes into account the recommendations of the Report of the Environment Committee's Wind Energy Inquiry.

2.83. This statement confirms that the SPPS clarifies policy on the weight to be attached to social, environmental and economic considerations in the determination of planning applications. PPS18 Policy RE1 states that 'significant' weight 'must' be attached to such considerations whereas paragraph 6.225 of the SPPS states that 'appropriate' weight should be attached:

2.84. The wider environmental, economic and social benefits of all proposals for renewable energy projects are material considerations that will be given appropriate weight in determining whether planning permission should be granted.

2.85. The change in wording means that whereas PPS18 directs the weight to be attached to the benefits, the SPPS provides the decision maker with discretion in deciding the appropriate amount of weight to be attached to the benefits. In making such a judgement, it is anticipated that the decision maker will take account of the extent of the benefits in a relative or proportionate way. Where a scheme, such as this, will deliver large scale benefits (as set out within the Socio Economic details at Chapter 13), it would be logical to suggest that the decision maker would conclude it appropriate to give significant weight to the benefits. The consequence of this is that if a scheme would deliver only small scale benefits, less weight would be attached to the benefits.

2.86. The other main provisions of PPS18 and its associated Best Practice Guidance are carried through into the SPPS including:

- The direction to take particular care when considering the potential impact of all renewable proposals on the landscape (para 6.222);
- The direction to apply a cautious approach for renewable energy projects within designated landscapes of significant value such as Areas of Outstanding Natural Beauty (para 6.223);
- The presumption in favour of renewables proposals where there will be no unacceptable adverse effect on the PPS18 set of planning considerations (6.224);
- Stating that renewable energy development on active peatland will not be permitted unless there are imperative reasons of overriding public interest (para 6.226);
- Specifying that for wind farm development a separation distance of 10 times rotor diameter to occupied property, with a minimum distance of not less than 500m, will generally apply;
- Confirming that consideration of renewables projects will take account of their contribution meeting wider environmental benefits (para 6.228);
- Confirmation that the factors considered in a planning decision will include the wider environmental benefits as well as normal planning criteria (paragraph 6.229);
- A restatement of the acknowledgement that windfarms are highly visible in the landscape yet this does not render them unacceptable, and the reference to the skill of the designer and the characteristics of the receiving landscape (paragraph 6.230);
- The requirement, where a project will result in unacceptable damage, for an indication of how such damage will be minimised, mitigated and compensated for (paragraph 6.231);
- The requirement to provide details of future decommissioning and site restoration (paragraph 6.233);
- The direction to take account of the supplementary planning guidance ‘Wind Energy Development in Northern Ireland’s Landscapes’ and all other practice notes in assessing all wind turbine proposals (paragraph 6.234).

2.87. This chapter considers the retained policy framework having regard to the SPPS and its associated transition arrangements.

Planning Policy Statement 2 – Natural Heritage

2.88. PPS2 is retained policy for the purposes of the SPPS transition arrangements. There is considered to be no conflict with the equivalent provisions in the SPPS, therefore until the Council adopts its Plan Strategy, its provisions will apply, together with the SPPS, with no less weight attached to the retained policy.

2.89. SPPS policy on Natural Heritage is set out on pages 80 to 85. It consolidates and restates policy set out in PPS2. The Minister did not identify any conflicts or clarifications in his statement launching the SPPS. The principal focus of this section is, therefore, on PPS2.

2.90. PPS 2 was published in July 2013 and provides strategic planning policy for the conservation, protection and enhancement of the natural heritage. For the purpose of the PPS, natural heritage is defined as 'the diversity of our habitats, species, landscapes and earth science features'.

2.91. The policy lists its objectives as:

- To seek to further the conservation, enhancement and restoration of the abundance, quality, diversity and distinctiveness of the region's natural heritage;
- To further sustainable development by ensuring that biological and geological diversity are conserved and enhanced as an integral part of social, economic and environmental development;
- To assist in meeting international (including European), national and local responsibilities and obligations in the protection and enhancement of the natural heritage;
- To contribute to rural renewal and urban regeneration by ensuring developments take account of the role and value of biodiversity in supporting economic diversification and contributing to a high quality environment;
- To protect and enhance biodiversity, geo-diversity and the environment; and
- To take actions to reduce our carbon footprint and facilitate adaptation to climate change.

2.92. The policy at paragraph 3.3 notes that in taking decisions, the Department should ensure that appropriate weight is attached to designated sites of international, national and local importance; priority and protected species; and to biodiversity and geological interests within the wider environment.

2.93. At section 5 the PPS lists the policy context and statutory framework, addressing international, national and local contexts.

2.94. The Proposed Development is located in the Antrim Coast and Glens Area of Outstanding Natural Beauty (AONB). The Development site occupies part of the southern slopes of the 'Garron Plateau', below the 'Binnagee Peak'. As expanded upon in Chapter 6, the area is designated as a Special Area of Conservation (SAC) and Area of Specific Scientific Interest (ASSI). Four of the proposed turbines are located within the Antrim Hills Special Protection Area (SPA).

2.95. Relevant policies to the Proposed Development include:

- Policy NH1 – European and Ramsar Sites – International;
- Policy NH 3 – Sites of Nature Conservation Importance (National);
- Policy NH 4 – Sites of Nature Conservation Importance (Local);
- Policy NH 5 – Habitats, Species or Features of Natural Heritage Importance;
- Policy NH6 – Areas of Outstanding Natural Beauty.

2.96. The policies outline that a development will only be granted planning permission if it does not have a significant adverse impact on the environment. In the instance that there will be an adverse impact on a site, development may only be permitted when the benefits of the proposed development outweigh the value of the site, habitat or species.

2.97. Chapter 7 of this ES assesses the impact of the Proposed Development from an ornithological perspective and concludes that it is unlikely to have any significant adverse effects on local bird populations or on the regional conservation status of any species of Conservation Concern.

2.98. As part of the assessment, mitigation measures are proposed in the form of an Outline Habitat Management Plan (Appendix 6.6) which will minimise the effects of the development.

INTERNATIONAL SITES

2.99. In relation to international sites, such as SACs & SPAs, Policy NH1 - European and Ramsar Sites – International, sets out the relevant planning policy requirements.

2.100. The policy indicates that planning permission will only be granted for a development proposal that, either individually or in combination with existing and/or proposed plans or projects, is not likely to have a significant effect on an SAC or SPA. In line with the legislative framework it goes on to state:

Where a development proposal is likely to have a significant effect (either alone or in combination) or reasonable scientific doubt remains, the Department shall make an appropriate assessment of the implications for the site in view of the site's conservation objectives. Appropriate mitigation measures in the form of planning conditions may be imposed. In light of the conclusions of the assessment, the Department shall agree to the development only after having ascertained that it will not adversely affect the integrity of the site.

2.101. The final part of the policy describes the type of exceptional circumstances where proposals which could adversely affect the integrity of an international site may be permitted.

2.102. The area is a designated as a Special Area of Conservation (SAC) and Area of Specific Scientific Interest (ASSI). Four of the proposed turbines are located within the

Antrim Hills Special Protection Area (SPA). The SPA has been designated for its breeding populations of hen harrier *Circus cyaneus* and merlin *Falco columbarius*.

2.103. Direct habitat loss (which would be relatively minor) to the four turbines and associated infrastructure located within the SPA boundary is highly unlikely to have any significant adverse effects on the hen harrier population within the local part of the SPA and by extension on the SPA population as a whole.

2.104. The Displacement effect, collision risk, and direct disturbance (nesting) are all unlikely and highly unlikely to occur to the hen harrier and merrin, therefore the local part of the SPA and by extension on the SPA population as a whole will not be significantly adversely impacted.

2.105. Mitigation is proposed to minimise potential effects including long term habitat management for breeding waders, an Ornithology Mitigation Strategy for the construction-phase and an Ornithology Management and Monitoring Plan along with the oHMP.

2.106. **Assessment:** Chapters 6, 7, 8, and 9 of this ES assess the impact of the Proposed Development on designated sites. The assessment concludes that there is a low potential of effect for the Proposed Development to have effects on designated sites. The scheme is downslope from Garron Plateau SAC/ASSI, the nearest designated site, and no effects are therefore considered likely. The Proposed Development therefore complies with Policy NH1.

European and National Species

2.107. In relation to European and National species protected by law, Policy NH2 sets out the relevant planning policy requirements. In relation to European protected species, the policy states that planning permission will only be granted for a development proposal that is not likely to harm a European protected species. It goes on to identify exceptional circumstances. In relation to National protected species, the policy states that planning permission will only be granted for a development proposal that is not likely to harm any other statutorily protected species and which can be adequately mitigated or compensated against.

2.108. **Assessment:** Chapters 6, 7, 8 and 9 of this ES assess the impact of the project on protected European and National Species, the Hen Harrier and Merlin.

2.109. Baseline surveys identified two pairs of hen harriers within a 5km extent of the development, however neither pair were closer than 4km of the development site. The assessment of effects indicates there are unlikely to be significant adverse effects on the hen harrier population within the local part of the SPA and by extension on the SPA population as a whole.

2.110. Baseline surveys have also indicated that breeding merlins are not currently present within the local part of the SPA (within a 2 km extent of the Development). It is unlikely that the development will cause a significant effect on the Merlin species. The Proposed Development therefore complies with Policy NH2.

National Sites

2.111. In relation to national sites, such as ASSIs, Policy NH3 – Sites of Nature Conservation Importance – National, sets out the relevant planning policy requirements.

2.112. The policy indicates that planning permission will only be granted for a development proposal that is not likely to have an adverse effect on the integrity, including the value of the site to the habitat network, or special interest of an ASSI. The policy indicates that a proposal which could adversely affect a site of national importance may only be permitted where the benefits of the proposed development clearly outweigh the value of the site. In such cases, appropriate mitigation and/or compensatory measures will be required.

2.113. **Assessment:** Chapters 6, 7, 8 and 9 of this ES assess the impact of the project on the ASSI designated site, the Garron Plateau. There are also 13 ASSI's within 7.5km of the centre of the development.

2.114. Assessment on statutory sites Garron Plateau SAC; Straidkilly Wood ASSI Glenarm Woods ASSI, Glenarm Woods ASSI Part2, concluded that there is low potential for works to have effects on designated sites because of the distance of the scheme from sites. The scheme is downslope from Garron Plateau SAC/ASSI, the nearest designated site, and no effects are therefore likely on this site.

2.115. Identification and evaluation of likely significance of effects associated with the development during construction, operation and decommissioning phases permit recommendation of appropriate mitigation measures to avoid and/or reduce the predicted adverse effects of the Proposed Development on the recorded ecological receptors identified as part of the baseline survey. While the proposed development is outside the ASSI designation, habitat specific and species specific mitigation measures are proposed, outlined in Table 6.16 'Summary of Residual Impacts after Mitigation and Enhancement' in Chapter 6.

2.116. The potential adverse effects of the development on the red grouse relate principally to displacement due to disturbance during construction however the effect would be temporary with red grouse densities recovering after construction. The disturbances are unlikely to extend beyond a 500m extent from the development. Therefore, it is unlikely that the development would have any significant adverse effects on the red grouse population within the local part of the ASSI and by extension on the ASSI population as a whole. The Proposed Development therefore complies with Policy NH3.

Habitats, Species or Features of Natural Heritage Importance

2.117. Policies relevant to Habitats, Species or Features of Natural Heritage Importance are set out at Policy NH5. The policy indicates that a development proposal which is likely to result in an unacceptable adverse impact on, or damage to, habitats, species or features may only be permitted where the benefits of the proposed development outweigh the value of the habitat, species or feature. In such cases, appropriate mitigation and/or compensatory measures will be required.

2.118. This policy applies to priority habitats; priority species; active peatland; ancient and long-established woodland; features of earth science conservation importance; features of the landscape which are of major importance for wild flora and fauna; rare or threatened native species; wetlands (includes river corridors); and other natural heritage features worthy of protection.

2.119. Assessment: Chapters 6, 8, and 9 of this ES assess the impact of the project on important habitats, species and features of natural heritage importance, including peat and active peatland.

2.120. There are discrete peat deposits within the Site boundary. The Peat Slide Risk Assessment (PRSA) (Chapter 9, appendix 9.3) found that risk of run out and significant damage to the wider hydrological environmental is deemed low, provided the relevant control measures outlined in the PSRA are implemented at site. The wider geomorphological assessment and evidence from recorded peat depths would indicate that a large-scale translational mass movement of peat deposits is very unlikely.

2.121. Peat is present within the area of proposed turbines 4, 12, 13 and 14. The PRSA has assigned an overall low risk at each location. Key control measures are also outlined to ensure the risk of peat slide remains at residual (low) levels. The Proposed Development therefore complies with Policy NH5.

Areas of Outstanding Natural Beauty

2.122. Policy NH6 sets out planning policy in relation to projects in Areas of Outstanding Natural Beauty (AONB). Planning permission for new development within an AONB will only be granted where it is of an appropriate design, size and scale for the locality and three criteria are met, including: a) the siting and scale of the proposal is sympathetic to the special character of the AONB in general and of the particular locality; and b) it respects or conserves features (including buildings and other man-made features) of importance to the character, appearance or heritage of the landscape.

2.123. **Assessment:** Chapter 4 of this ES assesses the impact of the project on the Antrim Coast and Glens AONB. Consistent with the SPPS' cautious approach to protected landscapes (para 6.223) and the BPG (para 1.3.23), every effort in siting and design has been made to reduce the impact of the proposed development and aid integration into the local landscape. Whilst there are significant landscape and visual effects, as are expected (by PPS18) with a windfarm, the proposal has sought to be of an appropriate design, size and scale for the locality, recognising the character of the wider AONB and the specific locality.

2.124. The proposed site location is noted as being of medium and lesser sensitivity than other parts of Landscape Character Area 122 Garron Plateau. This is the lowest level of sensitivity included within the SPG (no LCA in Northern Ireland is deemed by the SPG to be of Low or no sensitivity). Therefore, whilst the Proposed Development would have a direct physical effect on the part of the LCA within which it is located, it would be well located and its overall effect on landscape character would be medium and not significant.

2.125. The Development may have indirect effects on the landscape character of some other parts of the Study Area amounting to small areas of four other LCAs and one SCA which are in proximity to it. However, of the 20 Viewpoints which have been selected to represent typical views of the Development within the Study Area only six would experience significant visual effects resulting from the Proposed Development.

2.126. From the majority of the Study Area and the majority of the AONB the Development would either have no visibility or no significant visual effects. There is a noticeable absence of visibility from coastal areas aside from Carnlough or from the lower parts of any of the Glens except Glencloy where visibility is also not widespread. Therefore, the effects of the Development on the AONB as a whole are limited.

2.127. Therefore the landscape and visual impact of the Proposed Development is not unacceptably adverse for the purposes of the SPPS and PPS18 Policy RE1 because the inherent characteristics of the landscape provide the capacity to absorb it. The effects – relative to the qualities that underpin the designation – would not undermine the overall AONB or compromise wider landscape and visual amenity to an unacceptable degree. The impacts which are identified have to be weighed against the significant benefits of the proposed development (see Chapter 13) in the planning balance.

Planning Policy Statement 3 – Access, Movement and Parking

2.128. PPS3 is retained policy for the purposes of the SPPS transitionary arrangements. There is considered to be no conflict with the equivalent provisions in the SPPS, therefore until the Council adopts its Plan Strategy, its provisions will apply, together with the SPPS, with no less weight attached to the retained policy.

2.129. SPPS policy on Transportation is set out on pages 106 to 110. It consolidates and restates policy set out in PPS3 and PPS13. The Minister did not identify any conflicts or clarifications in his statement launching the SPPS. The principal focus of this section is, therefore, on PPS3.

2.130. PPS 3 (NI Planning Service, 2005) states that the orderly and effective implementation of the local development plan objectives requires provision of infrastructure and facilities, which include an adequate public road and transport network. Also the potential impact that a development may have on the efficiency of the public road network or on road safety is an important material consideration.

2.131. Policy AMP2 Access to Public Roads states:

2.132. *'Planning permission will only be granted for a development proposal involving direct access, or the intensification of the use of an existing access, onto a public road where such access will not prejudice road safety or significantly inconvenience the flow of traffic.'*

2.133. **Assessment:** Chapter 11 of this ES assesses the impact of the Proposed Development on the receiving road network. It demonstrates that there will be no significant impacts on the road network subject to appropriate mitigation in the form of a Traffic Management Plan to be secured via a planning condition on any planning permission. The Proposed Development therefore complies with the relevant policies in the SPPS and PPS3.

Planning Policy Statement 6 – Planning, Archaeology and the Built Heritage

2.134. PPS6 is retained policy for the purposes of the SPPS transition arrangements. There is considered to be no conflict with the equivalent provisions in the SPPS, therefore until the Council adopts its Plan Strategy, its provisions will apply, together with the SPPS, with no less weight attached to the retained policy.

2.135. SPPS policy on Archaeology and Built Heritage is set out on pages 37 to 44. It consolidates and restates policy set out in PPS6. The Minister did not identify any conflicts or clarifications in his statement launching the SPPS. The principal focus of this section is, therefore, on PPS6.

2.136. PPS 6 (NI Planning Service, 1999) sets out the Department's planning policies for the protection and conservation of archaeological remains and features of the built heritage. Archaeological sites and monuments, whether scheduled or otherwise, and their settings is a material consideration due to the desire to preserve these features. The contents of PPS 6 will be taken into account when preparing development plans and will be considered when determining planning applications.

2.137. Policy BH 1 of PPS 6 states the following:

"Development which would adversely affect such sites of regional importance or the integrity of their settings will not be permitted unless there are exceptional circumstances."

2.138. And Policy BH 2 states:

"Development proposals which would adversely affect archaeological sites or monuments which are of local importance or their settings will only be permitted where the Department considers the importance of the proposed development or other material considerations outweigh the value of the remains in question."

2.139. Policy BH 3 states:

"Where the impact of a development proposal on important archaeological remains is unclear, or the relative importance of such remains is uncertain, the Department will normally require developers to provide further information in the form of an archaeological assessment or an archaeological evaluation."

2.140. Policy BH 4 states:

"Where it is decided to grant planning permission for development which will affect sites known to contain archaeological remains, the Department will impose conditions to ensure that appropriate measures are taken for the identification and mitigation of archaeological impacts of the development…"

2.141. Policy BH6 states:

'The department will not normally permit development which would lead to the loss of, or cause harm to, the character, principal components or setting of parks, gardens and demesnes of special historic interest. Where planning permission is granted this will normally be conditional on the recording of any features of interest which will be lost before development commences.'

2.142. Policy BH11 states:

- 'The department will not normally permit development which would adversely affect the setting of a listed building. Development proposals will normally only be considered appropriate where all the following criteria are met:
- The detailed design respects the listed building in terms of scale, height, massing and alignment;
- The works proposed make use of traditional or sympathetic building materials and techniques which respect those found on the building; and
- The nature of the use proposed respects the character of the setting of the building'

2.143. PPS6 paragraph 2.6 states that development plans, where appropriate, will designate areas of significant archaeological interest (ASAIs). Such designations seek to identify particularly distinctive areas of the historic landscape in Northern Ireland. They are likely to include a number of individual and related sites and monuments and may also be distinguished by their landscape character and topography. Local policies or proposals for the protection of the overall character and integrity of these distinctive areas will normally be included in development plans.

2.144. **Assessment:** Chapter 5 of the ES considers the potential effects the Proposed Development would have on the historic environment. The assessment concluded that there would be no significant effect on the setting of any of the historic assets identified for assessment and the proposed development complies with the relevant policies in the SPPS, PPS6 and PPS18.

Planning Policy Statement 10 – Telecommunications

2.145. PPS10 is retained policy for the purposes of the SPPS transition arrangements. There is considered to be no conflict with the equivalent provisions in the SPPS, therefore until the Council adopts its Plan Strategy, its provisions will apply, together with the SPPS, with no less weight attached to the retained policy.

2.146. SPPS policy on Telecommunications and Other Utilities is set out on pages 94 to 96. It consolidates and restates policy set out in PPS10. The Minister did not identify any conflicts or clarifications in his statement launching the SPPS. The principal focus of this section is, therefore, on PPS10.

2.147. PPS 10 (NI Planning Service, 2002) states that large, prominent structures such as wind turbines can cause disruption to analogue television services by obstructing or reflecting the wanted signals. Policy TEL2 Development and Interference with Television Broadcasting services further states that:

2.148. 'The Department may refuse planning permission for development proposals which would result in undue interference with terrestrial television broadcasting services.'

2.149. In its justification for this statement the Department advises that it:

'Will wish to be satisfied that the potential for interference has been fully taken into account in the siting and design of large and prominent buildings and structures, since it will be more difficult, costly and sometimes impossible to correct after the event. Developers of wind turbines and any other structure which by virtue of its size, height or finishes is likely to result in undue interference are therefore encouraged seek expert advice on this matter before submitting their proposals.'

2.150. It further states that:

'Only in extreme cases where there is evidence that no practical remedy exists to overcome or otherwise mitigate problems of undue interference would the Department be justified in refusing planning permission.'

2.151. Paragraph 6.35 of PPS10 states that:

2.152. 'In any development, significant and irremediable interference with other electrical equipment of any kind can be a material planning consideration. Electromagnetic interference may be caused by a radio transmitter or by unwanted signals emitted by other electrical equipment. The Radio communications Agency has statutory powers for dealing with this type of interference under the Wireless Telegraphy Act 1949 (see Annex B).

2.153. **Assessment:** The proposals will have no significant effect on PPS10 interests.

Planning Policy Statement 15 (Revised) - Planning and Flood Risk

2.154. PPS15 is retained policy for the purposes of the SPPS transition arrangements. There is considered to be no conflict with the equivalent provisions in the SPPS, therefore until the Council adopts its Plan Strategy, its provisions will apply, together with the SPPS, with no less weight attached to the retained policy.

2.155. SPPS policy on Flood Risk is set out on pages 61 to 68. It consolidates and restates policy set out in PPS15. The Minister did not identify any conflicts or clarifications in his statement launching the SPPS. The principal focus of this section is, therefore, on PPS15.

2.156. Revised PPS15 was published in September 2014 and contains policies relevant to the development of any proposal site in relation to flood risk:

2.157. Policy FLD 3 states:

Beyond coastal flood plains and the flood plains of rivers the Department will not permit development which is known to be at risk from flooding, or which would be likely to increase the risk of flooding elsewhere. An exception to this policy will only be permitted where an application is accompanied by measures to mitigate the risk of flooding and it is demonstrated that such measures will not increase flood risk elsewhere, will not result in an adverse impact on visual amenity or the character of the local landscape; and will not result in an adverse impact on features of importance to nature conservation, archaeology or the built heritage.

2.158. **Assessment:** Chapter 9 of this ES assesses the impact of the Proposed Development from hydrological and hydrogeological perspective. The hydrological and hydrogeological setting of the site for the purposes of the assessment is the downstream Glencloy River and Ticloy Water (including Braid River (Aghacully), as identified in Chapter 9.

2.159. Aspects of the design, construction and operation of the Development that may potentially impact on the receiving geological and water environment have been identified and the pathways for impacts assessed. This has determined the mitigation methods required to prevent any significant adverse impacts.

2.160. Monitoring of the effect of the Development on the water environment and fisheries habitat will be provided by the Applicant through physicochemical and biological water quality monitoring. Implementation of the proposed mitigation methods, as identified in Chapter 9, reduces the potential impact to not significant. The Proposed Development therefore complies with policy.

Planning Policy Statement 16 - Tourism

2.161. PPS16 is retained policy for the purposes of the SPPS transition arrangements. There is considered to be no conflict with the equivalent provisions in the SPPS, therefore until the Council adopts its Plan Strategy, its provisions will apply, together with the SPPS, with no less weight attached to the retained policy.

2.162. SPPS policy on Tourism is set out on pages 97 to 100. It consolidates and restates policy set out in PPS16. The Minister did not identify any conflicts or clarifications in his statement launching the SPPS. The principal focus of this section is, therefore, on PPS16.

2.163. PPS 16 was published in June 2013. This statement sets out the Department's planning policy for tourism development and also for the safeguarding of tourism assets. It seeks to facilitate economic growth and social well-being through tourism in ways which are sustainable and compatible with environmental welfare and the conservation of important environmental assets. It embodies the Government's commitment to sustainable development and to the conservation of biodiversity.

2.164. The objectives of PPS16 are to:

- Facilitate sustainable tourism development in an environmentally sensitive manner;
- Contribute to the growth of the regional economy by facilitating tourism growth;
- Safeguard tourism assets from inappropriate development;
- Utilise and develop the tourism potential of settlements by facilitating tourism development of an appropriate nature, location and scale;
- Sustain a vibrant rural community by supporting tourism development of an appropriate nature, location and scale in rural areas; and
- Ensure a high standard of quality and design for all tourism development.

Policy TSM 8 sets out the criteria for the safeguarding of tourism assets. It indicates that planning permission will not be granted for development that would in itself or in combination with existing and approved development in the locality have an adverse impact on a tourism asset such as to significantly compromise its tourism value.

2.165. **Assessment:** The information within this ES, in particular at Chapters 4 & 5 assesses the impact of the proposals on the receiving environment, considering its visibility and connection to tourist assets within the study area.

2.166. Paragraph 1.3.80 of the Best Practices Guidance refers to wind energy development not necessarily being incompatible with tourism and leisure interests.

2.167. Having regard to the conclusions of Chapters 4 & 5 in respect of landscape/visual impact and cultural heritage insofar as both of these considerations contribute to the area's tourism assets and on the basis that the proposal would not deter visitors from utilising the tourism assets in the area, it is concluded that the proposed development complies with Policy TSM8.

Planning Policy Statement 18 – Renewable Energy

2.168. PPS18 is retained policy for the purposes of the SPPS transitionary arrangements. There is considered to be conflict with the equivalent provisions in the SPPS, only insofar as the SPPS changes the direction to attach 'significant' weight to the benefits associated with renewable energy projects and provides the decision maker with discretion in deciding the 'appropriate' amount of weight to be attached to the benefits. This is discussed in paragraphs 58 to 60 above. Therefore until the Council adopts its Plan Strategy, in terms of the 'weighting direction' the provisions of the SPPS apply, with less weight being attached to the retained policy. In all other respects, it is anticipated that no less weight will be attached to the retained policy in PPS18 Policy RE1.

2.169. PPS18, of August 2009, is the key planning policy for renewable energy in Northern Ireland. Paragraph 3.1 of PPS18 states that its aim is to facilitate the siting of renewable energy generating facilities in appropriate locations to achieve Northern Ireland's renewable energy targets and to realise the benefits of renewable energy. This is a permissive policy context. In a speech on 2 September 2009 to the Irish Wind Energy Association (IWEA) the Minster of the Environment stated "nothing illustrates the promotive nature of PPS18 more so than the opening up of AONB's to wind energy development for the first time. This is in stark contrast to the previous policy where there was a general presumption against wind farm development in AONB's".

2.170. Within this permissive policy context PPS18 sets out the Department's objectives relevant to renewable energy and its proposed planning policies that will help deliver these objectives.

2.171. The applicable policy objectives of PPS18 are:

- to ensure that the environmental, landscape, visual and amenity impacts associated with or arising from renewable energy development are adequately addressed; and
- to ensure adequate protection of the Region's built and natural, and cultural heritage features.

2.172. Policy RE 1 - Renewable Energy Development sets out a presumption in favour of renewable energy development provided it will not result in unacceptable adverse impact on five criteria. These include criteria around the need to protect and conserve the environment, visual amenity, human health and residential amenity, and public access to the countryside.

2.173. The policy specifically adopts a mitigation/compensation led approach and emphasises the 'significant' weight to be attached to the wider benefits of renewable energy projects. Paragraph 4.1 of the justification and amplification states that:

2.174. "Where any project is likely to result in unavoidable damage during its installation, operation or decommissioning, the application will need to indicate how this will be minimised and mitigated, including details of any proposed compensatory measures, such as a habitat management plan or the creation of a new habitat.

2.175. The wider environmental, economic and social benefits of all proposals for renewable energy projects are material considerations that will be given significant weight in determining whether planning permission should be granted.

2.176. This direction on where significant weight should be attached in the balancing exercise required by the policy is probably unique in the UK and Ireland and must be rooted in the Executive's agenda for renewable energy. The policy goes on to establish a set of seven additional criteria specifically for wind energy proposals including protection of visual amenity, consideration of cumulative impact, landslide risk, electromagnetic interference, roads, and residential amenity. The overall wording and thrust of the policy suggests that some degree of adverse impact may be acceptable.

2.177. The policy also states that for wind farm development a separation distance of 10 times rotor diameter to occupied property, with a minimum distance not less than 500m, will generally apply. The policy note also advises that turbines should be set back at least fall over distance plus 10% from the edge of any public road; public right of way; or railway line so as to achieve maximum safety.

2.178. **Assessment:** The wider environmental, economic and social benefits (Chapter 13) of the proposal are identified of this ES. Retained policy in PPS18 Policy RE1 requires that significant weight is attached to these factors but since there is conflict with the SPPS, greater weight is to be attached to the equivalent provision in the SPPS. The equivalent provision in the SPPS states that 'appropriate' weight should be given to the benefits. Appropriate weight must be relative to the scale of the benefits. In this case the social, environmental and economic benefits of the project are large in scale, proportionate to the scale and significance of the project. It follows that when considering the appropriate weight to attach to the benefits, the decision maker should attach significant weight.

2.179. This approach is evident in the PAC's consideration of the following appeals whereby the substantial environmental, economic and social benefits of the proposal were attributed significant weight (PAC Refs: 2012/A0070, 2015/A0102, 2015/A0168, 2015/A0169 and 2015/A200).

This ES demonstrates that there are limited adverse effects after mitigation and these are confined to landscape and visual effects, as are anticipated (by PPS18) with a windfarm.

2.180. Tested in the round, with the appropriate weighing of the benefits as still directed by the policy, the Proposed Development is considered to meet the requirements of the SPPS and PPS18.

2.181. Planning Appeals Commission interpretation in respect of the 10 rotor diameter distance is outlined in the following appeal cases PAC Refs: 2012/A0070, 2013/A0220, 2014/A0285, 2015/A0200, 2017/A0050, 2018/A0199 where in summary a degree of latitude can be applied to separation distances and the 10 times rotor diameter need not rigidly be applied. This would reflect Policy RE1 of PPS18 which references that the consideration of the appropriate separation distances will 'generally' apply.

2.182. There are residential properties located on Drumourne Road and Ballymena Road which lie outside a 1km radius of the Proposed Development. Turbines 1, 2, 3 & 5 have a relationship to these properties being located generally to the south-west of the turbines. Due to the orientation of the dwellings to the turbines, none have a direct relationship to the properties. The existing hillside is a significant feature in the landscape and forms an existing backdrop for the dwellings. Many are nestled within the hillside and there are intervening undulations in the land between dwellings and the ridge of the. The steeply rising nature of the land up to the ridge is the main experience within and around the properties. As such, visibility of the turbines will be limited from within the curtilage of the properties and therefore there will be limited impact on the amenity enjoyed within these properties.

2.183. There are residential properties located on Slane Road beyond a 1km radius of the Proposed Development; specifically turbine 10 is the most proximate and located to the north and north east of the properties. The undulating landform continues to be a factor in limiting the visual impact of this turbine on the residential amenity of these properties along with the open nature of the landscape. The land rises from Slane Road to the turbine location. The primary aspect of the properties is towards the public road rather than directly orientated toward the turbine. Boundary features such as vegetation, outbuildings and landform changes immediately around the curtilage of properties further serve to limit impact on residential amenity to an acceptable level.

2.184. There are residential properties on Killycarn Road beyond a 1km radius of the Proposed Development; specifically turbine 11 is the most proximate. The land gradually rises from the properties towards the turbine with vegetation and trees being evident across the intervening landscape. The turbine has no direct visual relationship to the properties due to the orientation of the properties and the presence of outbuildings around the curtilage of the properties. All these factors serve to minimise the impact on the residential amenity of these properties to an acceptable level.

2.185. No turbines are located within fall distance of any roads. The fall over distance as suggested in the Best Practice guidance is tip height + 10%. Consequently, the distance for Unshinagh is 198m which has been applied to all roads. The potential for impact on residential amenity from the BESS has been considered. The nearest property to the BESS is 1295m which will mitigate any risk to local properties or their occupiers. Any potential impact is considered to be low and will be controlled by appropriate management processes and a risk assessment that will be incorporated into the operation of the Proposed Development. This is detailed in Chapter 9 of the ES. In addition to protecting the water environment, the safety measures will also serve to protect residential amenity.

2.186. The Proposed Development is therefore considered to meet the requirements of Policy RE1 in this regard.

PPS18 Best Practice Guidance (BPG)

2.187. PPS18 BPG is to continue to be treated as a material consideration during the transitionary (or after) as per paragraph 1.14 of the SPPS.

2.188. The guidance document (NI Planning Service, 2009b) provides background information on a variety of renewable energy technologies and is intended to be read in conjunction with PPS 18. Section 1 is specific to wind energy. Paragraph 1.3.4 of the guidance document states that “Each planning application will be considered on its own merits, and the argument that granting permission might lead to another application will not be sufficient grounds for refusal."

2.189. The guidance document (NI Planning Service, 2009b) provides background information on a variety of renewable energy technologies and is intended to be read in conjunction with PPS 18.

2.190. The guidance document further details the issues relevant to planning applications for onshore wind energy. These include nature conservation, landscape and visual impact, hydrology and geology, archaeology and built heritage, noise, aviation, and health and safety issues (e.g. public access, shadow flicker and ice throw).

2.191. **Assessment:** The policy assessment in relation to PPS18 has had regard to the guidance contained within the BPG as evident in Chapter 4.

Wind Energy Development in Northern Ireland's Landscapes - Supplementary Planning Guidance (SPG)

2.192. This SPG is to continue to be treated as a material consideration during the transitionary (or after) as per paragraph 1.14 of the SPPS.

2.193. The SPG (NIEA, 2010) sets out the background to Northern Ireland's landscapes, describes the approach and general principles that should be applied to potential wind energy developments, and it provides guidance related to specific sensitivity of each of the 130 Landscape Character Areas (LCAs) in Northern Ireland to wind energy development. It is intended to help developers in identifying appropriate sites for wind energy generation.

2.194. **Assessment:** The SPG has been taken into account in the assessment of landscape and visual impact in Chapter 4.

Planning Policy Statement 21 – Sustainable Development in the Countryside

2.195. PPS21 is retained policy for the purposes of the SPPS transitionary arrangements. Although referred to in the Minister's statement launching the SPPS, as far as renewable energy proposals are concerned there is considered to be no conflict with the equivalent provisions in the SPPS. Therefore until the Council adopts its Plan Strategy, the renewable energy related provisions of PPS21 will apply, together with the SPPS, with no less weight attached to the retained policy.

2.196. The aim of PPS 21 (NI Planning Service, 2010) is to manage development in the countryside in a manner consistent with achieving the strategic objectives of the Regional Development Strategy for Northern Ireland, which also strikes a balance between the need to protect the countryside from unnecessary or inappropriate development, while supporting rural communities.

2.197. Policy CTY 1 (Development in the Countryside) states that there are a range of types of development which in principle are considered to be acceptable in the countryside and that will contribute to the aims of sustainable development. Nonresidential developments such as renewable energy projects are considered an acceptable type of development when they are in accordance with PPS 18.

2.198. **Assessment:** On the basis that the proposals meet the requirements of PPS18, the project is also acceptable in respect of PPS21.

Local Policy Context

2.199. Section 6(4) of the Planning Act (NI) 2011 (the Act) requires that the determination of proposals must be in accordance with the prevailing local development plan unless material considerations indicate otherwise.

2.200. Section 45(1) of the Act provides meaning on the weight to be afforded to the plan in determining planning applications subject to this part and section 91(2); 'Where an application is made for planning permission, the Council, or as the case may be, the Department, in dealing with the application must have regard to the local development plan, so far as material to the application, and to any other material considerations..'

2.201. The site falls within Mid and East Antrim Borough Council. The following Local Plans are of relevance.

Larne Area Plan 2010

2.202. The purpose of the Larne Area Plan (LAP) is to set out the broad land use framework for the physical development of the district. It aims to create urban and rural environments which will make a positive contribution to an improvement in the quality of life in the Borough. Whilst significantly dated (published in March 1998) it remains the extant plan for the area. References to applicable policy are outlined below with relevant references to those superseded by strategic policy direction where relevant.

2.203. The LAP contains policies and provisions relating to development in the countryside, the protection of Areas of Significant Archaeological Interest (ASAIs), wind turbine development within the AONB and the protection of tourism resources.

2.204. The application site falls outside of any defined settlements in the Plan and as such falls within the countryside. The Development falls within:

- an Area of Outstanding Natural Beauty (Antrim Coast and Glens)
- an Area of Constraint on Mineral Development.

The following designations are relevant:

- an Area of Special Archaeological Interest;
- Scawt Hill and Sallagh Braes ASI, incorporating Scawt Hill ASSI; and
- Feystown ASSI.

2.205. Policy MAN EN1 of the LAP states that the Planning Authority will protect ASAIs from inappropriate development. It states that the designation of the overall setting in which a number of individual and related monuments are located, or an area of historic landscape, as an ASAI, is intended to protect the individual sites or monuments and their setting from inappropriate development.

2.206. The archaeological designation refers to an upland area known as Knockdhu and is designated due to the concentration of prehistoric and archaeological sites located here. The area is also shown as a Countryside Policy Area in the Larne Area Plan however; the policy provisions of PPS21 take precedence over this designation, as noted in the preamble on page 2 of PPS21 (June 2010).

2.207. Specific to Energy page 41 of the LAP states:

2.208. 'As part of an international drive to combat acid rain and reduce the emission of greenhouse gases there is a greater awareness of the environmental consequences of energy production and a growing emphasis on both energy conservation and renewable energy sources.

2.209. Government Policy in relation to energy is aimed at ensuring that the needs of society for energy are satisfied while at the same time ensuring that environmental damage is kept to a minimum. Consequently the Department will support initiatives aimed at reducing the demand for energy from fossil fuels

2.210. Much of the Area is within the Antrim Coast and Glens AONB and as such would not be considered suitable for the location of wind turbines'.

2.211. However the provisions of the more recent regional policies of the PPS18 and SPPS take precedence over this statement with respect of wind turbine development within the AONB.

2.212. Policy COU 1 of the LAP states that the Planning Authority will protect, conserve and enhance sensitive landscapes, accommodate the needs of the farming community and protect vulnerable areas from development pressure. Policy NV 4 of the LAP designates a Countryside Policy Area (CPA) for the Antrim Coast and Glens AONB. Regional policy provisions superseded these policies.

2.213. Policy COU 3 states that in assessing development proposals, the Department will apply the principles contained in the Antrim Coast and Glens AONB Design Guide. However the noted guide deals essentially with the design of buildings and does not consider wind turbine development.

2.214. Policy T1 outlines that the tourism resources of the area comprised in the landscape and the natural and manmade environment, will be protected from inappropriate forms of development. It outlines that that the Countryside Policy Area (CPA) applicable in the Antrim Coast and Glens AONB will help to protect such areas from development which is not considered to be essential. This policy is superseded by the policies within PPS16.

Emerging Local Development Plan

2.215. The Council has prepared a timetable for the preparation of its Local Development Plan (LDP) for the Borough up to 2030 and published its Mid and East Antrim

Borough Council Local Development Plan 2030 draft Plan Strategy (dPS) in September 2019. The Plan is currently awaiting for the Independent Examination to be held which will be the forum under which the plan will be assessed in terms of its soundness.

2.216. The dPS contains several policies which, directly and indirectly control the feasibility, viability and location of renewable energy infrastructure and particularly wind turbines. These policies are:

- Draft Policy CS1 – Sustainable development in the Countryside (cross refers to Draft Policy RE1)
- Draft Policy CS2 – Special Countryside Areas
- Draft Policy CS3 - Areas of Constraint on High Structures
- Draft Policy CS5 – Antrim Coast and Glens Area of Outstanding Natural Beauty
- Draft Policy RE1 – Renewable Energy Development; and
- Draft Policy TOC1 – Telecommunications Development and Overhead Cables

2.217. The above policies have been the subject of objections and it cannot be assumed such policies will be carried forward to an adopted Plan Strategy. Indeed, as set out above, the plan has yet to be independently examined against the tests of soundness or found sound, as required under Section 10 (6) of the 2011 Act.

2.218. The SPPS is clear in setting out the transitional arrangements, in that a transition period will operate until the adoption of a Plan Strategy. Therefore, until the adoption of the Plan Strategy for the relevant council areas the planning authority (in this case DfI) will apply existing regional policies and those contained in the SPPS.

2.219. The SPPS at para 5.73 considers that proposals should only be refused on the basis of prematurity where:

2.220. "….development proposals which are individually so substantial, or whose cumulative effect would be so significant, that to grant planning permission would prejudice the outcome of the plan process by predetermining decisions about the scale, location or phasing of new development with out to be taken in the LDP context…."

2.221. Guidance on weight to be afforded to the provisions of an emerging development plan is also set out the in Joint Ministerial Statement 2005 (JMS) which remains a relevant consideration. Whilst the JMS is still material, the contents of the SPPS would be afforded greater weight, where there is conflict identified. In this instance there is not direct conflict with the SPPS. It is our view that the proposed development would not prejudice the delivery of policies within the emerging Plan Strategy as it:

- would not prejudice the ability of the Plan Strategy to retain conformity with the RDS

- would not result in an adverse impact on an environmental asset, as demonstrated within this ES;
- would not undermine the rationale behind a proposed Special Countryside Area designation proposed in the emerging plan as the draft policies make provision for exceptions.

2.222. Furthermore, the SPPS is clear at paragraph 6.221 that "moratoria on applications for renewable energy development whilst LDPs are being prepared or updated are not appropriate". For this reason, the proposed development can be determined under existing regional policies and the SPPS.

2.223. **Assessment:** Most aspects of local planning policy have been superseded by subsequent regional planning policy. On the basis of the conclusions of the detailed assessments within this ES, there is no conflict with applicable local planning policy.

Other Guidance

Antrim Coast and Glens Area of Outstanding Natural Beauty Management Plan 2008 - 2018

2.224. The Antrim Coast and Glens AONB Management Group, in partnership with the Causeway Coast and Glens Heritage Trust produced a management plan for the AONB. The Management Plan helps everyone with a stake in the landscape respond in ways that enhance the landscape and ensure the AONB remains an area everybody can identify with and enjoy and allow it to continue contributing crucially to the economy of the area.

2.225. The management plan covers a 10-year period and is accompanied by an Action Plan which details how the goals will be attained. The Management Plan and Five Year Action Plan were published for the period 2008 –2018. The purpose of the Management Plan is to state what elements of the AONB are special, characteristic and valued and to devise objectives and mechanisms by which change can occur whilst maintaining the intrinsic character of area.

2.226. The Management Plan identifies a number of objectives around the themes of land, coast and sea - biodiversity, geodiversity and landscape; built heritage – the built and historic environments; and sustainable communities – community, planning, the economy and tourism.

2.227. The Five Year Action Plan that accompanies the AONB Management Plan provides some additional detail as to how Objectives will be achieved. In relation to the management objective of protecting landscape and seascape character and restoring key areas of visual prominence where they are currently degraded the Action Plan refers to existing planning policy, guidance and landscape character assessments for information.

Overall Policy Compliance

2.228. Making an energy infrastructure contribution of the scale proposed (58.8 MW) will assist in the achievement of strategic energy targets and objectives, consistent with a wide range of International, European, UK and Regional level priorities. The rationale for the project in relation to the delivery of renewable is clear.

2.229. There is a strategic qualified national presumption in favour of developing renewable energy projects of this type.

2.230. The established approach to decision making advocated in policy is to balance the wider environmental, economic and social benefits of the project against the environmental impacts, attaching significant weight to the former.

2.231. The SPPS changes this approach insofar as the PPS18 direction to attach significant weight to the benefits is replaced by a discretion for the decision maker to determine the appropriate weight to be attached to the benefits. This must mean that the large scale social, environmental and economic benefits associated with this project are attached significant weight. In weighing the acceptance of the proposals the following must be considered:

- The proposal will offer job creation and economic activity to the regional economy providing catalytic benefits to investment within Northern Ireland.
- Given the 30 year lifetime of the development it is expected that direct operational impacts equate to 30 jobs, £1.70 million direct wages and £5.71 million of direct Gross Value Added over the operational phase.
- Both the construction and operational phases will generate increased tax and business rates revenue and the proposal is estimated to involve a capital spend of £39.78 million.
- Based on rateable values of £13,293 per MW— it is calculated that the proposed development will increase rateable value by £0.8 million each year, or by £23.45 million over the project horizon.
- The amount of electricity that could be produced by the proposed development is estimated at 236.9gWh per year which is enough electricity to meet the needs of 61,900 homes each year , over 5,000 more than the current housing stock (of approximately 56,000) in the local area.
- The proposed development is also estimated to reduce CO_2 emissions by 109,000 tonnes each year.

2.232. The landscape and visual impact of the windfarm is not unacceptably adverse for the purposes of the SPPS and PPS18 Policy RE1 because the inherent characteristics of the landscape provide the capacity to absorb it. The effects – relative to the qualities that underpin the designation – would not undermine the overall AONB or compromise wider landscape and visual amenity to an unacceptable degree.

2.233. With the discretion to attach significant weight to the wider environmental, economic and social benefits arising from the proposal, and having regard to how the project demonstrates that it will have limited adverse impacts, the project is considered to meet the requirements of planning policy because there are no unacceptable adverse effects which are not outweighed by the local and wider environmental, economic and social benefits of the Proposed Development.

References

Department for Regional Development (NI) (DRD) Regional Development Strategy 2035 (March 2012)

Department of the Environment (NI) (DoE) A Strategic Planning Policy Statement for Northern Ireland Planning for Sustainable Development (SPPS)

Department of the Environment (NI) (DoE) Best Practice Guidance to Planning Policy Statement 18: Renewable Energy (BPG, PPS18), (August 2009)

Department of the Environment (NI) (DoE) Larne Area Plan 2010

Department of the Environment (NI) (DoE) Planning Policy Statement 2: Natural Heritage (PPS2), (July 2013)

Department of the Environment (NI) (DoE) Planning Policy Statement 3: Access, Movement and Parking (PPS3), (February 2005)

Department of the Environment (NI) (DoE) Planning Policy Statement 6: Planning, Archaeology and The Built Heritage (PPS6), (March 1999)

Department of the Environment (NI) (DoE) Planning Policy Statement 10: Planning & Telecommunications (PPS10), (April 2002)

Department of the Environment (NI) (DoE) Planning Policy Statement 15: Planning and Flood Risk (PPS15), (September 2014)

Department of the Environment (NI) (DoE) Planning Policy Statement 16: Tourism (PPS16), (June 2013)

Department of the Environment (NI) (DoE) Planning Policy Statement 18: Renewable Energy (PPS18), (August 2009)

Department of the Environment (NI) (DoE) Planning Policy Statement 21: Sustainable Development in the Countryside (PPS21), (June 2010)

Department of the Environment (NI) (DoE) Supplementary Planning Guidance: Wind Energy Development in Northern Ireland's Landscapes (SPG), (August 2010)

Causeway Coast & Glens Heritage Trust - Antrim Coast and Glens Area of Outstanding Natural Beauty Management Plan 2008 – 2018 (2008)

Mid and East Antrim Borough Council - Mid and East Antrim Borough Council Local Development Plan 2030 draft Plan Strategy (September 2019)

Joint Ministerial Statement – Development Plans and Implementation of the Regional Development Strategy (January 2005)

3

Design Evolution & Alternatives

3 Design Evolution & Alternatives

Introduction

3.1 In this chapter a description is given of the site selection process and design strategies that have been adopted in order to arrive at the Development described in **Chapter 1: Introduction & The Proposed Development**. Firstly, the general design principles adopted by RES are outlined and potential key issues which have affected the design are identified. Thereafter, a description is given of how the turbine layout and infrastructure design has evolved in response to constraints identified through the EIA process.

3.2 **Figures 3.1 – 3.3** are referenced in the text where relevant.

Current land use and site context

3.3 The location of the Development is shown in **Figure 1.1: Site Location**. The 'Planning Application Boundary' (red line) and 'Land Under Applicant Control' (blue line) are shown on **Figure 1.2**: **Planning Application Boundary**. The 'Land Under Applicant Control' formed the Preliminary Site Boundary, hereinafter referred to as 'the Site'.

3.4 The Site is located in the townlands of Drumourne, Unshinagh Mountain, Unshinagh South, Ticloy, Slane, Cregcattan (part of Galdanagh) and Aughareamlag, approximately 4km South West of the village of Carnlough Village, Co. Antrim

3.5 The Site is currently used for sheep and cattle grazing and predominantly comprises semi-improved agricultural land. The lands are well managed with extensive stoned farm tracks providing access to agricultural fields which are bounded by mature hedgerows and stone walls.

Key Issues and Constraints

3.6 The design of a wind farm is optimised in order to produce a layout that maximises the use of the land available for wind power generation balanced against the overall environmental impact of the development. The optimal layout of a wind farm depends on a range of technical, economic and environmental criteria. There following are site specific factors determining the viability of a wind farm:

- Wind Speeds/Energy Yields: Sufficiently high wind speeds to ensure energy production from the wind turbines that would yield an adequate return on investment
- Planning: A site which complies with planning policy and in particular, avoids unacceptable effects on areas designated by statutory agencies; maintains appropriate distances from dwellings to avoid unduly impacting local amenity and; avoids impeding or interfering with major electromagnetic transmission and airport communication systems
- Area of Site: A site must have sufficient area to accommodate the number of wind turbines required for economic viability

- Access: Adequate vehicular access to a site using existing roads wherever possible to minimise the amount of civil works, particularly during the construction phase
- Local Terrain and Topography: Terrain and topography affect wind flow across a site and need to be considered in relation to turbine performance, specification and life-span
- Ground Conditions: A site must have suitable ground conditions for the construction of wind turbine foundations, erection of the machines and the provision of access tracks and cables.

3.7 There are additional factors which also influence the scale and viability of a wind farm including:

- Turbines must be separated by specific distances both perpendicular to, and in line with, the prevailing wind direction to minimise turbulent interaction between the wind turbines (i.e. wake effect). This needs to be considered to balance turbine performance with energy extraction, and to protect the life-span of the turbines. Spacing requirements vary between turbine manufacturers and are also subject to wind conditions;
- Wind turbines have to be located at a distance sufficiently far from occupied residential property to ensure adherence to relevant noise criteria and to ensure that shadow flicker impacts are minimised;
- The implications of locating turbines near environmentally sensitive features and areas (ecology, archaeology, hydrology etc.) need to be carefully considered; and
- Landscape and visual design considerations need to be taken into account.

3.8 The apportioning of weight to each element is a site-dependent consideration and results in bespoke design approaches and strategies for each site.

3.9 For this Development, the upland nature of the Site creates a number of sensitivities that need to be carefully addressed through appropriate design of the wind farm. The following sections identify potential issues and outline how these have been addressed through appropriate design.

3.10 The basis of the design process is the evaluation of the various constraints that have been identified through the environmental surveying that was undertaken between 2019 and 2021. The constraints identified through these surveys, along with other technical constraints and appropriate buffers are presented in **Figure 3.3**: **Combined Constraints and Infrastructure**.

Potentially significant effects

3.11 Following consultation and baseline characterisation of the Site, the following key environmental issues have been identified:

- Landscape and visual
- Archaeology and cultural heritage
- Ecology
- Ornithology

- Fisheries
- Geology and the water environment
- Noise and shadow flicker
- Traffic and transport.

3.12 The issues listed above have been considered during the iterative design process with the aim of designing out significant effects. Where it is not possible to mitigate these effects through design, the issues are considered further as part of the Environmental Impact Assessment process (EIA) which is described in this Environmental Statement (ES).

Consultation

3.13 Prior to and during the production of this ES, RES and the Consultant project team consulted with various stakeholders and, where appropriate, incorporated the outcome of this into the various chapters of this ES.

3.14 Throughout the EIA process, continual scoping has occurred to ensure that the ES fully, but concisely, addresses all potentially significant issues.

3.15 A summary of the telecommunications and aviation consultations are provided in **Table 3.1**. Details of consultation undertaken in the preparation of each of the technical chapters of this ES (chapters 4 to 13) are presented in the relevant chapter.

Table 3.1 – Summary of Consultation

Consultee	Date of Consultation	Nature and Purpose of Consultation
BT	19/03/2021	BT were consulted to establish the location of any telecommunication links they manage.
EMR	19/03/2021 and 26/03/2021	EMR were consulted to establish the location of any telecommunication links they manage.
Atkins Global	19/03/2021	Atkins Global were consulted to establish the location of any radio links they manage.
Arqiva	19/03/2021	Arqiva were consulted to establish the location of any transmission links they manage.
JRC	19/03/2021 and 22/03/2021	JRC were consulted to establish the location of any radio links they manage.
Northern Ireland Water	19/03/2021 25/03/2021 and 22/07/2021	NIW were consulted to establish the location of any links they manage.
Telefonica	19/03/2021	Telefonica were consulted to establish the location of any telecommunication links they manage.
United Utilities	19/03/2021	UU were consulted to establish the location of any telecommunication links they manage.
CAA	24/09/2021, 13/10/2021 and 02/11/2021	CAA were consulted to establish and agree a suitable lighting scheme for the Development.
Belfast International Airport	13/10/2021	Consultation regarding any issues airport may have with the Development.
Belfast City Airport	12/10/2021	Consultation regarding any issues airport may have with the Development.
Ministry of Defence DIO	05/02/2021 and 22/07/2021	Consultation regarding any safeguarding issues they may have with the Development.

Public Consultation

3.16 RES is committed to finding effective and appropriate ways of consulting with all its stakeholders, including local residents and community organisations, and believes that the views of local people are an integral part of the development process. RES began the engagement process eight months prior to the submission of the planning application, to facilitate a constructive consultation process which helped RES to understand and address any concerns as the project developed.

3.17 A virtual public exhibition was held on 15th September 2021 which included detailed maps and information about the proposals, including: a map of the proposed layout; photomontages representing how the proposed layout would appear from a range of viewpoints, and; Zone of Theoretical Visibility (ZTV) diagrams. A ZTV is a map-based diagram illustrating where and how many wind turbines, or wind farms, would theoretically be visible from all parts of a given area. The methods for preparing ZTVs and their uses within the EIA process are described in **Chapter 4: Landscape**

and Visual Impact Assessment. RES staff where available to answer questions and feedback was encouraged.

3.18 A Pre-Application Community Consultation (PACC) Report has been produced and is available for viewing at the locations listed in **Chapter 1: Introduction & Policy Context**.

Alternatives

3.19 RES considers a range of potential options when selecting and designing wind farm sites. The following sections outline the broad design alternatives that have been considered in terms of the EIA Regulations.

Do-Nothing Alternative

3.20 The “do-nothing” scenario is a hypothetical alternative considered as a basis for comparing the potential significant effects of a development proposal. In the case of the Development the “do-nothing” scenario would be to have the Site continue to be managed for sheep and cattle grazing by the landowners. It is likely that current land management activities, including agricultural improvements would continue.

Alternative Sites

3.21 RES has a robust site selection methodology, using a Geographical Information System (GIS) to aid identification of potential wind farm sites.

3.22 The Development site meets the criteria listed in section 3.28 of this chapter. The GIS model was used to identify potential constraints which could restrict development, or would need to be addressed in the design process.

Alternative Layout Designs

3.23 There have been several iterations of the turbine and infrastructure layouts. From the outset the following design principles have been employed when making design decisions:

- Mitigation by design should be the principle method of reducing potential environmental impacts
- Utilisation of existing infrastructure should be implemented whenever possible to avoid unnecessary development
- All site infrastructure should be designed as efficiently as possible to reduce the overall extent of development whilst maximising the renewable energy generation potential.

3.24 A key tool in the design process is the combined constraints drawing which integrates all potential constraints that need to be considered in the design process. The finalised combined constraints map is shown as Figure 3.3.

3.25 The combined constraints drawing is iteratively updated as new information from surveys, site visits and consultation is received. The following surveys informed the combined constraints drawing:

- Breeding and wintering bird survey
- Ornithological vantage point survey
- National Vegetation Classification (NVC) Phase 2 survey
- Terrestrial fauna surveys
- Fisheries survey
- Peat probing
- Hydrology assessment
- Archaeology and cultural heritage surveys
- Landscape field survey
- Aviation
- Transport and traffic reconnaissance trip
- Technical and engineering site walkovers.

3.26 The final site layout for the Development (Figure 1.2: Infrastructure Layout) balances the need to optimise the energy yield whilst paying due regard to environmental and technical sensitivities. Wind farm design is an iterative process and is influenced by potential environmental effects identified throughout the EIA process: policy recommendations; environmental, technical, engineering and landscape design considerations; and as a result of feedback from consultees.

3.27 The following sections describe the evolution of the turbine and infrastructure layouts.

Design Evolution

Turbine Layout

3.28 There were four principle iterations of the turbine layout, these are shown in **Figure 3.1: Turbine Layout Evolution**, which were developed at the following key stages in the project process:

- Initial Turbine Layout (Layout 1), when turbines were located based on preliminary constraints only and prior to baseline environmental surveys being completed;
  Turbine Layout (Layout 2), when turbines were located based on preliminary constraints (prior to baseline environmental surveys being completed) and landowner area was increased to the south;
  Primary Turbine Layout / EIA baseline data stage (Layout 3) when baseline surveys were complete and constraint information gathered.
  Primary Turbine Layout / EIA baseline data stage (Layout 4) when baseline surveys were complete and constraint information gathered and final refinements were made to the layout.

Initial Feasibility Stage

3.29 At the beginning of the development process an initial layout was produced to show the maximum potential extent of the development within the space available and in accordance with the design principles, prior to baseline surveys had been completed. The layouts were informed by the following constraints:

- Preliminary watercourse buffers
- Slope
- Known private water supply locations
- Separation from housing (1000m) / Double the minimum separation distance of 500 m).
- 198 m buffer (tip height + 10%) to public roads in accordance with the Best Practice Guidance to PPS 18[1].

3.30 This identified that the Site could potentially accommodate 13 turbines with a 136m rotor diameter.

3.31 This initial feasibility layout was reviewed by the Landscape Consultant (Layout 2). A layout comprising 16 turbines was initially assessed. ZTV diagrams were prepared to compare the difference in theoretical visibility for blade tip heights of 150 m versus 180 m and hub height visibility for three potential rotor diameter options (117 m, 126m and 136 m). Comparative wirelines were prepared from six provisional viewpoint locations in key parts of the Study Area.

3.32 The provisional wirelines showed no significant difference in the appearance of the turbines regardless of rotor diameter but 180 m blade tip was deemed to be the preferable tip height if 136 m rotor diameter is used (a larger rotor is able to capture more wind and is therefore more productive). This is because the taller hub creates more clearance/ visual separation between the blade tips and skyline and means that the blades are less likely to interfere with appreciation of the landscape.

3.33 A review of the initial 16-turbine layout based on wirelines of the six PVPs concluded that some refinements to turbine spacing/ groupings could be made to create a more uniform appearance that better reflected to underlying topography.

Primary Turbine Layout

3.34 Prior to detailed site assessments being undertaken by external consultants, RES technical analysts undertook site visits to check that there were no physical characteristics on site that may impact upon the turbine performance such as topography.

[1] Best Practice Guidance to Planning Policy Statement 18: Renewable Energy, DOE Planning & Environmental Policy Group, August 2009.

3.35 RES engineering and construction undertook site visits with ecological, and to agree principles for the design of the onsite infrastructure based on the constraints determined to date.

3.36 Following this 3 Turbines were added, and this necessitated other changes to maximise the efficiency of the turbines and to create a balanced layout.

3.37 The revised layout was informed by the original constraints with the following amendments:

- Hydrological buffer 50 m;
- Hydrological buffer 10 m;

3.38 The relocation of a number of the Turbines enabled some refinements to the layout.

- Turbines were removed from the Curlew territories identified and an 800m buffer area was applied.
- T14 was relocated to the centre of the site in order to reduce turbine numbers within the Antrim Hills SPA and reduces track required in areas identified as Blanket Bog.

3.39 The resulting 14 turbine layout with 136.0 m rotor diameter produced a more sympathetic layout as detailed below.

Combined Constraints

3.40 To ensure that all requirements were captured a combination of desktop and site based surveys were undertaken to refine constraints. Detailed environmental and technical surveys were carried out to characterise the baseline environmental conditions on the Site and associated study areas, as described in more detail in Vol 2 Chapters 4 to 13 of this ES. Any constraints to development resulting from the baseline surveys were used to build up the combined constraints drawing.

Landscape & Visual

3.41 As mentioned above a Landscape Consultant was involved throughout the design process to provide advice regarding the scale of the Development and turbine heights and geometry. The Landcape Consultant prepared ZTV diagrams to compare the difference in theoretical visibility for blade tip heights of 150 m versus 180 m and hub height visibility for three potential rotor diameter options (117 m, 126 m and 136 m). Comparative wirelines were prepared from six provisional viewpoint locations in key parts of the Study Area (full details of this are included in Vol 2 Chapter 4).

3.42 At an early stage of the iterative design process the number of turbines was reduced from 16 to 14. Whilst this had little effect on the theoretical zone of visibility over the 30 km Study Area is has resulted in a number of benefits in landscape and visual terms, namely:

- The number of turbines has been reduced from 16 to 14;
- Turbines have been further set back from higher ground at the northern end of the site to reduce visibility from Carnlough;

- The turbines in the final layout that is presented in this ES are evenly spaced in relation to each other and to the site topography which has resulted in a simpler layout with fewer variations in tip heights in relation to contour AOD levels;
- Turbine 14 has been repositioned within the northern turbine grouping and appears as a coherent element rather than an outlier;
- There are fewer instances where 'stacking' of turbines occurs. Stacking is where two or more turbines will appear directly in front of each other in a view and will therefore result in a 'heavier' or more solid, and hence more prominent appearance.

3.43 Discussion with other members of the EIA project team was also carried out as part of the iterative design process. The archaeological consultant in particular has provided input into the selection of Provisional Viewpoints to ensure that cultural heritage sites are adequately represented. Chapters 4: Landscape & Visual and Chapter 5: Archaeology & Cultural Heritage of the ES provide detailed information with regards to these areas.

Aviation

3.44 Wind turbines can potentially interfere with aviation by either physically affecting the safeguarding of an aerodrome via the close proximity of the turbines to an aerodrome or through interference with the Air Traffic Control (ATC) radars that direct aircraft in flight. RES consulted with all relevant organisations that could be affected by the Development.

3.45 NATS En Route (NERL) supplies air traffic service to all en route aircraft navigating UK airspace. RES has consulted the published NATS safe-assessment maps which have been produced to indicate if a wind farm development will impact NERL infrastructure. The Development lies outside the safeguarding areas which identify the need for further consultation with NERL and therefore the Development will have no impact on NERL infrastructure.

3.46 The Defence Infrastructure Organisation (DIO) consultation response stated that, as a condition of any planning permission granted, the Applicant must notify UK DVOF & Powerlines at the Defence Geographic Centre with the following information prior to development commencing: Precise location of development; Date of commencement of construction; Date of completion of construction; The height above ground level of the tallest structure; The maximum extension height of any construction equipment; Details of aviation warning lighting fitted to the structure(s).

3.47 As detailed above in **Table 3.1**, pre-submission consultation was undertaken with airports located within 50 km of the Development. The only two airports are Belfast International Airport (BIA) and Belfast City Airport BCA).

3.48 BIA is located over 33.5 kilometres to the south west of the Development. Initial assessments revealed no line of sight visibility to the air traffic control radar and no impact on the airport safeguarding areas.

3.49 BCA is located over 38.0 kilometres to the south of the Development. Initial assessments revealed no line of sight visibility to the air traffic control radar and no impact on the airport safeguarding areas. Confirmation of this was provided by the airport.

Ecology - Vegetation

3.50 The site occupies the extensive southern slopes of the Garron Plateau, below a peak called Binnagee which rises to a height of 346 m at (IGR D26583 17070). The initial studies within the site “Blue Line,” which encloses an area that is approximately 5.7 km in length and approximately 3.5 km in width (at its widest point).

3.51 The northern-most part of the site consists of a gently undulating upland plateau which descends into improved agricultural fields to the east in close proximity to the A42 Carnlough/Ballymena Road, and to swathes of semi-improved wet grasslands and coniferous forestry blocks to the south. The central part of the site lies on the fringes of an upland lake which supports a wide fringe of sedge fen, wet heath and mire habitats.

3.52 Sites designated at international, national and local level for their conservation value within a potential impact zone were considered. The nearest designated sites to the study area were identified, to assess the potential for remote effects of the scheme on valued habitats and species outside the immediate area.

Vegetation

3.53 The higher elevation areas in the northern-most part of the site are dominated by a complex mosaic of wet heath, mire, rush-pasture and acid grassland habitats which vary according to variations in peat depth, slope, aspect, local topography and a combination of both past and current grazing pressure. Grazing is mostly by sheep, although cattle were also observed on lower ground in the southern part of the site as well as smaller numbers in some of the northern-most, upland fields.

3.54 Grazing pressure differs markedly across the site according to vegetation type and elevation, with higher ground in the north and west of the site being subjected to relatively low intensity grazing whereas lower-lying areas consisting of Holcus lanatus-dominated rush-pasture and acid grassland which are often heavily grazed with a tight sward and associated poor species diversity.

3.55 Grazing pressure is one of the main factors impacting negatively on the favourable condition of areas of NI Priority Habitat within the site, with a reversion from more typical upland heath and mire communities to grass-dominated communities in those areas subjected to the most sustained high levels of grazing pressure.

3.56 Sloping ground across the site, but particularly at mid-elevation and lower elevation parts of the site, often supports large expanses of marshy grassland consisting of species-poor rush-pastures where Juncus effusus, Molinia caerulea and/or Holcus lanatus can be present with occasionally more species-rich swards where Juncus acutiflorus is often the most dominant species. Wetland forbs present within such species-rich swards can include Jacobaea aquatica, Cirsium palustre, Ranunculus flammula, Galium palustre and Epilobium palustre. Such species-rich habitat falls within the description of the NI Priority Habitat Purple Moor-grass and Rush Pasture.

3.57 A series of four coniferous forestry blocks is present near the southern limit of the application area, each consisting of a monoculture of Sitka Spruce Picea sitchensis.

3.58 A JNCC Phase 1 Habitat Survey was conducted across the Site. This early study described the habitats within an area of approximately 618ha. While a more detailed NVC Habitat Survey was completed within a smaller Red Line, across an area of approximately 208.5 ha. The latter involved recorded detailed botanical information over 130 (2x2m) quadrats.

Terrestrial Fauna

3.59 Signs of mobile species were assessed to determine their point of origin. The study area was thus extended to take account of the potential for species to use the vicinity of the proposed development as part of wider territories or foraging areas. Watercourses within the site, and some tributaries outside the site, were surveyed for signs of otter. Specific study areas for each species are as follows;

- Bats (450m around proposed turbine locations);
- Otter, badger, (planning application boundary +100m buffer);
- Red squirrel & pine marten (forestry plantations);
- Common lizard & smooth newt (site);
- Marsh fritillary Habitat (site);

3.60 Aside from detailed botanical and habitat surveys (as well as surveys for common lizard, smooth newt, pine marten, red squirrel, otter and badger) detailed bat surveys were also undertaken across the entire site, during the 2021 survey season. Overall, during 391 nights of monitoring; during 347-nights bat activity was either negligible or low. Moderate levels were experienced during 21-nights; 19-nights were high and 4-nights with near constant activity. Therefore, a BMMP (Bat Monitoring Mitigation Plan) has been recommended. Once implemented in full this will ensure that there is no significant impact to the local bat population. In addition, a detailed and significant HMP (Habitat Management Plan) has been agreed, the implementation of which will result in a 'Net Gain' in biodiversity terms as a result of the proposed windfarm.

Water Environment and Fisheries

3.61 The hydrology consultant recommended watercourse buffers of 50 m and 10 m depending on the catchment size of the watercourse, which were agreed as appropriate by the fisheries consultant.

Public Roads and Walking routes

3.62 198 m buffers were applied to nearby public roads in line with the Best Practice Guidance to PPS18 which recommends a setback distance of at least tip height plus 10% between turbines and roads.

Finalising Turbine Layout - EIA Baseline Stage - Final Layout

3.63 Using design principles agreed with environmental, engineering and technical disciplines, the infrastructure layout was developed and used to undertake baseline assessments.

3.64 During the course of the baseline surveys changes were made to the turbine layout the revised turbine layout is illustrated in Layout 4 – Figure 3.1: Turbine Layout Evolution.

- The configuration of substation, associated car parking and temporary
- construction compound / energy storage facility was refined;
- Minimization of land take by combining bell mouths at junctions/turning heads with areas of temporary crane hard standing to reduce the extent of infrastructure.

3.65 Key adjustments in response to constraints made through the design evolution are summarised in the following sections.

Infrastructure Design Evolution

3.66 The infrastructure design has evolved through the EIA process as illustrated in **Figure 3.2: Infrastructure Design Evolution**, Designs 1 to 2.

Engineering considerations

3.67 The following general principles were taken into consideration when designing the supporting infrastructure:

- Avoidance of environmental and technical constraints (as shown in Figure 3.3)
- Design of the track layout to follow natural contours as far as possible, to avoid unnecessary amounts of excavation and reduce adverse hydrological impacts using the following methods:
- Maximise the use of existing track locations via upgrades;
- Minimisation of the overall length of access track;
- Minimisation of the number of watercourse crossings, as far as possible
- Watercourse buffers of 50 m and 10 m
- Avoidance of steep slope areas to minimise earthworks (except where existing farm access tracks where in situ);
- Incorporation of measures to improve the visual appearance of the scheme, including reinstatement of temporary infrastructure following the construction period;

- Sympathetically locating control room building / substation / energy storage facility within the site surroundings.

3.68 A number of amendments were made to the design of the infrastructure between Design 1 and Design 2 on (as shown on Figure 3.2) for engineering reasons and these are summarised below:

- Removal of Track to the west of T12 to avoid an area of sensitive habitat;
- The configuration of substation, associated car parking and temporary construction compound / energy storage facility was refined;
- Minimization of land take by combining bell mouths at junctions / turning heads with areas of temporary crane hard standing to reduce the extent of infrastructure.

3.69 Key adjustments in response to constraints made through the design evolution are summarised in the following sections.

Vegetation

3.70 The engineering considerations minimised impact on sensitive habitats by utilising the existing track locations via upgrades where possible. This minimised the length of new track and where new access track is proposed, it is predominantly located in agricultural fields and coniferous shelterbelts of low ecological value.

Water Environment

3.71 The number of watercourse and drainage crossings has been minimised through the principle of avoidance at the layout design stage, and a number of culverts have been sited to coincide with existing culverts which will be upgraded. Proposals submitted in conjunction with this assessment indicate:

- Six crossing of a significant watercourse
- Fourteen crossings of minor watercourses, the majority of which comprise existing track-side drains.

3.72 The location and nature of watercourse crossings were reviewed with the hydrology and fisheries consultants as detailed in **Chapter 8: Fisheries and Chapter 9: Geology & Water Environment.**

Site Entrance Location

3.73 The site entrance is located to the north of the Slane road/Ballymena road junction see ES Vol 3 Figure 1.10. As specified in DCAN 15, visibility splays measuring 160m x 4.5m are provided in both directions.

3.74 Following construction, the site entrance will be reinstated to reduce the extent of hardstanding back to its original pre-construction state see ES Vol 3 Figure 1.10.

Control Building and Substation

3.75 The buildings will located to the central of the site along which is to the lower slope of the site and is set back from the public road. Visibility will be limited from out with the site. The building will be orientated to be accessed from the south.

3.76 The buildings will be traditional in nature with rendered walls and tiled roofs, common characteristics of many rural buildings. The appearance of the buildings has been selected to reflect the rural character of the area to maximise the integration of the buildings within the wider landscape.

Temporary Construction Compound / Energy Storage

3.77 The temporary construction compound is required to be located close to the main bulk of the construction works and the energy storage facility is co-located adjacent to the Control Building and Substation.

3.78 Energy storage containers will utilise the southern portion of the temporary construction compound on a permanent basis with the remainder of the temporary construction compound being removed and returned to farmland.

Final Infrastructure Layout

3.79 The final infrastructure layout is shown in Design 2 of Figure 3.2: Infrastructure Design Evolution. Once finalised, the Planning Application Boundary was redrawn, ensuring sufficient space within the boundary for all features including SUDS.

3.80 The final infrastructure layout and combined constraints is shown in Figure 3.3: Combined Constraints & Infrastructure.

Residual Design Considerations

Electromagnetic Interference / TV

3.81 RES has consulted with all organisations operating microwave links which could be affected by the Development and these are listed in **Table 3.1** above. No existing links cross the Site and as such there will be no interference experienced.

Ice Throw

3.82 Under certain climatic conditions, ice can build up on turbine blades which may be thrown from the blades during blade rotation or fall when blades are stationary.

3.83 The International Energy Association (IEA) has recommended an empirical formula to calculate the maximum distance that ice may be thrown from an operating turbine based on turbine geometry. For the proposed turbine envelope this ice throw risk distance has been calculated and used in the wind farm design to locate turbines away from public roads and therefore the potential for ice throw to affect members of the public is considered to be low.

Summary

3.84 The final layout of the Development reflects the need to optimise the energy yield whilst minimising potential effects on environmental sensitivities. Wind farm design is an iterative process and the design has been influenced by potential environmental effects identified through the EIA process. The proposed layout has evolved in response to policy recommendations, environmental, technical, engineering and landscape and visual design considerations and as a result of feedback from key consultees.

List of Figures (Appendix 3)

4

Landscape & Visual

4 Landscape and Visual Impact Assessment

Executive Summary

4.1 This chapter is a Landscape and Visual Impact Assessment (LVIA) of the proposed Unshinagh Wind Farm (hereinafter referred to as 'the Development'). An LVIA is a formal part of the Environmental Impact Assessment (EIA) process and the methodology used to prepare this chapter is defined by the requirements of the Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2017 (hereinafter referred to as the 'EIA Regulations') and best practice guidance publications relating both to the LVIA process in general and in specific relation to wind farm developments (refer to Volume 4 Technical Appendix 4.1 for further details).

4.2 The Development comprises 14 turbines with overall heights to blade tip of 180 m. Turbine hub heights of 112 m and rotor diameters of 136 m have been used for the purpose of preparing visualisations (see Volume 2 Figures 4.5 onwards). Ancillary works associated with the turbines, including infrastructure, sub-station and electrical cable connections to the local grid network, energy storage and site access, are also considered briefly in this Chapter. However, a detailed description of these elements is contained in Chapter 1. The Development is located in the Antrim Coast and Glens Area of Outstanding Natural Beauty (AONB) approximately 2.8 km to the south west of the coastal village of Carnlough and approximately 17 km to the north east of Ballymena town centre, Co. Antrim. The turbines would be located on upland grazing land between the townlands of Unshinagh and Ticloy on the Garron Plateau uplands to the south east of Cleggan Forest and below the summits of Berry Hill, Binnagee and Neill's Top. The Study Area for this LVIA covers an area that extends to a 30 km radius from the Development and is further described from paragraph 4.78.

The Purpose of this Chapter

4.3 The objectives of an LVIA are to:

- Present an objective analysis of the landscape and visual character of a defined area (i.e. the baseline conditions within the Study Area for this LVIA) in so far as they relate to the Development;
- Identify the potential effects of the Development on these baseline conditions including direct, indirect, permanent, temporary and cumulative effects;
- Clearly distinguish between landscape effects and visual effects which although closely related are also distinct from each other. The former relates to the effects on the physical landscape as a resource in its own

right. The latter relates to the effects on specific views and general visual amenity as experienced by people (hereinafter referred to as visual receptors);

- Propose appropriate mitigation measures to address likely significant effects, where possible, and to assess any residual effects that would remain following the implementation of these measures;
- Present all information clearly and objectively with a well-reasoned methodology that is in accordance with best practice guidance and in a manner that will inform the decision making process.

Statement of Authority

4.4 This LVIA has been prepared by Shanti McAllister Landscape Planning & Design Ltd (hereinafter referred to as SMc Ltd) on behalf of the applicant, RES Ltd (hereinafter referred to as RES). Shanti McAllister is an independent consultant and Chartered Landscape Architect with over 20 years' experience of preparing LVIAs for major development proposals including a large number of wind farms in Northern Ireland.

4.5 All information presented in this LVIA has been prepared in accordance with a methodology that is derived from a suite of best practice guidance (see Technical Appendix 4.1). A summary of the LVIA process and the key elements of this methodology are provided from paragraph 4.32 and are described in full detail in Technical Appendix 4.2. The identification and objective analysis of the landscape and visual effects of the Development is made using professional expertise and impartial judgement. The conclusions of the LVIA are based on whether or not the Development is likely to result in significant effects on the landscape and visual elements of the Study Area. The appropriate weight to be attached to these effects, when weighed against the other effects analysed in the ES, is the responsibility of the relevant planning authority, which in this case is the Department for Infrastructure.

Feasibility Appraisal and Design Iterations

4.6 The Development that is being assessed in this LVIA has evolved through an iterative design process that has been informed by a careful analysis of the constraints and opportunities presented by the site location and the characteristics of the Development itself. This process is further detailed from paragraph 4.25 of the LVIA and in Chapter 3: Design Evolution and Alternatives.

Establishing Baseline Conditions and Analysing Effects

4.7 The Baseline Assessment has considered statutory landscape designations covering the Study Area contained within current planning policy in Northern Ireland. The primary policy guidance on the assessment of landscape and visual effects of wind farm development is the Strategic Planning Policy Statement for Northern Ireland (SPPS) which should be read in conjunction with Planning Policy Statement 18: Renewable Energy (PPS 18) and its accompanying Best Practice and Supplementary

Planning Guidance (BPG and SPG). In addition there are a number of guidance documents and extant Development Plans, which contain relevant statutory planning designations. These are analysed in the Baseline Assessment where applicable.

4.8 It is noted that changes in planning policy and updates to development plans are expected to take place over the coming months and years as Planning Policy Statements, supplementary guidance and existing Development Plans become superseded by emerging Local Development Plans. These must be primarily informed by the SPPS. Mid and East Antrim Borough Council published a Draft Plan Strategy for the Local Development Plan in September 2019 which set out the Council's strategic intentions for development within the Borough and representations submitted in response to this are currently being considered by the Council. The Draft Strategy, representations and counter representations were forwarded to the DfI for Independent Examination in March 2021 to determine whether or not the Plan satisfies statutory requirements and the outcome of this process is awaited. Therefore, for the purpose of this ES it is considered that the Draft Plan Strategy is at too early a stage to be afforded weight. The SPPS notes that decisions should continue to be taken in line with the SPPS and relevant PPSs until such time as a Plan Strategy for the whole Council area has been adopted and the timescale for this is, as yet, unknown.

4.9 The Baseline Assessment also considers non-statutory landscape classifications and the information gleaned through driving and walking surveys of the Study Area to amplify and enhance the understanding of its landscape and visual character.

4.10 Twenty viewpoints have been shortlisted for detailed analysis in this LVIA as a result of the viewpoint selection process which identified parts of the Study Area and key groups of visual receptors that may be potentially affected by the Development. A detailed description of this selection process and a full list of Provisional Viewpoint Locations (PVPs) are provided in Technical Appendix 4.4. Detailed descriptions of the final Viewpoints are an integral part of the Visual Impact Assessment section of this LVIA chapter (starting at paragraph 4.146). The locations of final Viewpoints are indicated on all map-based Figures (Figures 4.1 – 4.10) and visualisations to accompany the detailed written analysis of these Viewpoints are provided in Figures 4.11 – 4.30.

Overall Significance of Landscape and Visual Effects

4.11 The Development conforms to the general principles laid out in policy and best practice guidance in terms of both landscape and visual effects. Both the SPPS and PPS 18 are broadly promotive of renewable energy developments as a means of mitigating against the effects of climate change and the BPG further states that, given their importance, is it important for society at large to accept wind farms as a feature of the Region for the foreseeable future. The BPG notes that some locations may be highly visible but that this does not necessarily render them unacceptable. The latter judgement depends on the degree of effect and sensitivity of the receiving landscape. In this respect the Development conforms to seven of the 9 landscape and visual character issues that the SPG notes should be considered for wind energy developments within the Antrim Plateau region within which the Development is located. The BPG also notes that groups of turbines can normally appear acceptable as single isolated features in open, undeveloped landscapes and this principle can be applied to the Development's position within its landscape and visual context. Beyond 5 km the BPG notes that wind farms are likely to be visible as part of the wider landscape and prominent only in clear visibility, becoming less prominent as viewing distances increase. This is the case for the Development. Furthermore, its visibility from key parts of the Study Area such as the coast and within glens, and also from locations beyond approximately 10 km is particularly limited.

4.12 The Development is located within an AONB and the SPPS requires that a cautious approach should be taken to siting renewable energy developments in designated landscapes where they would result in detrimental effects on the value of these landscapes. In this respect it is necessary to consider policy principles set out in Planning Policy Statement 2 (PPS 2) which states that permission will only be granted in AONBs where the Development would be sympathetic to the character of the AONB in general and also of the particular locality but defers to the descriptions of LCAs and AONB Management Plans for further information on these elements.

4.13 The Development is located in conformance with the SPG's guidance for LCA 122 Garron Plateau which is noted as being suitable for wind energy development in theory. The proposed site location is noted as being of medium and lesser sensitivity than other parts of LCA 122. This is the lowest level of sensitivity included within the SPG (no LCA in Northern Ireland is deemed by the SPG to be of Low or no sensitivity). Therefore, whilst the Development would have a direct physical effect on the part of the LCA within which it is located, it would be well located and its overall effect on landscape character would be medium and not significant.

4.14 The Development may have indirect effects on the landscape character of some other parts of the Study Area amounting to small areas of four other LCAs and one SCA which are in proximity to it, or which contain viewpoints used in this LVIA. The SPG's description of these LCAs is very similar to LCA 122 in many respects including their value and levels of sensitivity to wind energy development. In relation to these other LCAs the magnitude of effects resulting from the Development would range from medium to negligible. Sensitivity would range from high to negligible depending on whether the LCAs would be located in relatively close proximity to the Development or at a greater distance and to what extent existing and consented wind farms define the physical landscape character of these LCAs and their settings. However, in no instances are the physical effects on landscape character deemed to be significant. It is also noted that the sites of Elginny Hill and Rathsherry wind farms, which are located in the adjoining LCA 117 Central

Ballymena Glens, are specifically identified by the SPG as being particularly highly sensitive but have nevertheless been subject to planning consents.

4.15 The Antrim Coast and Glens AONB Management Plan[1] defines special characteristics and identifies mechanisms by which changes and developments can take place whilst maintaining the AONB's special character. The special characteristics that are identified in the Management Plan include the area's relative isolation from the rest of the country and its visual links with the Scottish coastline; the distinctive character of each of the nine Glens and the sequence of cliffs, headlands and bays along the coastline which are framed by the Antrim Plateau landscape which is located inland and above these parts of the landscape and overlooking this coastal landscape/ seascape (see paragraph 4.88 onwards for further detail).

4.16 The Development is located towards the south eastern edge of Garron Plateau below the highest parts of the plateau which would effectively prevent views of the turbines from much of the northern half of the AONB. Higher ground to the south of the Development would have a similar effect on visibility from the southern part of the AONB. Whilst the Development would be clearly visible from some close to medium range views, predominantly from other elevated upland parts of the Study Area, it becomes less visible at distances beyond approximately 10 – 15 km where visibility is often restricted to blade tips or entirely absent. There is also a notable absence of views of the Development from the Glens and visibility across the AONB as a whole is also very limited. Visibility from coastal areas is also distinctly absent with the exception of views in proximity to Carnlough. When views from open sea are excluded from the ZTV calculations, theoretical land-based (blade tip) visibility of the Development covers only 17.38% of the Study Area (see Table 4.1 and Figure 4.7).

4.17 Of the 20 Viewpoints which have been selected to represent typical views of the Development within the Study Area only six would experience significant visual effects resulting from the Development. These are Viewpoints 1, 2, 5, 6, 9 and 12 which are all located within 3 km and from where the Development would be both prominent and visible in its entirety or near-entirety. These viewpoints are also all located to the south of the Development and in close proximity to Carnlough. However, it is noted that there are no significant effects from other close range Viewpoints within Carnlough, along other parts of the A42 road corridor or from more elevated viewpoints overlooking Glenarm and Glencloy at higher elevations. From the majority of the Study Area and the majority of the AONB the Development would either have no visibility or no significant visual effects. There is a noticeable absence of visibility from coastal areas aside from Carnlough or from the lower parts of any of the Glens except Glencloy where visibility is also not widespread. Therefore, the effects of the Development on the AONB as a whole are limited.

[1] '*Antrim Coast and Glens Area of Outstanding Natural Beauty Management Plan 2008 – 2018*' (June 2008) Causeway Coast and Glens Heritage Trust

4.18 In relation to cumulative effects the overall magnitude of cumulative effects on both landscape and visual character is deemed to medium magnitude and not significant. Whilst the Development would be immediately apparent on a small part of the Garron Plateau LCA it would have no direct physical effects on adjacent LCAs in conjunction with other wind farms or turbines. Neither would it be significantly visible from adjacent LCAs in conjunction with any existing, consented or proposed wind farms that would cause indirect effects on landscape character of any more than low magnitude. There are few instances where the Development would be visible in conjunction with other wind farms in the cumulative baseline and where this does occur it is from elevated viewpoints located at a greater distance from the Development where the Development itself is less visually prominent.

4.19 It is also noted that wind farms are not an uncommon feature in approaches to the AONB and there is already a pattern of wind farms and single turbines in the Study Area. Existing and consented wind farms are generally located along the south western and western edges of the AONB and are closely associated with the lowlands around the A26 road corridor. The closest existing wind farms, Rathsherry/ Elginny Hill, are sometimes visible from the same locations as the Development but rarely in the same field of view and always with approximately 8 - 10 km separation distance. The nearest consented wind farm would be Ballykeel, located approximately 12.95 km to the south east and not clearly discernible from parts of the Study Area with clear views of the Development. The nearest proposed wind farm would be Carnalbanagh, located approximately 4 km to the south west. It would also usually be viewed with an area of ‘undeveloped’ land in between, and in these instances from elevated viewpoints encompassing wider views of the Study Area and the landscape beyond the AONB. The Development’s position on the east-facing edge of the Garron Plateau, on lower ground means that close range views tend to be more restricted in their extent and visibility of the Development from most parts of the AONB is limited.

Description of the Development

4.20 The turbines would be located on upland grazing land between the townlands of Unshinagh and Ticloy on the Garron Plateau to the south east of Cleggan Forest and below the summits of Berry Hill, Binnagee and Neill’s Top. The site is largely open ground but is divided in part by stone walls and post and wire fences. There are two small and irregular shaped areas of coniferous forestry and smaller groups of conifers in the south western part of the site that would be partially removed to facilitate construction of the access track near turbine 8 and turbine 10. There are a number of agricultural and forestry tracks across the site but no public access.

4.21 The Development itself comprises 14 wind turbines with a maximum blade tip height of 180 m located between approximately 204 m – 339 m AOD. A detailed description of the Development is provided in Chapter 1 of the ES, including the turbines, infrastructure, sub-station and electrical cable connections to the local grid network, energy storage compound, site access arrangements, site layout, forestry felling, construction methods and anticipated 18-month programme of construction work.

4.22 The visual effects of construction traffic and work on site will be short term and experienced only in close range views from the north eastern end of Slane Road and the A42 near Doonan Leap on the outskirts of Carnlough. Construction traffic will access the site from a newly formed site entrance at this point. A new access track will be formed in cutting from this point heading in a south westerly direction into the centre of the site where it will connect with an existing track. The point of access would include the removal of a small bank of existing trees adjacent to the A42 and, for a temporary period of time, the site entrance area will become clearly visible from a short section of this road. However, the majority of the access track would then be in cutting and is unlikely to be clearly visible from any public viewpoints. Proposals to create a new belt of mixed woodland on the southern side of this embankment, and to extend an existing belt of Scots Pine on the northern side, will ensure that the site entrance and access track will steadily become screened from view as the planting establishes and matures (assuming an approximate growth rate of 0.9 m per year for broadleaved tree species).

4.23 During the operational phase of the Development, anticipated to be 35 years, the landscape and visual effects would primarily relate to the presence of the turbines themselves as described and analysed in the following section of this LVIA. Day-to-day site activity would be minimal and there would be no further discernible changes to the landscape or visual character of the site resulting from site maintenance activities.

4.24 In addition to the turbines, there will be a sub-station and control building and energy storage compound located to the south of Turbine T14 which is one of the lower turbines in the layout at 237.44 m AOD. This compound will be positioned on lower lying ground between T14 and Curraghvohil Hill, the latter being likely to screen views of the compound from most parts of the Study Area.

4.25 Following the cessation of the sites function as a wind farm, all above-ground structures would be dismantled and removed from site (unless further consent is given to extend the operational life of the wind farm or replace the turbines) in accordance with a decommissioning and restoration plan which will be agreed with the local planning authority prior to decommissioning.

Feasibility Appraisal, Design Evolution and Iteration

4.26 The Development assessed in this LVIA has evolved through an iterative design process that has been informed by a careful analysis of the constraints and opportunities presented by the site location and the characteristics of the Development itself. This process is further detailed in Chapter 3: Design Evolution and Alternatives. The 14-turbine option that is presented in the EIA is the result of this iterative design process.

4.27 A layout comprising 16 turbines was initially assessed. ZTV diagrams were prepared to compare the difference in theoretical visibility for blade tip heights of 150 m versus 180 m and hub height visibility for three potential rotor diameter options (117 m, 126 m and 136 m). Comparative wirelines were prepared from six provisional viewpoint locations in key parts of the Study Area (PVPs 1 – 6 as detailed in Technical Appendix 4, Table 4.4.1) to compare and assess the appearance of the turbines with the three rotor diameter options. The comparative wirelines are not reproduced in the LVIA but a comparative ZTV illustrating the difference between the two blade tip height options is included at Figure 4.5.

4.28 The findings of this initial review of layouts and potential turbine dimensions were as follows:

- The provisional wirelines showed no significant difference in the appearance of the turbines regardless of rotor diameter but 180 m blade tip was deemed to be the preferable tip height if 136 m rotor diameter is used (a larger rotor is able to capture more wind and is therefore more productive). This is because the taller hub creates more clearance/ visual separation between the blade tips and skyline and means that the blades are less likely to interfere with appreciation of the landscape;
- It was noted that the 117 m rotor option would have a similar effect to that described above because these turbines would have a proportionally higher hub height. . However, use of a smaller rotor is less productive in terms of wind capture. Furthermore, initial comparative ZTV diagrams (not reproduced in the LVIA) illustrated that use of smaller rotor diameter would actually increase hub height visibility across a slightly larger proportion of the Study Area regardless of overall tip height because it would necessitate a taller hub;
- The comparative ZTV diagram illustrating the difference in blade tip visibility between the 150 m and 180 m turbines (Figure 4.5) showed no significant increase in levels of visibility either within the Study Area as a whole or within the AONB resulting from turbines with 180 m tip heights. The additional visibility that would result from the use of 180 m high turbines would be 3.18%. The majority of this increase would only be experienced from sea-based viewpoints to the north east of Cushendun and beyond distances of 15 - 20 km to the west of the Development where actual visibility is likely to be greatly reduced by land cover elements in the pastoral landscape between Antrim and Ballymoney.
- Overall the initial ZTV diagrams also illustrated: no significant difference in levels of visibility resulting from the various tip height and rotor diameter options; a greater proportion of the Study Area would have no visibility of the wind farm (ranging from approximately 55% - 63%); there

would be comparatively little visibility of the Development within the AONB as a whole;

- A review of the initial 16-turbine layout based on wirelines of the six PVPs concluded that some refinements to turbine spacing/ groupings could be made to create a more uniform appearance that better reflected to underlying topography. Four of the proposed turbines - T11, 12, 14, 15 - sometimes appeared as outliers from the main group and, in some PVPs, this was also the case for T1 and 2. In other PVPs some of the turbines appeared to be more densely clustered together in the centre of the layout.

4.29 As a result of the above findings refinements were made to the proposed layout as presented in the ES and this has resulted in a number of benefits in landscape and visual terms:

- The number of turbines has been reduced from 16 to 14;
- Turbines have been further set back from higher ground at the northern end of the site to reduce visibility from Carnlough;
- The turbines in the final layout that is presented in this ES are evenly spaced in relation to each other and to the site topography which has resulted in a simpler layout with fewer variations in tip heights in relation to contour AOD levels;
- Turbine 14 has been repositioned within the northern turbine grouping and appears as a coherent element rather than an outlier;
- There are fewer instances where 'stacking' of turbines occurs. Stacking is where two or more turbines will appear directly in front of each other in a view and will therefore result in a 'heavier' or more solid, and hence more prominent appearance.

Consultation

4.30 Consultation and discussion between RES and the Department for Infrastructure (DfI) has taken place through the submission of a Proposal of Application Notice (PAN) a copy of which is provided in Volume 4 Appendix 1.1. A copy of the response from DfI is provided in Appendix 1.2. The Department are obliged to consult with other statutory consultees who would have an interest in the likely landscape and visual effects of the Development and it is understood that they consulted directly with the Department of Agriculture, Environment and Rural Affairs: Northern Ireland Environment Agency (NIEA) although no scoping response relating to landscape and visual issues has been received to date.

4.31 An online public exhibition was held in September 2021 to present and discuss the Development with interested parties from the local and wider community. A map-based figure was presented to illustrate the theoretical visibility of the Development overlaid with the AONB boundary, the location of PVPs and cumulative wind farms. Wirelines and photomontages of five PVPs were also presented to illustrate how the Development would appear from some of the key viewpoints in the surrounding area (PVPs 3, 7, 9, 14 and 15), refer to Technical Appendix 4.4 Table 4.4.1).

4.32 General concerns were raised about the likely landscape and visual effects of the Development on the AONB and Carnlough village. In order to fully address these concerns the selection and analysis of viewpoints in this LVIA includes representative close range and contextual views within the AONB and from several locations in and around Carnlough.

Summary of the Methodology for this Landscape and Visual Impact Assessment

Best Practice Guidance

4.33 An LVIA is a formal assessment, which is carried out as part of the EIA, a process defined by the EIA Regulations. In accordance with these Regulations the LVIA takes an objective approach to the identification of the baseline conditions within an appropriate 'Study Area'. In this instance the Study Area extends to a 30 km radius from the Development.

4.34 The LVIA methodology used by the author for wind farm projects has been developed in accordance with the EIA Regulations and the suite of available best practice guidance on the preparation of LVIAs in both general terms and specifically in relation to wind energy development. The latter, published by Nature Scotland and the Landscape Institute, haves been adapted by the author to suit the Northern Ireland context. A full list of this best practice guidance is provided in Technical Appendix 4.1 and a detailed description of the Methodology is provided in Technical Appendix 4.2. This LVIA must be read in conjunction with these Technical Appendices in order to be properly understood.

4.35 The criteria used to identify and analyse both the nature of landscape and visual receptors (their 'Sensitivity'), the nature of landscape and visual effects ('Magnitude') and the Signficance of these effects are all key LVIA terms which are defined in detail in the Methodology. They are also summarised in this section of the chapter for ease of reference (paragraph 4.38 onwards).

The LVIA Process

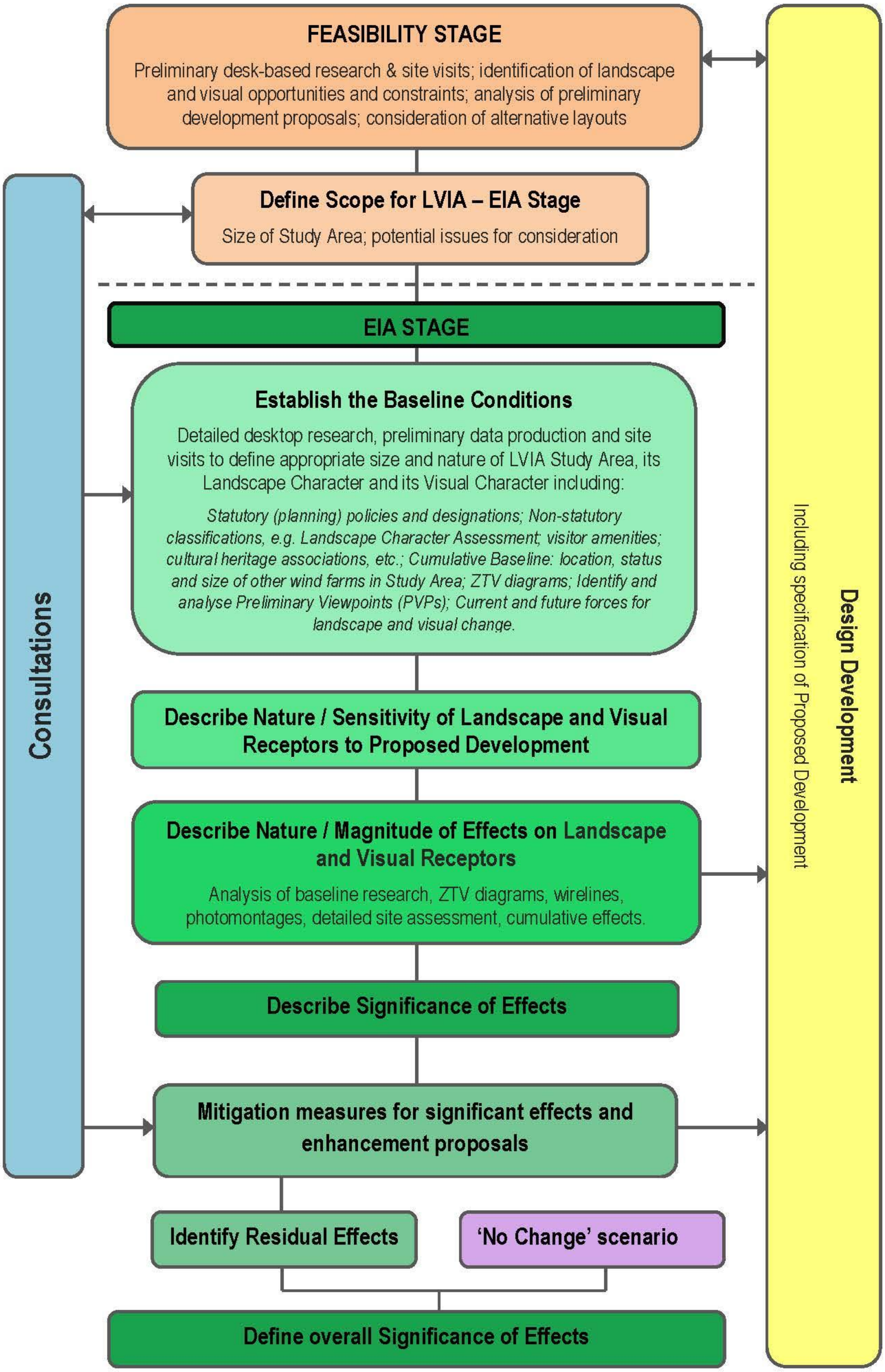
4.36 The LVIA begins with an assessment of baseline conditions combining existing desktop information, such as maps and documents, with site surveys of the Study Area carried out by an experienced Chartered Landscape Architect. A review of relevant planning policy is carried out in order to identify any elements or parts of the Study Area which are recognised for their landscape or visual qualities and any locations that may have been identified by the SPG as being more or less suitable for wind energy development. The baseline assessment also evaluates likely levels of acceptable change for various parts of the Study Area in accordance with current definitions of landscape and visual sensitivity (see paragraphs 4.41 – 4.42).

4.37 Potential landscape and visual effects on the baseline conditions are then assessed as separate but linked issues. However, it is noted that all policy guidance and publications providing information on the baseline character of the Study Area deal with landscape and visual elements in combination. To avoid repetition and present an accurate reflection of this baseline information it has been necessary for the LVIA analysis of these publications to reflect this approach. The assessment of both landscape and visual effects require a combination of quantitative and qualitative evaluation. The magnitude of landscape effects is derived from the extent to which physical changes resulting from the Development would cause changes in landscape character. Visual effects relate to changes in the composition of views and people's perception of/responses to these physical changes.

4.38 For both landscape and visual effects the Significance of effect is derived from the assessment of Landscape Value, Sensitivity and Magnitude of change and also by using objective professional judgement in relation to site circumstances. It is important to recognise that the landscape is constantly evolving and that opinions on the beneficial or adverse effects of wind farms are highly subjective. Therefore, in order to ensure that the LVIA presents information objectively, a judgement is made on the significance of effects but no judgement is made on whether these effects are beneficial or adverse.

Plate 4.1 presented on next page…

Plate 4.1: The LVIA Process



Key LVIA Terminology and Assessment Criteria

4.39 The following terms and assessment criteria form the basis for the LVIA and are summarised below for ease of reference. They are fully described in Technical Appendix 4.2.

The Nature of Landscape and Visual Receptors

4.40 The baseline assessment element of the LVIA gathers information on the 'nature' of landscape and visual receptors which is then correlated with the nature of the Development and its anticipated 'effects' on these receptors in order to draw conclusions on the 'significance' of these effects.

4.41 This LVIA uses the term 'Landscape Sensitivity' to refer to the overall nature of landscape receptors (refer to the landscape attributes described in Technical Appendix 4.2, paragraph 4.19) and their susceptibility to the changes caused specifically by the Development.

4.42 The consideration of key landscape attributes enables a considered judgement to be made on the level of sensitivity to be apportioned to each defined LCA within the Study Area specifically related to the Development. The following criteria outline the general principles that are used to inform and guide the assessment of Landscape Sensitivity:

- ***High Landscape Sensitivity:*** A landscape where the majority of attributes are unlikely to withstand change without causing a change to overall landscape character to the extent that it would be difficult or impossible to restore. The frequency and sensitivity of landscape receptors may be high but not exclusively so;
- ***Medium Landscape Sensitivity:*** A landscape with a combination of attributes that is capable of absorbing some degree of change without affecting overall landscape character. There are unlikely to be large numbers of sensitive landscape receptors;
- ***Low Landscape Sensitivity:*** A landscape where the majority of attributes are robust and/ or tolerant of change to the extent that change or development would have little or no effect on overall landscape character. It is likely to be easily restored and the frequency and sensitivity of landscape receptors may be low but not exclusively so.

4.43 Visual effects relate to changes in the composition of views and people's responses to these changes. The nature of visual receptors is determined through the analysis of ZTV diagrams, site assessment and viewpoints representing both typically occurring views within the Study Area and views from specific locations or those likely to be experienced by specific visual receptors (for example, visitors to a specific site such as Glenarm Castle). 'Visual Sensitivity' refers to the overall nature of views and viewers (visual receptors) and their likely sensitivity to the changes in views that would be caused specifically by the Development. The following criteria outline the general principles that are used to inform and guide the assessment of visual sensitivity:

- ***High Visual Sensitivity***: may typically include residents of properties where the main view is orientated towards the Development, or people undertaking recreation where the landscape within which the Development is seen is the primary reason for attraction (for example, walkers, cyclist and drivers on scenic routes). Receptors are more likely to be located within a designated landscape and could be attracted to visit more frequently, or stay for longer, by virtue of the view;
- ***Medium Visual Sensitivity***: may typically involve people undertaking active recreational pursuits where the wider landscape within which the Development is not seen as the primary reason for attraction (e.g. golf, water sports, theme and adventure parks, historic sites, parks and gardens). Receptors are less likely to be located within a designated landscape and could be attracted to visit more frequently or stay for longer by virtue of the facilities and features of the particular attraction rather than by the value of the view;
- ***Low Visual Sensitivity***: may typically include vehicular travellers; outdoor workers (e.g. farm and forestry workers); people in indoor workplaces and community facilities; and residents within larger settlements. Receptors are unlikely to be within a designated landscape and are most likely to be present at a given viewpoint by virtue of some other need or necessity unrelated to the appreciation of the landscape or visual value.

The Nature of Landscape and Visual Effects

4.44 This LVIA uses the term 'Magnitude' to cover assessment of the degree of change that would result from the introduction of the Development into the baseline landscape and visual context.

4.45 The nature of landscape effects is dependent on the degree of change that would result from the introduction of the Development in terms of size or scale, geographical extent, duration and reversibility of the proposed change and whether the effects would be experienced directly or indirectly (refer to Technical Appendix 4.2 paragraph 4.29 for further detail). The following criteria outline the general principles that are used to inform and guide the assessment of the Magnitude of landscape effects:

- ***High Landscape Magnitude***: The Development would be immediately apparent and would result in substantial loss or major alteration to key elements of landscape character to the extent that there is a fundamental and permanent, or long-term, change to landscape character. The change may occur over an extensive area;

- ***Medium Landscape Magnitude***: The Development would be apparent and would result in loss or alteration to key elements of landscape character to the extent that there is a partial long-term change to landscape character. The change may occur over a limited area;
- ***Low Landscape Magnitude***: The Development would result in minor loss or alteration to key elements of landscape character to the extent that there may be some slight perception of change to landscape character. The change may be temporary and occur over a limited area;
- ***Negligible Landscape Magnitude***: The Development would result in such a minor loss or alteration to key elements of landscape character that there would be no fundamental change.

4.46 The nature of visual effects is dependent on factors including, for example, the prominence of the Development in the view; the number of turbines that would be visible and the geographical extent of turbines in relation to the extent of the view; the angle and relative elevation of the viewpoint in relation to the Development; and the context within which the Development will be seen (refer to Technical Appendix 4.2 paragraph 4.37 for further detail). The following criteria outline the general principles that are used to inform and guide the assessment of the Magnitude of visual effects:

- ***High Visual Magnitude***: The Development would be a dominant and immediately apparent feature that would affect and change the overall character of the view and to which other features would become subordinate;
- ***Medium Visual Magnitude***: The Development would form a visible and recognisable new element within the overall view and would be readily noticed without changing the overall nature of the view;
- ***Low Visual Magnitude***: The Development would form a component of the wider view that might be missed by the casual observer. Awareness of the Development would not have a marked effect on the overall quality of the view;
- ***Negligible Visual Magnitude***: The Development would be barely perceptible, or imperceptible, and would have no marked effect on the overall quality of the view.

The Significance of Landscape and Visual Effects

4.47 The EIA Regulations require the LVIA to identify and assess the acceptability of significant effects. Best practice guidance recognises that the significance of effects is not absolute and is related specifically to the Development. It is also dependent on the relationship between sensitivity and magnitude.

4.48 This LVIA uses the following criteria to inform and guide the assessment of the Significance of Landscape Effects:

- ***Significant Landscape Effects:*** Effects that would occur when the majority of landscape attributes are deemed to be highly sensitive and the magnitude of change would alter landscape character to the extent that it would become defined, or considerably influenced, by the presence of the Development;
- ***No Significant Landscape Effects (Not Significant)***: Effects would not be significant when the majority of landscape attributes are not deemed to be highly sensitive and where the Development would have little, or no, effect on existing landscape character. This would also occur where the Development can be integrated into the existing Study Area without the loss of key landscape attributes. Where the magnitude of effect is higher but the number and sensitivity of landscape attributes decreases, so landscape character would become less defined by the Development and more so by other landscape attributes.

4.49 This LVIA uses the following criteria to inform and guide the assessment of the Significance of Visual Effects:

- ***Significant Visual Effects***: Effects that would occur when the majority of visual receptors are deemed to be highly sensitive and the magnitude of change would alter visual character to the extent that it would become defined, or considerably influenced, by the presence of the Development;
- ***No Significant Visual Effects (Not Significant)***: Such effects would occur when the majority of visual receptors are not deemed to be highly sensitive and where the Development would have little or no effect on existing views. The Development would be likely to constitute a minor component of the wider view, which might be missed by the casual observer, and awareness of the Development would not have a marked effect on the overall quality of the view. Where the Development is easily noticeable but the number and sensitivity of visual receptors decreases, so overall visual character would remain less defined by the Development and more so by other elements of the existing view.

Cumulative Landscape and Visual Effects

4.50 The purpose of the cumulative impact assessment is to measure the incremental effect of the Development on the Cumulative Baseline rather than to assess the combined effects of all, or some, of the Cumulative Baseline with the Development[2]. The magnitude of cumulative change is dependent on a number of factors, including the presence of other wind farms and the degree to which these already influence landscape and visual character and the distance between the

[2] Scottish Natural Heritage (March 2012), 'Assessing the Cumulative Impacts of Onshore Wind Energy Development s' paragraphs 7 and 55, paraphrased from the GLVIA para 7.12

Development and other wind farms (see Technical Appendix 4.2, paragraphs 4.61 and 4.66 for further detail).

4.51 There are existing and consented wind farms as well as single turbines in other parts of the 30 km Study Area and these are considered to form part of its baseline character which informs the assessment of landscape and visual effects, particularly the analysis of effects on viewpoints for this LVIA. Proposed wind farms are also considered but may be afforded less weight when assessing the incremental effects of the Development because their status is less certain. The additional cumulative effects of the Development when considered with other wind farms and single turbines in the cumulative baseline are assessed from paragraph 4.210.

4.52 Cumulative landscape effects relate to the incremental degree of change to the existing landscape character or physical fabric of the Study Area that would result from the introduction of the Development over and above that of the Cumulative Baseline. The following criteria outline the general principles that are used to inform and guide the assessment of the Magnitude of Cumulative Landscape Effects:

- ***High Cumulative Landscape Magnitude***: The introduction of the Development to the Cumulative Baseline would result in substantial incremental loss of, or major alteration to, key elements of landscape character to the extent that there would be a fundamental and permanent, or long-term, change to landscape character. The change may occur over an extensive area;
- ***Medium Cumulative Landscape Magnitude***: The introduction of the Development to the Cumulative Baseline would result in the incremental loss of, or alteration to, key elements of landscape character to the extent that there would be a partial long-term change to landscape character. The change may occur over a limited area;
- ***Low Cumulative Landscape Magnitude***: The introduction of the Development to the Cumulative Baseline would result in minor incremental loss of, or alteration to, key elements of landscape character to the extent that there may be some slight perception of change to landscape character. The change may be temporary and occur over a limited area;
- ***Negligible Cumulative Landscape Magnitude***: The introduction of the Development to the Cumulative Baseline would result in such a minor incremental loss of, or alteration to, key elements of landscape character that there would be no fundamental change to landscape character.

4.53 The significance of cumulative landscape effects is dependent on landscape sensitivity, the magnitude of cumulative change, and the relationship between these two factors. The following criteria outline the general principles that are used to inform and guide the assessment of the significance of cumulative landscape effects:

- ***Significant Cumulative Landscape Effects***: Effects that would occur when the majority of landscape attributes are deemed to be highly sensitive and the incremental effects of the Development would alter landscape character to the extent that it would become defined or considerably influenced by the presence of wind farms, taking account of cumulative baseline conditions;
- ***No Significant Cumulative Landscape Effects (Not Significant):*** Such effects would occur when the majority of landscape attributes are not deemed to be highly sensitive and where the Development would have little or no incremental effect on the existing landscape character. Where the Development can be integrated into the existing cumulative baseline, without the loss of key landscape attributes, cumulative landscape effects would also be deemed as Not Significant. This level of significance would also occur where the Development may have a greater magnitude of effect but its incremental effects would not cause the landscape character to become more defined by wind farms than it currently is, or to become more defined by wind farms than by other landscape attributes

4.54 Cumulative visual effects relate to the degree to which wind energy developments feature in particular views or sequences of views, and the resulting effects of this upon visual receptors. This LVIA considers simultaneous and sequential cumulative visual effects that may arise within the Study Area and in relation to the selected viewpoints. The LVIA principally considers the degree to which the Development would contribute to wind energy development becoming a significant or defining characteristic of visual character. The following criteria outline the general principles that are used to inform and guide the assessment of the Magnitude of cumulative visual effects:

- ***High Cumulative Visual Magnitude***: The Development would increase the scale of wind turbines in the landscape to a level at which the view would become dominated by wind farms;
- ***Medium Cumulative Visual Magnitude***: The Development would result in a noticeable increase in turbines but this increase would not result in wind farms being the dominant feature of the view;
- ***Low Cumulative Visual Magnitude***: The Development would be visible but would constitute a component of the view that might be easily missed by the casual observer and/ or would not contribute to the overall prominence of wind farms within the view;
- ***Negligible Cumulative Visual Magnitude***: The Development would be barely perceptible, or imperceptible, and/ or would have no effect on the perception of wind turbines within the view.

4.55 The following general principles are used to inform and guide the assessment of the Significance of Cumulative Visual Effects:

- ***Significant Cumulative Visual Effects***: Effects that would occur when the majority of visual receptors are deemed to be highly sensitive and the addition of the Development to the cumulative baseline would result in the view becoming defined, or considerably influenced, by wind turbines;
- ***No Significant Cumulative Visual Effects (Not Significant)***: Such effects would occur when the majority of visual receptors are not deemed to be highly sensitive and where the Development would have little or no incremental effect on existing views. The Development is likely to constitute a barely perceptible, or imperceptible, component of the wider view, which might be missed by the casual observer. Awareness of the Development would not have a marked effect on the overall quality of the view. Where the Development may be a noticeable addition to views containing wind farms in the cumulative baseline but it would not cause the overall visual character of the view to become defined by wind turbines rather than by other elements of the existing view the overall effects would also be deemed to be Not Significant.

Baseline Assessment

Legislation and Planning Policy

4.56 The primary policy guidance on the assessment of landscape and visual effects of wind farm development is the Strategic Planning Policy Statement for Northern Ireland (SPPS) which should be read in conjunction with Planning Policy Statement 2 (PPS 2), Planning Policy Statement 18 (PPS 18) it's Supplementary Planning Guidance (SPG) and Best Practice Guidance (BPG)[3]. Further changes in planning policy and updates to development plans are expected to take place over the next few months and years as Planning Policy Statements, supplementary guidance and existing Development Plans become entirely superseded by the SPPS and emerging Local Development Plans.

Strategic Planning Policy Statement for Northern Ireland (SPPS): Planning for Sustainable Development

4.57 The SPPS sets out strategic subject policies, including renewable energy, and is intended to provide core principles to underpin the delivery of the new two-tier planning system where the new local councils have primary responsibility for the implementation of development control. However, for the transitional period whilst Local Development Plans are being prepared, the existing suite of Planning

[3] Department of the Environment Northern Ireland (September 2015) 'Strategic Planning Policy Statement for Northern Ireland (SPPS): Planning for Sustainable Development' , (2013) 'Planning Policy Statement 2: Natural Heritage); (2009) 'Planning Policy Statement 18: Renewable Energy' and (August 2010) 'Wind Energy Development in Northern Ireland's Landscapes, Supplementary Planning Guidance to Accompany Planning Policy Statement 18 'Renewable Energy'; (2009) 'Best Practice Guidance to Planning Policy Statement 18: Renewable Energy'

Policy Statements, supplementary and best practice guidance and relevant provisions within the *'Planning Strategy for Rural Northern Ireland'* will remain in place.

4.58 The aim of the SPPS is to facilitate for sustainable development based on three overarching principles of supporting rural regeneration; promoting economic growth and environmental sustainability. The latter principle includes for the protection of landscape character as well as a reduction in greenhouse gas emissions, and the mitigation and adaptation to the effects of climate change is a key principle in the SPPS and the promotion of renewable energy systems is one of the means by which the planning system will achieve this principle.

4.59 'Subject Polices' for Renewable Energy are covered in paragraphs 6.214 - 6.234 of the SPPS and the SPG remains in place. The SPPS retains the European Landscape Convention's definition of 'landscape' to mean "*an area, as perceived by people, whose character is the result of the action and interaction of natural and / or human factors*"[4]. The SPPS also recognises that Northern Ireland has significant renewable energy resources and that the renewable energy industry makes an important contribution to sustainable development and investment in the region. Renewable energy also reduces our dependence on imported fossil fuels and benefits our overall health, well-being and quality of life. "*The aim of the SPPS in relation to renewable energy is to facilitate the siting of renewable energy generating facilities in appropriate locations within the built and natural environment in order to achieve Northern Ireland's renewable energy targets and to realise the benefits of renewable energy without compromising other environmental assets of acknowledged importance*." (SPPS paragraph 6.218).

4.60 The strategic regional objectives are to ensure that environmental, landscape and visual amenity impacts are adequately addressed, and that natural and cultural heritage features are adequately protected. However, the SPPS also expects that the emerging Local Development Plans will support a diverse range of renewable energy developments whilst taking account of both local circumstances and the wider recognised benefits of renewable energy. Whilst the SPPS advises that a cautious approach should be applied to proposals within designated landscapes which are of significant value, and their wider settings where it may be difficult to accommodate renewable energy developments without detriment to the regions cultural and natural heritage assets it also notes that *"It will not necessarily be the case that the extent of visual impact or visibility of wind farm development will give rise to negative effects; wind farm developments are by their nature highly visible yet this in itself should not preclude them as acceptable features in the landscape. The ability of the landscape to absorb development depends on careful siting, the skill of the designer, and the inherent characteristics of the landscape such as landform, ridges, hills, valleys, and vegetation*." (SPPS paragraphs 6.230 -

[4] Definition of landscape used in the European Landscape Convention (2000, Article 1.a) Council of Europe and 'Northern Ireland's Landscape Charter' (January 2014) NIEA

231). Whilst the Development would be located within a designated landscape this is not unusual in a Northern Ireland context. The extent of its visibility from within the AONB boundary would be relatively limited (see paragraph 4.133) and it would also have limited cumulative effects (see paragraph 4.210). Furthermore, it would be in accordance with the more strategic aims of the SPPS related to the mitigation of climate change.

Planning Policy Statement 2: Natural Heritage

4.61 Policy NH6 of PPS 2 states that permission will only be granted for new development in AONBs where it is of an appropriate design, size and scale for the locality and meets three criteria including; siting that is sympathetic to the special character of the AONB in general and also the particular locality; it respects or conserves features of importance to this character and; it respects vernacular styles and materials. PPS 2 also notes that "*the quality, character and heritage value of the landscape of an AONB lies in their tranquillity, cultural associations, distinctiveness, conservation interest, visual appeal and amenity value*" (PPS 2, paragraph 5.15). It refers to LCAs and AONB Management Plans for further information.

4.62 Due regard has been given to the special character of the AONB and the manner in which the Development as a whole reflects this special character is included in the analysis of the AONB Management Plan from paragraph 4.90. Detail of the appropriateness of the proposed design, scale and size of the Development in relation to landscape character as described by the SPG is analysed from paragraph 4.68. The proposed site entrance will include areas of replacement/ additional planting with appropriate species to provide screening of the site access track and the turbines from close range viewpoints on the A42 (see paragraphs 4.21 and 4.155). The substation and associated buildings would be located in between two areas of higher ground to minimise visibility.

Planning Policy Statement 18: Renewable Energy

4.63 The aim of PPS 18, which is broadly aligned with that of the SPPS, is "*to facilitate the siting of renewable energy generating facilities in appropriate locations within the built and natural environment in order to achieve Northern Ireland's renewable energy targets and realise the benefits of renewable energy*" (PPS 18, section 3.1). Policy RE1 states that proposals must demonstrate that they "*would not have an unacceptable impact on visual amenity or landscape character through: the number, scale, size and siting of turbines; that the development has taken into consideration the cumulative impact of existing turbines, those which have permissions and those that are currently the subject of valid but undetermined applications*". It is noted that the more recently published EIA Regulations do not require consideration of proposed wind farms due to the unknown nature of their status.

Best Practice Guidance to accompany PPS 18

4.64 The BPG provides technical information and potential considerations in relation to planning applications for wind energy projects. It refers to the SPG for guidance on the landscape and visual analysis process and advice on the indicative type of development that may be appropriate but is not prescriptive. The BPG notes that "*There are no landscapes into which a wind farm will not introduce a new and distinctive feature. Given the Government's commitment to addressing the important issue of climate change and the contribution expected from renewable energy developments, particularly wind farms, it is important for society at large to accept them as a feature of the Region for the foreseeable future.*" However, it also notes that the locations of developments should be carefully considered in order to reduce their impact and aid integration into the local landscape even though they may be highly visible. (BPG section 1.3.18 - 19).

4.65 The BPG reiterates the SPPS in its recognition that visibility doesn't necessarily equate with levels of acceptability and notes that there are three considerations when considering the capacity of a landscape to accommodate wind farm development (BPG 1.3.21):

- The degree of impact the development will have on the existing character of the landscape;
- The sensitivity of the character of the landscape; and
- The extent to which this impact can be modified and reduced by design.

4.66 The BPG also refers to the inherent characteristics of a landscape, such as landform and vegetation, the careful siting and skilful design of developments all playing an important role in the ability of a landscape to absorb development. Turbine layouts must also be appropriate to the local landform and landscape characteristics; groups of turbines can normally appear acceptable as single isolated features in open, undeveloped landscapes whereas rows of turbines may be more appropriate where there are formal field boundaries within flatter agricultural landscapes. Wind farms should not appear visually confusing in relation to the character of the landscape and should ideally be separate from surrounding features to create a simple image (sections 1.3.22 & 1.3.26).

4.67 In relation to visual impact the BPG notes that wind farms in an open landscape setting are likely to be prominent features at distances below 2 km, and relatively prominent at up to 5 km. Between 5 – 15 km they are more likely to be seen as part of the wider landscape and prominent only in clear visibility. Beyond 15 km they are only likely to be seen in clear visibility and as a minor element in the landscape (section 1.3.25).

4.68 It is noted that Nature Scotland's best practice guidance in relation to the siting and design of wind farms has been updated since the BPG was published and no longer refers to specific distances in relation to visual prominence (see Technical Appendix 4.1, paragraph 4.3). Their research has found that other factors such as weather conditions, time of day/year, angle of view, and composition of other elements in the view, all contribute to the assessment of visual effects and visual prominence.

Supplementary Planning Guidance to accompany PPS 18

4.69 The SPG is intended to provide broad strategic guidance on appropriate locations for wind energy development based on the definition of LCAs within the Northern Ireland Landscape Character Assessment (NILCA). It advises that the detailed assessment of the nature of a wind farm's effects on landscape character should be dealt with on a case-by-case basis via an LVIA. The SPG itself is non-prescriptive with regards to turbine heights and groupings. Its assessment of landscape sensitivity is intended to provide broad guidance but not to exclude development. Rather it places an onus on developers to demonstrate, via the EIA process, that wind farms can be developed without unacceptable effects on LCAs as a whole.

4.70 The SPG recommends a 20-30 km radius Study Area for medium or large commercial height turbines, which has informed the selection of a 30 km Study Area for this Development. The SPG includes recommendations that are specific to the potential effects of wind energy developments on the character of individual LCAs. The SPG as it relates to the Development is analysed starting at paragraph 4.105.

4.71 The assessment of Landscape Value and Sensitivity for some LCAs is altered from the SPG if detailed site survey in relation to Development has revealed variations in particular areas. This is in accordance with the SPG, which states that, "*It should be noted that within many LCAs there is considerable variation in sensitivity level across the area, reflecting the fact that the LCAs are broad character or identity areas. The overall sensitivity level is therefore the level that prevails over most of the LCAs geographic area. Localised areas of higher or lower sensitivity may also exist and these are generally identified in the sensitivity descriptions within each LCAs assessment sheet. The overall sensitivity level of a LCA is indicative of the relative overall sensitivity level of each LCA. A high sensitivity level does not necessarily mean that there is likely to be no capacity for wind energy development within the LCA and conversely a low sensitivity level does not mean that there are no constraints to development*" (SPG section 2.3).

Emerging Council Policy

4.72 Changes in planning policy and updates to development plans are expected to take place over the coming months and years as Planning Policy Statements, supplementary guidance and existing Development Plans become superseded by emerging Local Development Plans, which will be primarily informed by the SPPS. The SPPS (at paragraph 1.10) sets out transitional arrangements where this is the case to ensure continuity of planning policy and decision making and notes that decisions should be taken in line with the SPPS and relevant PPSs until such time as a plan strategy for the whole council area has been adopted.

4.73 Mid and East Antrim Borough Council published a Draft Plan Strategy for the Local Development Plan (LDP) in September 2019 which set out the Council's strategic intentions for development within the Borough and representations submitted in response to this are currently being considered by the Council. The Draft Strategy, representations and counter representations were forwarded to the DfI for Independent Examination in March 2021 to determine whether or not the Plan satisfies statutory requirements and the outcome of this is awaited. The SPPS notes that decisions should continue to be taken in line with the SPPS and relevant PPSs until such time as a Plan Strategy for the whole Council area has been adopted and the timescale for this is, as yet, unknown. Therefore, for the purpose of this LVIA it is considered that the Draft Plan Strategy is at too early a stage to be afforded weight.

Analysis of the Developments Effects on Planning Policy

4.74 The Development is located within the Antrim Coast and Glens AONB, which is an environmental asset of acknowledged importance. With the exception of Glenarm demesne and Cleggan House Registered Park this is the only statutory landscape designation that applies to the Development. The Development's location is not contrary to the relevant planning policies described in the preceding paragraphs because they do not preclude such Development from designated areas. However, they do require them to be appropriately located in relation to the AONB, the key characteristics of which are described within the AONB Management Plan. This is a non-statutory document providing information on the special qualities of the AONB and the aims and objectives for its long term management (the Developments effects on the AONB are analysed starting at paragraph 4.90).

4.75 The SPPS, which is the overarching policy document, recognises that renewable energy is a beneficial type of development provided it is appropriately located. The SPPS also reiterates the European Landscape Convention's definition of landscape as being a result of both natural and human factors. The SPPS is supportive of renewable energy developments as a means of mitigating against the effects of climate change but advises that a cautious approach should be taken to taken to siting renewable energy developments in designated landscapes where such developments would result in detrimental effects on the value of these landscapes. In this respect it is necessary to consider policy principles set out in Planning Policy Statement 2 (PPS 2) relating to AONBs and more detailed advice set out by the SPG in relation to specific Landscape Character Areas (LCAs) and also to the AONB Management Plan and Northern Ireland Regional Landscape and Seascape Character Assessments (NIRLCA and NIRSCA).

4.76 PPS 2, Policy NH6 notes that the special qualities of AONB's include tranquillity cultural associations, distinctiveness, conservation interest, visual appeal and amenity value. PPS 2 states that permission will only be granted in AONBs where the Development would be sympathetic to the character of the AONB in general and also of the particular locality. In broad terms this character lies in the tranquillity, cultural associations, distinctiveness, conservation interest, visual appeal and amenity value of the AONB. PPS 2 defers to the descriptions of LCAs and AONB

Management Plans for further information on these elements. It is noted that the LCAs which combine to form the AONB are assessed by the SPG as being of much the same or higher sensitivity to wind energy development as LCA 122 within which the Development would be located and many upland parts of these LCAs are described as being theoretically suitable locations. The sites of Elginny Hill and Rathsherry wind farms, which are located in the adjoining LCA 117 Central Ballymena Glens to the east of LCA 122, are specifically identified by the SPG as being particularly highly sensitive but have nevertheless been subject to planning consents.

4.77 PPS 18 and its Best Practice Guidance (BPG) are generally promotive of wind energy development in appropriate locations and note that the capacity of a landscape to accommodate such development is dependent on the existing character of the landscape. The BPG further states that, given their importance, is it important for society at large to accept wind farms as a feature of the Region for the foreseeable future. The BPG notes that some locations may be highly visible but that this is not necessarily unacceptable. The latter judgement depends on the degree of effect and sensitivity of the receiving landscape. Of relevance to this Development the BPG also notes that groups of turbines can normally appear acceptable as single isolated features in open, undeveloped landscapes such as the proposed site. Beyond 5 km they are likely to be visible as part of the wider landscape and prominent only in clear visibility, becoming less prominent with distance.

4.78 The general principles contained within the SPG to PPS 18 are also broadly supportive. The Development is located in accordance with seven of the 9 landscape and visual character issues that the SPG notes should be considered for wind energy developments within the Antrim Plateau region. The Development also maintains adequate separation distances from other wind farms and is of a form and layout that reflects the large scale and strong horizontal form of the uplands on which it is located as per the SPG's design principles.

Baseline Landscape Character Assessment and Analysis of Effects

The Site and the Study Area

4.79 The Study Area for this LVIA extends to a radius of 30 km from the centre of the Development and is indicated on all map based figures (Figures 4.1 – 4.10 in Section 4, Volume 3 of the ES). Much of the eastern part of the Study Area is open sea, the character of which is described in the Northern Ireland Regional Seascape Character Assessment (NIRSCA, see paragraph 4.117). In regional terms the Study Area is located within the Antrim Plateau which, as described in the SPG, is formed by a variety of upland landscapes interspersed with valleys, glens and bogs which have been formed through the erosion of various layers of geology to create distinctive topographical variations across the Plateau. This regional landscape character area is described in relation to the Development in Appendix 4.3 from paragraph 4.72.

Within the Antrim Plateau region the Development is located on the Garron Plateau which is defined as Landscape Character Area 122 (LCA) in the Northern Ireland Landscape Character Assessment (NILCA) and the SPG (see paragraph 4.105). The northern and central parts of the Study Area are part of the Antrim Coast and Glens AONB. The western and southern parts of the Study Area are formed by relatively low lying rural agricultural landscapes surrounding the larger settlements within the Study Area and providing the setting for the AONB.

4.80 The largest settlements are Ballymena, located approximately 18 km to the south west of the Development, and the port town of Larne located at the mouth of Larne Lough just beyond the south eastern edge of the AONB and approximately 18 km to the south east. Whilst the southern edge of the AONB provides a backdrop to the landscape around Larne, the character and extent of the AONB, including the site of the Development is not visible from this part of the Study Area. The landscape around Ballymena is pastoral in character and is overlooked by the south western facing edge of the AONB which includes two clusters of existing wind farms. The landscape in this part of the Study Area is also not strongly influenced by that of Development site.

4.81 Urban settlement also characterises the outer edges of the Study Area beyond 20 – 30 km from the Development where there are other large and medium-sized towns: Antrim to the south west; Ballyclare to the south. The coastal settlements and outer edges of Newtownabbey, Carrickfergus and Whitehead fall largely outwith the south eastern edge of the Study Area. There are a series of smaller towns and villages located along the coastal edge of the AONB and to the north of the Development, each at the base of one of the Glens which give the AONB its name. The nearest settlement to the Development is Carnlough which is located approximately 2.8 km to the north east. It is characterised by its coastal outlook across Carnlough Bay, which forms the central part of the Southern Glens Coast Seascape Character Area (defined as SCA 10 of the Northern Ireland Seascape Character Assessment) towards the open sea of the North Channel (SCA 23). The land-side of Carnlough’s coastal character is its backdrop of distinctive and varied cliffs which are formed by the eastern-facing edge of the Garron Plateau LCA in which the Development is located. Other coastal settlements include Glenarm (5 km to the south east), Cushendall (12 km to the north) and Cushendun (18 km to the north). The landscape character of these villages is an integral part of the AONB’s character.

4.82 The Garron Plateau uplands are in the central part of the Antrim Coast and Glens Area of Outstanding Natural Beauty. The AONB as a whole is characterised by a series of similar upland plateaus interspersed with narrow lowland glens and pastoral landscapes. The site of the Development is part of an expansive area of rough grazing land and open moorland located to the north of the A42 road corridor which dissects the Larne Glens LCA, and primarily Glencloy, terminating at the coastal village of Carnlough.

4.83 To the north and the immediate south the landscape is also characterised by broad uplands overlooking coastal villages and dissected by other glens. The expansive area of uplands to the south - the Larne Basalt Moorlands - forms the southern edge of the AONB. There are several particularly distinctive profiled hills and basalt cliffs within the wider Study Area at Slemish, Scawt Hill, Knockdhu, Sallagh Braes and Agnew's Hill. Slemish in particular is a key landscape feature of the western edge of the AONB particularly from the rural lowlands surrounding Ballymena and Broughshane. Scawt Hill and Knockdhu are particularly prominent in coastal views and, along with Agnew's Hill, on southern approaches to the AONB. They are less distinctive in profile from the central part of the AONB and, instead, they combine to form a long profiled upland area which separates the coastal landscape from the central uplands. Sallagh Braes forms a distinctive backdrop to the coastal landscape between Larne and Ballygally when viewed from sea-level but it is not a visible feature from elsewhere.

4.84 The proposed site is located on an area of expansive rising ground below the uppermost parts of Garron Plateau to the south east of Cleggan Forest. The 14 turbines would be positioned in two distinct clusters. A grouping of 10 turbines in the northern part of the site would have a backdrop of rising ground formed by the summits of Berry Hill, Binnagee and Neill's Top. Turbine T2 at the northern end of the layout would be located near the summit of Binnagee Hill (approximately 340 m AOD) with a base height of 339 m AOD and would be the highest turbine in the layout. The highest points on the Garron Plateau are located to the north western side of the plateau and range from 429 m – 438 m. A smaller grouping of four turbines would be located in the southern part of the site on flatter lower lying ground below Neill's Top and associated with a number of small areas of forestry at Ticloy. The lowest positioned and southern-most turbine would be T11 (204.6 m AOD). There would be a lateral spread of turbines from north to south of approximately 4 km.

4.85 There is evidence of long-standing human influence on the site in the form of extensive rough open grazing, forestry, access tracks and drainage channels. Although there is a lack of mature trees and hedgerows, and some rush-infestation on wetter ground, post and wire fencing boundaries are generally in good repair and the landscape is in relatively good condition overall. There is no public access or amenity value to the site or the immediate surrounding area. Glenariff Forest Park and a footpath to Cranny Falls above Carnlough village are the nearest outdoor recreational amenities to the Development. Cleggan Forest is specifically noted on the Northern Ireland government website as having no public access[5]. Human influence and activity shapes the wider landscape as well. Aside from the towns and villages and interconnecting roads this is evidenced by large areas of coniferous forestry on uplands throughout the AONB. Agricultural practices have shaped the

[5] https://www.nidirect.gov.uk/articles/cleggan-forest

physical appearance of all rural parts of the Study Area and this includes extensive sheep grazing on the uplands surrounding and including the Development site.

4.86 In terms of wind energy the landscape within 5 km of the Development already features a number of existing single turbines and these are also a characteristic feature of the rural landscape in the wider Study Area, particularly around the Larne coast and glens and Ballymena farmland. There are also three clusters of existing wind farms spanning various parts of the AONB's western boundary: Altaveedan, Corkey and Gruig are located approximately 14 km to the north west of the Development; Rathsherry and Elginny Hill are located on the uplands near Broughshane and Ballymena approximately 8 km to the west; Elliot's Hill and Wolf Bog are located approximately 16 km to the south west. A consented wind farm at Ballykeel is located approximately 12.95 km to the south east of the Development within the southern part of the AONB on the Larne Basalt Moorlands. It is currently the nearest consented or existing wind farm to the Development. It is therefore noted that wind turbines per se are not a new or unusual landscape character element in this part of the Study Area, around the AONB as a whole or in the wider Study Area. Full details of these wind farms, along with other consented and proposed schemes are included in the cumulative baseline section of this chapter (paragraph 4.209), Technical Appendix 4.5 and illustrated in Figure 4.4. The presence of existing wind turbines is considered to form part of the existing landscape and visual character of the Study Area and is also considered in the analysis of effects in this respect.

Landscape Designations

4.87 The European Landscape Convention (2000) requires member states to recognise that all landscapes can have value, and that the perception of value may vary from person-to-person. Statutory designations are one of the criteria used to assess the significance of effects on landscape character and visual amenity in an objective manner. Whilst it is recognised that all landscapes have some subjective importance, particularly for those who live and work in them, or use them for leisure, designation gives an indication of a landscape's 'value to society'. Landscapes are designated by statute, and policies for their protection, use, and management are included in Development Plans, usually following a consultation process (which seeks to reach a consensus opinion, thereby reducing subjectivity). The national, regional and local designations that have been identified as being relevant to the landscape and visual character of this Study Area are described in the following paragraphs and illustrated in Figure 4.1.

4.88 Statutory landscape designations are contained within the current planning policy and guidance which cover the Study Area. The primary designated landscape within the Study Area is the Antrim Coast and Glens AONB and policy guidance in relation to this designation is contained within the SPPS, PPS 2, PPS 18 and SPG which are described in the preceding paragraphs. The nature of the AONB and the effects of the Development on this landscape are analysed below. Other statutorily designated landscapes within the Study Area are analysed in subsequent paragraphs. As noted previously the draft Local Development Plan Strategy is considered to be at too early a stage for its proposed policies to be afforded weight.

Antrim Coast and Glens Area of Outstanding Natural Beauty

4.89 AONBs are the principal landscape conservation designation in Northern Ireland. The designation gives statutory recognition to the high scenic quality and distinctive landscape character of an area and the need to ensure that sensitive conservation measures take place to preserve these qualities alongside measures to allow public access and enjoyment of the area. The needs of local communities, including their social and economic well-being, is a key management objective for all AONBs, although development deemed to be detrimental to environmental quality is not permitted by the SPPS and supporting PPSs. The landscape around AONBs also performs an important function by providing context, particularly in views to and from the AONB and from key approach routes.

4.90 The Antrim Coast and Glens AONB is regarded as the primary designation to be considered in this LVIA because it is of regional importance. The majority of the AONB, with the exception of Rathlin, is located within the Study Area and its boundary is shown on all map based figures that accompany the LVIA (Figures 4.1 – 4.10). The Development is located in the central part on an upland area that is physically separate and visually distinct from the coast and the adjacent glen, Glencloy. With the exception of one long distance viewpoint (Viewpoint 20) all representative viewpoints in this LVIA are also located within the AONB and within approximately 10 km of the Development. This demonstrates the limited extent of the Development’s effects on both landscape and visual character of the AONB as a whole as well as the wider Study Area.

4.91 The Antrim Coast and Glens Management Forum is responsible for developing and updating a Management Plan for the AONB which states the elements of the AONB that are regarded as special, characteristic and valued. The Management Plan also sets out objectives and mechanisms by which changes within the AONB may be allowed to occur whilst maintaining the intrinsic character of area. The current Management Plan for the period 2020 – 2030 and Five Year Action Plan 2021-2021 were published in September 2021. Two of the key challenges facing the AONB over the next decade have been identified by the Management Plan as climate change and inappropriate development. The summary recommendations in response to these challenges are to “*support peatland restoration and other climate change mitigation measures, e.g. afforestation*” and to “*champion sustainable development within the AONB*” whilst protecting landscape character, habitats, historic sites and buildings[6]. Further amplification to these

[6] AONB Management Plan 2020 – 30, page 9

recommendations is provided in the main body of the Management Plan document, the accompanying Appendices.

4.92 The Development would be an intrinsically sustainable development and would assist in the mitigation of climate change. The current Management Plan defers to the NILCA, NIRLCA and NIRSCA for a summary description of the key features, physical condition and sensitivity to change of various landscape character elements within different parts of the AONB. However, for the purpose of this LVIA the SPG is regarded as providing more relevant guidance on landscape and visual character than the NILCA in relation to wind energy development. Although the Management Plan suggests that afforestation would be an appropriate response to the challenges posed by climate change within the AONB it is noted that the SPG repeatedly refers to large scale commercial forestry as being detrimental because it conceals the intricate pattern of the landscape and often occupies visually prominent positions in upland areas. It may introduce temporary man-made influence to upland landscapes that would otherwise appear natural. A high degree of man-made influence on the landscape may also mean that it is less sensitive to wind energy development. The SPG also specifically notes that the presence of large scale forestry reduces landscape and visual sensitivity of the part of the Garron Plateau LCA in which the Development is located. [7]

4.93 A review of landscape character undertaken by Mid and East Antrim Borough Council in 2018 is highlighted by the Management Plan as identifying an increase in single rural dwellings and wind energy development as the main changes in landscape character since the NILCA was published in 2000. However, there is no clear overarching statement on the key characteristics of the AONB contained within the current version of the Management Plan. Therefore reference has been made to the previous version of the Plan which highlighted the following as key characteristics that make the AONB special [8]:

i. Its physical isolation from the rest of Northern Ireland and its visual links with Scotland which are a reminder of the areas proximity to the Scottish islands and mainland. The Development would have no physical effect on this characteristic;

ii. The nine hidden glens which each have their own character or "personality". The Development is not located within a Glen and is physically remote from most glens due to its position on an upland area in the central part of the AONB. It would have little to no visibility from the majority of the Glens and this is clearly illustrated by the Reverse ZTV diagrams in Figures 4.8. It would however have some visibility from Carnlough and approaches to Carnlough and Glenarm villages which are analysed as part of the assessment of landscape character effects on LCA

[7] SPG Tables 2 and 4 and description of LCA 122

[8] 'Antrim Coast and Glens Area of Outstanding Natural Beauty Management Plan 2008 – 2018', Causeway Coast and Glens Heritage Trust, page 3

122 and in relation to visual effects. Category D Viewpoints have been selected to represent the range of typical views of the Development from within Glens and from locations overlooking the Glens where they form a key characteristic of existing views;

iii. The high ground above these glens – the Antrim Plateau - which historically limited access to the Glens and which has distinct vegetation and topography across different parts resulting from variations in the underlying geology. The Development is located within the Garron Plateau within the wider Antrim Plateau. This is an extensive upland area and the Development would have a direct physical effect on only one part. It would be visible from surrounding elevated parts of the Antrim Plateau, particularly within 10 km to the south and south west, and would therefore have an indirect effect on the landscape character of these parts. It becomes far less apparent in views from the Plateau at greater distances and particularly those located to the northern part of the AONB. The Reverse ZTV diagrams in Figures 4.8 illustrate both this decline in visibility to the north and beyond 10 km. The AONB covers an area of approximately 72,488 hectares and the Development would have theoretical visibility within 30.32 – 36.4 % of the AONB (see paragraph 4.141 and Table 4.1). Category E Viewpoints have been selected to represent the range of elevated upland views from the Antrim Plateau;

iv. The coastline which forms a dramatic sequence of cliffs, headlands and bays at the foot of each Glen as well as the adjacent seascape which includes Rathlin located off the north eastern corner of the mainland and open views to Scotland. The Development would have no direct or indirect physical effects on the coastline around Rathlin which is beyond the LVIA Study Area and from where the Development would not be visible. It would also have no effects on the coastline to the north of Garron Point. Furthermore, it would have no visibility from much of the mainland coastline with the exception of a small part of the A2 Coast Road on the outskirts of Carnlough. Category B Viewpoints have been selected to represent the nature of views from approaches to coastal settlements and Category C Viewpoints provide representation of views from the coastal settlement of Carnlough, which is the only such settlement where views of the Development would be obtained;

v. The long history of human settlement in the area which is evidenced by groups of farmsteads or ‘clachans’ scattered throughout the valleys and sides of Glens with associated vernacular buildings, hedgerows, gateposts and ladder field patterns, archaeological sites including earthworks, tombs, stone enclosures, churches and castles. The Development is indicative of continued human use of the physical landscape and its resources;

vi. Today's population is concentrated mainly in settlements along the coastline and on the farms scattered throughout the countryside. The relative isolation of settlement in the AONB has created local communities with unique local traditions and cultures. Many of the coastal villages are old fishing communities including Cushendall, Carnlough and Glenarm which are all located in this Study Area. As described above the Development would be partially visible from Carnlough and in elevated approaches to Glenarm but it would not be visible or characteristic of the setting of other coastal villages.

4.94 This LVIA also makes reference to the Supplementary Planning Guidance to PPS 18 (SPG) because this provides a more detailed description of the physical and visual character of different parts of the AONB, and the sensitivity of these elements to wind energy development specifically, than that which is described in the Management Plan. The Development is located within LCA 122: Garron Plateau (see paragraph 4.105 for further detail).

4.95 The current Management Plan supports an ecosystems services approach to management of the AONB[9], whereby landscapes are recognised for the benefits they provide to human activities, and this is noted to include the provision of renewable energy. However, there is little support for this benefit elsewhere in the suite of Management Plan documents and a notable absence of references to PPS 18 throughout.

4.96 The Five Year Action Plan that supports the AONB Management Plan provides some additional detail as to how the management objectives will be achieved via a series of Aims. Aim 1 is to conserve and protect the landscape character of the AONB and the Action Plan refers to existing planning policy, guidance and landscape character assessments for information which it intends to build upon by monitoring changes to landscape character on a quarterly basis each year and reporting these changes back to the NIEA, Council, public and AONB Management Forum. The potential effects of the Development on planning policy has been analysed earlier in this section of the LVIA (from paragraph 4.73) and its effects in relation to supplementary guidance on landscape and visual character issues, as well as the relatively recent seascape character assessment are analysed from paragraph 4.105.

4.97 Aim 2, to conserve and protect the natural and historic environment, includes an objective to promote climate change adaption and mitigation measures in response to a number of policy documents which are listed in the Action Plan[10]. Although a number of PPSs are included here the absence of PPS 18: Renewable Energy is noted once again. Furthermore, whilst there is some acknowledgement that

[9] AONB Management Plan 2020 – 30, section 3

[10] AONB Action Plan 2021 – 2025, page 12

climate change will impact the coastal environment, there is no mention of actions to address the causes of climate change, but simply to monitor its effects.

4.98 The Appendices to the Management Plan include a summary of the key characteristics of the Antrim Plateau and Glens RLCA and forces for change within this area. Of relevance to this LVIA is that the RLCA suggests that "*landscape sensitivity studies may be required to determine the potential for landscape to absorb further wind farm developments or single turbines, without adversely affecting the character of the AONB.*[11]" This is noted as one of the purposes of the detailed assessment being undertaken in this LVIA. Landscape and visual sensitivity of the Study Area, and primarily those parts of the Study Area which are located within the AONB, as considered throughout this chapter.

4.99 Appendix 6 refers to a community questionnaire which found that, when asked to describe the challenges faced by the AONB now and in the future, 4 out of 117 respondents (i.e. 3.4%) expressed concern about wind farm development. Other topics of concern included the detrimental effects of tourism on the natural environment and local communities, the withdrawal of funding due to Brexit, pollution and littering, a lack of affordable house and the need to balance economic development with protection of the natural environment but no specific numbers are provided in relation to the number of respondents who raised these latter concerns.[12]

Other Statutorily Designated Landscapes in the Study Area

Register of Historic Parks, Gardens and Demesnes

4.100 The Register identifies sites that are considered to be of exceptional importance within Northern Ireland, which have historic significance, and which may also contribute to local landscape character. It is maintained by NIEA Built Heritage. Inclusion on the Register affords sites protection through the SPPS and Planning Policy Statement 6 (PPS6)[13] which requires NIEA to make comment on the protection of such sites as part of the planning consultation process. The SPPS states that permission would not be granted for development that would harm the overall character of site's integrity, overall quality or setting and its contribution to local landscape character should be maintained where possible.

4.101 There are a large number of registered sites located within the Study Area particularly on the edge of settlements. However, none are likely to have views of the Development due to screening factors such as surrounding built development, high levels of tree cover and flat topography in low lying areas. Only Cleggan Lodge is located within the ZTV but is understood to be a former shooting lodge in private ownership. Public access is not freely available and views are likely to be

[11] AONB Management Plan Appendices, Appendix 2, page 14

[12] AONB Management Plan Appendices, Appendix 6, page 35 - 36

[13] Department of the Environment (March 1999) 'Planning Policy Statement 6: Planning, Archaeology and the Built Environment'

restricted by its woodland setting. Glenarm Castle has an extensive demesne landscape focussed around the Glenarm River and extending to the sea and is the closest site to the Development. However, it's location within the lower part of Glenarm means that it does not fall within the Development's ZTV. For these reasons, Registered Parks, Gardens and Demesnes are not considered further in this LVIA.

Non-Statutory Landscape Classifications

The Northern Ireland Landscape Character Assessment

4.102 The NILCA classifies the landscape of Northern Ireland into six broad regions and 130 smaller areas of distinct and separate character termed Landscape Character Areas (LCAs). The Development is located within the Antrim Plateau region and the Garron Plateau LCA. The SPG accompanying PPS 18 provides further broad guidance on these regions and LCAs including the overall sensitivity of LCAs specifically in relation to wind energy developments. The descriptions of landscape and visual character in this LVIA are based on the SPG which itself reiterates information contained within the NILCA. They are also inextricably linked to the description of the key characteristics of the Antrim Coast and Glens AONB and some elements of the subsequent LCAs have already been analysed in the preceding sections.

4.103 The SPG identifies nine broad landscape and visual character issues to be considered in relation to wind farm development in the Antrim Plateau region[14] only three of which are considered to be of relevance to this LVIA. All nine are summarised below with the two most relevant to this LVIA listed first:

- Of particular relevance to this LVIA is the issue of impacts on the wild character of the moorlands to the north and east which are located within the Antrim Coast and Glens. The Development would be located in this part of the Region and is therefore likely to have significant effects in some instances. These effects are the primary focus of the analysis of both landscape and visual effects in this LVIA. The analysis of effects on landscape character focusses on the potential effects of the Development on the AONB and the LCAs which are located within the AONB or which form the setting to it, particularly to the south and east. The majority of representative viewpoints in this LVIA have also been chosen to illustrate the nature of visual effects in this respect;
- Also of relevance to this LVIA is the issue of appropriate separation distances and cluster sizes which are recommended by the SPG to ensure that wind energy developments do not become overbearing or dominant in the landscape. The nearest existing wind farms to the Development would be Rathsherry and Elginny Hill located over 8 km to the south west They

[14] section 3.3.1 of the SPG

would be physically separated, and frequently screened from views of the Development by the highest parts of the Garron Plateau to the west of Cleggan Forest. The Development would also be located 12.95 km from the consented Ballykeel wind farm but the two wind farms would rarely be visible together, either simultaneously or sequentially from the same locations. Where the Development would be visible Ballykeel would generally be screened from view by intervening high ground on the Larne Basal Plateau;;

- Also of relevance to this LVIA is the issue of cumulative impacts caused by simultaneous, successive or sequential views of more than one wind energy development. This is similar to the issue of separation distances noted above. The Development would, in some instances, be visible with other wind farms and single turbines in the Study Area as noted above and this is assessed via the detailed analysis of representative viewpoints (from paragraph 4.146) and in relation to cumulative landscape and visual effects (from paragraph 4.209);
- The SPG notes that long distance views from transport corridors and tourist routes on approaches to the Antrim Coast and Glens to the south and west are also an issue for consideration. However, the ZTV clearly illustrates that visibility of the Development from these parts of the Study Area is particularly limited. A number of provisional viewpoint locations were identified (see Figure 4.3 and Technical Appendix 4.4) but many were found to have no views or views that were heavily restricted by distance and land cover elements such as vegetation;
- Compatibility of smaller and larger newer turbines. This is considered to relate primarily to the clustering of wind energy developments in close proximity to each other and is not considered to be of relevance to this Development. It is also noted that the Development is located such that it would appear to be visually distinct and separate from any single turbines that are located within 5 km;
- Impacts when seen in conjunction with electricity transmission lines. There are no such lines located in proximity to the site and this is not considered to be an issue of particular relevance to this Development;
- Impacts on skylines along the bold western edge of the Plateau and the escarpment above Belfast Lough. This issue is considered to relate to the existing wind farms at Carn Hill, Wolf Bog and Elliot's Hill, Rathsherry and Elginny Hill which are located in a linear fashion in these parts of the region. The Development is not located in either of these areas. It is also noted that Elginny Hill and Rathsherry were both consented following publication of the SPG despite their location being specifically highlighted as unsuitable in the SPG;

- Impacts on the settings of a number of specific settlements also located to the south and west. These are noted as being in parts of the Study Area which are located beyond 20 km from the Development and from where it would either not be significantly visible or visible at all.

4.104 General principles for the layout, siting and design of wind farms are provided in section 3 of the SPG (Tables 3 and 4). Of particular relevance to the Development are:

- Adequate and appropriate spacing depends on landscape character, including pattern and rhythm, and the degree of intervisibility between wind farms. It is necessary to maintain areas of undeveloped landscape between wind farms in order to prevent a landscape becoming dominated by them. The Development maintains adequate separation distances between the nearest existing wind farms (Rathsherry/ Elginny Hill) and would be both physically and visually distinct from the consented Ballykeel wind farm as noted previously;
- The SPG notes that small turbine groupings are likely to fit best in small scale and more intricate landscapes whereas elevated landscapes with a strong horizontal form and of a larger scale, such as the Antrim Plateau are suitable for larger turbines and turbine groupings because they tend to diminish perceived scale. Complex and varied landforms may experience undesirable flattening effects from the latter. The Development is considered to be in conformance with this principle because it is located on a simple and expansive upland area below higher parts of the Garron Plateau and the layout reflects the broad undulations of the underlying topography;
- The turbine layout would not be directly comparable to any other wind farms in close proximity to it which is reflective of the principles in the SPG and, whilst there are a number of single turbines in the surrounding lowland landscapes, the upland character of the site ensures that the Development would remain clearly distinct from these;
- The SPG also notes that the settings of distinctive landscape features such as dramatic landform features like cliffs and cultural features like historic parks may be especially sensitive. The Development is not located in close proximity to any such features although a small number of the proposed turbines would be partially visible above the skyline behind Carnlough and this is analysed in relation to Category C Viewpoints (starting at paragraph 4.169);
- Furthermore, the SPG notes that wind farms that are set back from upland edges and located in the central parts of upland landscapes, such as the Development is, will generally be regarded as less prominent and less visible from adjacent lowlands. The Development's location on a lower part of the Garron Plateau, detached from the distinctive edges of the

LCA, means that it is not visible from the majority of the coast road, the sea immediately surrounding the coast or the majority of coastal settlements with the exception of Carnlough (see Category C Viewpoints);

- Sites characterised by heather moorland and bog are described as having a wilder character but proximity to scale indicators such as lines of forestry is noted as having the potential to increase apparent turbine heights. However, there is only a small area of forestry located in the south western part of the site, much of which would be removed as part of the Development, and the expansive Cleggan Forest located on higher ground to the west is of such a large scale that it would not be overwhelmed by the Development. Furthermore, the SPG repeatedly refers to large scale commercial forestry as being detrimental to landscape character and specifically notes that the presence of large scale forestry reduces landscape and visual sensitivity of the part of the Garron Plateau LCA in which the Development is located.

4.105 There are twenty Landscape Character Areas (LCAs) and seven Seascape Character Areas (SCAs) within the Study Area of which nine are located wholly or largely within the AONB. They are illustrated on Figure 4.2. The Development is located within LCA 122 Garron Plateau and would therefore have a direct physical effect on part of this area, which is described in detail below. A summary of other relevant LCAs and SCAs in provided in Technical Appendix 4.3.

Landscape Character Area 122: Garron Plateau

4.106 The SPG describes both the physical landscape characteristics and visual character elements of LCA 122: Garron Plateau within which the Development is located. The SPG defines LCA 122's overall sensitivity to wind energy and its capacity to accommodate turbines. Information from the SPG of relevance to the Development is summarised and analysed in the following paragraphs.

The SPG's description of Key Landscape and Visual Characteristics and Values

4.107 This LCA covers the upland landscape between the north-eastern side of Ballymena and Garron Point on the north east Antrim coast. It is described as a large scale open and expansive plateau with uneven relief in which many upland loughs and reservoirs have formed or been created. Rocky outcrops, steep descents and deeply incised stream corridors are typical throughout and the edges of the plateau either have a distinctive stepped profile or form rounded knolls. The LCA terminates with dramatic cliffs on its east-facing coastal edge. There are many summits over 400 m AOD, with the highest being Mid Hill (438 m AOD) which is located approximately 4 km to the west of the Development and forms part of a sequence of summits at similar heights in the western part of the LCA. The Development would be located in the south eastern part of this LCA, on a lower section of the plateau positioned to the south east of Cleggan Forest and backed by the summits of Berry Hill, Binnagee and Neill's Top. The lower summits of

Curraghvohil and Mullaghboy Hill are positioned between the central part of Slane Road and the four turbines located in the southern part of the site on lower-lying ground. They would frequently be partially or wholly concealed in both close and longer range views by these hills.

4.108 There is little native tree cover with this LCA and land cover is predominantly characterised by sheep grazing. On lower slopes grazing land is often enclosed by fences or stone walls and occasional stands of beech trees. On more elevated ground the landscape is more typically characterised by peat bogs, heather moorland, marshy areas and peat cutting. There are large scale areas of coniferous forestry at Glenariff Forest Park (the southern part is located in this LCA, the northern part located in the adjacent LCA 118 Moyle Moorlands and Forest) and Cleggan Forest but also smaller areas of forestry elsewhere, including around Ticloy which falls within the southern part of the Development site.

4.109 The SPG also notes that man-made influences on the landscape character are limited to the edges of the plateau and that upland areas have a strong sense of wildness because they are largely undisturbed by human activity. However, references to the lack of native tree cover, a proliferation of coniferous plantations, upland reservoirs, sheep grazing, peat cutting and archaeological sites being scattered along the fringes of the upland plateau and on the prominent Lurigethan summit overlooking this LCA, all suggest that this is in fact an LCA where character has long been shaped by human activity.

4.110 Glenariff Forest Park is noted as being a popular outdoor recreation area and there are two walking routes associated with the Park and the Dungonnell Way footpath that are located within this LCA. However, neither of these would be in close proximity to the Development. Nor would there be views of the Development from these paths with the exception of higher parts of the Dungonnell Way represented by Viewpoint 14 (paragraph 4.191) where there would be limited views of some blade tips. There are no other landscape or visual amenity associations within the LCA that are noted in the SPG and virtually no publicly accessible areas with the exception of two short sections of the tertiary road network at the northern end of Slane Road (see Viewpoint 2 starting at paragraph 4.152) and the middle of Longmore Road (largely outwith the ZTV). Recreational use of this LCA is, overall, very limited.

4.111 The SPG describes this LCA as being in excellent condition with very high scenic value and it is within the AONB for this reason. However blanket forestry is also noted as affecting scenic quality locally in proximity to the location of the Development.

The SPG's description of Landscape Sensitivity to the Development

4.112 Overall the SPG regards this LCA as being of high to medium sensitivity with the location of the Development being the latter. The SPG notes that the scale and simple topography of this LCA makes it, in theory, suitable for wind energy development. The plateau edges are noted as being more sensitive where they have a more complex topography and form prominent skylines and settings for coastal parts of Glenariff and Glencloy, or which are overlooked by the slopes and summits to the north around Glenariff Forest Park. This includes Trostan, which is the highest summit in the AONB and, for this reason, has been included for further analysis in this LVIA although it is not an easily accessible location and visibility is demonstrably limited (see Viewpoint 13 starting at paragraph 4.190). Less sensitive areas occur in the south west of the LCA where there are areas of simpler terrain and where there is a close association with large scale forestry at Cleggan Forest. The site of the Development is one of these less sensitive areas. The presence of such large scale forestry serves to contain visibility, reduce sensitivity and also has the potential to reduce the physical disturbance of wind energy developments via the re-use of access tracts.

The SPG's description of Key Location, Siting, Layout and Design Considerations

4.113 The SPG states that "*parts of the large scale and horizontal form of the upland plateau within this LCA are well suited to wind energy development, in particular the plateau areas adjacent to or within the Cleggan Forest, where commercial forestry reduces landscape and visual sensitivity and may facilitate vehicular access*". The Development is well located in this respect.

4.114 Whilst more than one area of wind energy development in this LCA is noted by the SPG as having the potential to fragment the moorland plateau, it is also noted that the clustering of wind farms could be considered beneficial. Locating wind energy developments well back from steep upland and plateau edges is also considered to be beneficial as this would assist in containing visibility. The Development is well located in this respect.

4.115 The SPG advises adverse impacts on key views from coastal glens, the sea to the east and the wild character of the area should be avoided as should visual effects on areas of more complex and varied terrain. Due to its proximity to the coastline, seaward issues are noted as a potential concern. However, the Development would not be substantially visible from the coast or open sea in proximity to the coastline as illustrated by the ZTV and the limited number of representative Viewpoints that have been identified along the coast. The Development was found to be clearly visible from the Coast Road on the southern side of Carnlough village (see Viewpoint 6 from paragraph 4.169) but it would become substantially less prominent within Carnlough or from locations to the north side of the village (see Viewpoints 7 and 8 also from paragraph 4.169). Whilst the tips of the north-easternmost turbines T1 and T2 would be visible from the coastal landscape in proximity to Carnlough, in most instances the majority of the Development would have very limited visibility from the coast road, coastal settlements or the seascape adjacent to the coast. The Development would have a negligible physical influence on the setting of the coast except around Carnlough Bay due to its location which is set-back from the coast on lower lying uplands surrounded by taller summits.

4.116 The SPG notes that the "*landscape interests of natural and cultural heritage features and recreational resources should be respected*" although there are few amenity or recreation features within this LCA and no known cultural associations noted in the SPG.

4.117 At the time of the SPGs publication there were no existing or consented wind farms within LCA 122 and the nearest wind farms were located approximately 7 km to the north west at Corkey and Gruig although proposed wind farms were noted in LCA 117 Central Ballymena Glens. These are assumed to be Elginny Hill and Rathsherry which are now operational. In this context the SPG notes that consideration should be given to maintaining adequate separation distances from wind farms in adjoining LCAs, particularly LCA 117, and that cumulative impacts within LCA 122 itself could be a future issue that also requires consideration. It is noted that Elginny Hill and Rathsherry would be physically separated (approximately 8 - 10 km separation distance) and frequently screened from views of the Development by the highest parts of the Garron Plateau to the west of Cleggan Forest . The Development would be located in closer proximity to the proposed Carnalbanagh wind farm (4.08 km) but the latter would be located in a different LCA (LCA 123 Larne Glens) on lower lying ground. Where visible, the two wind farms would appear as separate elements in different parts of the same view with an area of 'undeveloped' land in between, and in these instances from elevated viewpoints encompassing wider views of the Study Area and the landscape beyond the AONB. Their relationship is analysed in more detail in the assessment of cumulative effects, although it is noted that the EIA Regulations do not require the consideration of proposed schemes.

The Northern Ireland Regional Seascape Character Assessment

4.118 The NIRSCA identifies and provides a broad description of Seascape Character Areas (SCAs) extending up to 12 km offshore and including the narrow margin of the coastal edge and its immediate hinterland up to 5 km inshore. This document does not offer guidance but aims to provide a strategic understanding of seascape character in order to promote protective management and planning. No conclusions are made by the NIRSCA on the sensitivity of individual SCAs to wind energy developments and therefore all conclusions in this respect are made through the LVIA process.

4.119 The NIRSCA notes that seascape, like landscape, reflects the relationship between people and place and the part that the sea plays in forming the setting to everyday life. Therefore the LVIA concludes that it is reasonable to regard the seascape as a resource in much the same way as the landscape. Both land and sea are farmed and used for the extraction of valuable goods including energy, food and minerals. Coastal towns have also developed around sea-based rather than land-based activities such as fishing and tourism and one of the defining characteristics of the Antrim Coast and Glens is the outward-looking aspect which has developed due to the area's historic inaccessibility from the landward side. The AONB Management

Plan notes how the AONB has historically had a much closer relationship with Scotland than the rest of Northern Ireland.

4.120 The majority of the proposed turbines are located on lower lying parts of the Garron Plateau some distance from the coast and would not be visible from most parts of coastal SCAs. Coastal areas are appreciated most frequently from the scenic A2 Coast Road which is located nearly at sea level in many places and from here open views towards the sea are often contained on the land side by higher ground. Even from Carnlough Bay the Development is unlikely to be clearly perceptible due to the physical dominance of the coastal landscape and the east-facing cliffs which provides the backdrop. The coastline and seascape are also appreciated in the context of the AONB from elevated southerly approaches where the Development is unlikely to be visible. Therefore, of the seven SCAs which fall within the Study Area, only potential effects on SCA 23, North Channel are considered. It forms the open sea beyond the coastal area and, although it is deemed to be of relatively high value it would be of low sensitivity to the Development because the coastal SCAs and LCAs would provide physical separation between this LCA and the Development. The latter would be located on uplands largely screened by the eastern-facing edges of the Garron Plateau which overlook the coast. The majority of turbines are unlikely to be easily perceptible when viewed from this distance - in excess of 10 km - across open sea. Furthermore, the contribution of the open sea to physical landscape character is primarily regarded as its function as a backdrop to the landscape when looking outwards from the latter. In this respect, the magnitude of effect from the Development would be negligible and the overall effects would not be significant.

4.121 There are 16 LCAs and 6 SCAs within the Study Area which have not been assessed in detail because, following the Baseline Assessment and site survey, it is concluded that they are unlikely to be significantly affected by the Development. In particular, LCAs and SCAs on the periphery of the Study Area and the ZTV, and those which do not contain viewpoints have not been subject to a detailed assessment. These LCAs are also listed in Appendix 4.3. The ZTVs are illustrated in Figures 4.5 – 4.10.

Other Non-Statutory Landscape and Visual Classifications

4.122 A review of other relevant non-statutory landscape and visual classifications has also been carried out as part of this LVIA. These classifications identify landscapes or elements within the landscape which have no statutory protection but that are nevertheless recognised as having value by virtue of being marketed as visual attractions or identified in non-statutory documentation within the public realm. These classifications are illustrated on Figure 4.1. Information is drawn from a number of websites[15] providing relevant descriptive information which is used in

[15] www.walkni.com; www.visitcausewaycoastandglens.com; www.causewaycoastandglens.gov.uk; www.cycleni.com; www.sustrans.org.uk

conjunction with Ordnance Survey maps to plot the locations of visitor attractions. These have also been used to aid the selection of viewpoints (Figure 4.3).

Rights of Way, Cycle Routes, and Scenic Drives

4.123 The Ulster Way is a 1000 km long walking route which covers the most scenic parts of Ulster. It is divided into 'Quality Sections', which provide largely off-road way-marked access for walkers in highly scenic areas, and 'Link Sections', which are mainly along roads and are not generally way-marked. There are Quality sections of the Ulster Way extending from north to south across the Study Area including the hills to the north of Belfast above Newtownabbey and Carrickfergus, the eastern edge of the Larne Basalt Plateau around Sallagh Braes, Knockdhu and Scawt Hill and then around the coastline between Glenarm and Ballycastle. This route passes in close proximity to the existing wind farm at Carn Hill and the consented Ballykeel wind farm site in the southern part of the Study Area. The majority of this route is located outwith the ZTV. Only the elevated section between Knockdhu and Glenarm would have potential views of the Development and these are represented by Viewpoints 10, 17 and 18 (starting at paragraph 4.xx). From this section of the route walkers already experience views towards two clusters of existing wind farms at Elginny Hill and Rathsherry to the north west and Elliott's Hill and Wolf Bog alongside the consented Castlegore wind farm to the south west.

4.124 The International Appalachian Trail is one of the largest trail networks in the world with routes throughout Europe, America and Canada. It was developed in 2011 and, in Northern Ireland it shares the same route through the Glens of Antrim as the Ulster Way[16]. Elevated sections of the route between Glenarm and Knockdhu are therefore represented by Viewpoints 10, 17 and 18 as noted above.

4.125 Other parts of the Ulster Way are shared with, or linked to, shorter locally classified routes (further described in various online publications listed in footnote 14). The majority are also located outwith the ZTV for this Development although there would be views of other wind farms within the Study Area from some footpaths. The most elevated paths and summit areas would experience views of the Development and those with the clearest and most extensive views have been included in the selection of Viewpoints for detailed analysis. These routes include:

- the Antrim Hills Way which passes over the summit of Slemish (Viewpoint 15, paragraph 4.192);
- the Moyle Way which is a 42 km trail across the northern-most part of the Glens of Antrim and which links upland areas between Ballycastle and Glenariff in the northern part of the Study Area (Viewpoint 13, paragraph 4.190);

[16] http://www.walkni.com/iat/

- the Dungonnell Way which is a circular route across uplands below the summit of Trostan and Glenariff Forest Park (Viewpoint 14, paragraph 4.191);
- two short walks within Breen Forest near Altaveedan wind farm in the northern part of the Study Area which would experience no views of the Development because they are outwith the ZTV;
- short spurs from the coastal towns of Carnlough to Cranny Falls (Viewpoint 8, paragraph 4.171) and from Glenariff to the summit of Lurigethan (see PVP 58 in Technical Appendix 4 Table 4.4.1.

4.126 The National Cycle Network provides cyclists with marked scenic routes across the province. Within this Study Area there are routes linking Ballymena with Glenarm, Larne to Carrickfergus and along much of the Coast Road. The majority of the cycle network is located on roads within glens or along the coast where there would be limited views of the Development. However, Viewpoints 6 and 7 (from paragraph 4.171) near Carnlough would reflect the nature of views by cyclists from a relatively short section of the A2 Coast Road, and Viewpoint 16 (paragraph 4.194) is located in close proximity to the Ballymena-Glenarm route and would also represent the visual experience of cyclists in this part of the Study Area.

4.127 The A2 Coast Road which links Belfast with the Glens of Antrim is considered to be both one of the most scenic driving routes in the world as well as one of Northern Ireland's top visitor attractions. Visual receptors located along this route are therefore considered to be highly sensitive. However, there is a notable absence of views of the Development from the majority of the coastal landscape. Rising cliffs and promontories tend to screen all views beyond the coastal hinterland from this part of the Study Area. Furthermore, views tend to be orientated towards the sea and along the coastline itself as these are the natural visual attractions of this landscape. The only section of the Coast Road where views of the Development would be obtained is in proximity to Carnlough and this is analysed by Viewpoints 6 and 7 (from paragraph 4.170). There are also scenic driving routes between Magherahoney near Loughguile – the Orra Scenic Drive - and through Glendun both in the north west of the Study Area. These routes are signed on local roads and indicated on Figure 4.1 but are not further considered due to their locations outwith the ZTV

Other Visitor Attractions and Destinations

4.128 There are a number of other landscape-based visitor attractions and destinations in this Study Area which were identified as part of the baseline assessment. They are indicated on Figure 4.1. The majority are located outwith the ZTV and have not been subject to further analysis for this reason. The key attractions that fall within the ZTV have already been noted in the preceding paragraphs. These include coastal villages and towns, scenic driving routes and walks and registered demesne landscapes.

Summary of Landscape Effects

4.129 The Development would have a direct and significant physical effect on the part of the Study Area and LCA 122 within which it is located because the magnitude of change would be high and because this part of the LCA would become largely defined by the Development. However, its overall effects on LCA 122 are deemed to be of medium magnitude and not significant. Based on the SPG's description the Garron Plateau is deemed to be of Outstanding Landscape Value by virtue of its location within the AONB and it is in good physical condition. The Development would also be in close proximity to Cleggan Forest which is noted as being a particularly detractive feature which lessens the sensitivity of the landscape. The SPG also notes that this part of the LCA is the most suitable location for wind energy development. For these reasons the physical landscape character of the Garron Plateau is deemed to be sufficiently robust and capable of absorbing some degree of change without affecting its overall landscape character.

4.130 The Development would also be located in a manner that would minimise its effects on the key physical components of LCA 122 including the prominence of the east-facing cliffs when viewed from adjacent coastal settlements, the coast road and the seascape. The positioning of the turbines below and to the south-eastern side of taller summits within the LCA would minimise the prominence of the Development in relation to wider views and also views both from and towards the coast and from within Glencloy. Although it would become a prominent vertical feature from some parts of the A42 approach to Carnlough, from many parts of this key route through the AONB there would be more limited visibility of the Development.

4.131 The Development may have indirect effects on the landscape character of some other parts of the Study Area amounting to small areas of four other LCAs and one SCA which are in proximity to it, or which contain viewpoints used in this LVIA. These LCAs are listed in Appendix 4.3 Table 4.3.1 and illustrated in Figure 4.2. The SPG's description of these LCAs is very similar to LCA 122 in many respects including their value and levels of sensitivity to wind energy development. LCAs 117, 118, 123 and 124 are largely within the AONB and form other parts of the Antrim Plateau regional landscape. The majority of these LCAs are also upland plateaus from where there would be visibility of the Development from the sides which face the Development but less so from other parts which are orientated in other directions. In many instances views in the direction of the Development may be screened by taller summits including those within LCA 122 to the north west of the Development. Furthermore, the physical prominence of the Development would be lessened by the availability of very expansive views across the Antrim Plateau and AONB from these upland LCAs.

4.132 LCA 123 Larne Glens includes Glencloy and effects on the setting of this LCA would be experienced from the higher parts of the glen's slopes and in proximity to Carnlough. From elsewhere the Development would have a negligible influence on landscape or visual character. The Development would have similar effects on the landscape around Slemish within LCA 117 Ballymena Glens but negligible effects across the LCA as a whole. Furthermore, other LCAs already accommodate wind farm developments. The west-facing edges of LCA 117 and 118 include clusters of wind farms around Corkey and Elginny Hill/ Rathsherry and the western setting of LCA 124 features another cluster around Elliott's Hill. Whilst the Development would be a new location for a wind farm, there is already a pattern of wind energy development around the edges of the AONB and on other parts of the Antrim Plateau regional landscape. It is also noted that the sites of Elginny Hill and Rathsherry wind farms, which are located in the adjoining LCA 117 Central Ballymena Glens, are specifically identified by the SPG as being particularly highly sensitive but have nevertheless been subject to planning consents.

4.133 In relation to these other LCAs the magnitude of effects resulting from the Development would range from medium to negligible. Sensitivity would range from high to negligible depending on whether the LCAs would be located in relatively close proximity to the Development or at a greater distance and to what extent existing and consented wind farms define the physical landscape character of these LCAs and their settings (see Technical Appendix 4.3 table 4.3.1). However, in no instances are the physical effects on landscape character deemed to be significant.

Baseline Visual Character Assessment and Analysis of Effects

Visual Character of the Study Area

4.134 The visual characteristics of the Study Area are intertwined with the landscape characteristics described by the various policy and guidance documents and other publications which provide baseline information about the Study Area. Therefore, many visual characteristics have already been referred to in the previous section of this LVIA and are not repeated. However, they are summarised in relation to their visual as opposed to physical expressions.

4.135 The Study Area is located within the Antrim Plateau region of Northern Ireland which is described by the SPG as a series of visually striking headlands and cliff faces forming a bold escarpment overlooking the A2 Coast Road and the sea beyond. Between the headlands there is a sequence of enclosed bays which form the entrances to the highly distinctive-shaped 'Glens of Antrim' of which there are 9 in total. Much of the Study Area is also formed by the Antrim Coast and Glens AONB, the key visual characteristics of which are broadly reflective of the Plateau. These are described by the AONB Management Plan (refer to paragraph 4.92 for full details) as being the visually concealed or hidden nature of the narrow Glens afforded by the surrounding uplands; the visual contrast between the broad upland plateau and the coastline which is formed by a dramatic and visually distinctive sequence of cliffs, headlands and bays at the foot of each Glen as well as the adjacent seascape.

4.136 The highest quality views in the Study Area are those where the special character of the AONB can be best appreciated by the most sensitive visual receptors both within the AONB and in approaches to it. These high quality views are often located in semi-upland areas at the edges of the Glens overlooking the coast where the contrast between the coastline, the Glens, and the intervening uplands can be appreciated simultaneously. Views from the base of the Glens along the coastline and the Coast Road also provide a very unique sense of place. Views from upland areas between the Glens are often difficult to obtain due to the general lack of access to upland areas. Views on approaches to the AONB often provide a limited sense of the visual characteristics of the Glens and the coastline and there are few locations where widespread views across the AONB can be obtained.

4.137 Glencloy is the second most southerly of the Glens and would be in closest proximity to the Development. It is visually contained to the north by the Garron Plateau, on which the Development would be located. To the south it is enclosed by a finger of uplands that form the southern edge of the Central Ballymena Glens and which divide Glencloy from the southernmost Glen, Glenarm. The A42 road provides access between Ballymena and the AONB and dissects these two upland plateaus. It then descends through Glencloy towards the coastal town of Carnlough. Whilst there would be partial visibility of the Development from some parts of this lowland landscape, it would only be a noticeable feature from more elevated locations. Viewpoint 5 represents such a location along the A42 and other elevated views of the Development from public roads within the AONB are represented by Category D Viewpoints.

4.138 From elevated parts of the road and footpath network there are views across other upland parts of the AONB which appear as a series of broad hills, summits, escarpments and outcrops. Slemish is a visually prominent feature of the western edge of the AONB and is easily identifiable from many other parts of the Study Area including uplands and the rural lowlands surrounding Ballymena and Broughshane. It is also distinguishable in much more distant views across the Province in clear weather conditions because of its distinctive domed summit which rises to 437 m AOD. Lurig is noted in the SPG as being a particularly prominent summit overlooking the Garron Plateau. It divides Glenballyeamon from Glenariff and provides a backdrop to the villages of Glenariff and Cushendall in a similar manner that the east-facing edge of Garron Plateau provides a backdrop to Carnlough. However, it has less of a visual relationship with the Development, being located approximately 9.8 km to the north and of a similar height to the summits of Binnagee and Berry Hill. From Lurig the Development is largely screened by these summits and only 6 blade tips of the proposed 14 turbines were shown to be visible in the wireline prepared for PVP 58 located at the promontory fort on Lurig’s summit. Lurig itself is not visually distinct in views featuring the Development. These tend to be from other upland locations whereas the visual distinctiveness of Lurig tends to be appreciated from the coastal landscape. The tallest summit in the AONB, Trostan (550 m AOD), is located approximately 10 km to the north west of the Development but is similarly visually indistinct (see Viewpoint 13, paragraph 4.190).

4.139 The Development itself would be located in the central part of the AONB, in the south eastern part of LCA 122 Garron Plateau. The turbines would be positioned on a lower section of these uplands to the south east of Cleggan Forest and below the summits of Berry Hill, Binnagee and Neill's Top on ground ranging from approximately 204 m – 339 m AOD. The Development's lower position means that it is most visible from lower lying ground approaching Glencloy and in proximity to Carnlough. The highest land in the Plateau would be located to the north west of the Development with summits ranging from 419 – 438 m AOD. This rising ground effectively screens the Development from much of the northern and western parts of the Study Area with the exception of, often inaccessible, upland areas. Rising ground to the south, although not as high as the uplands to the north, also screen the Development from southern parts of the Study area at distances beyond 12 – 15 km. The well vegetated rural landscape which forms the southern and western setting for the AONB serve to minimise clear visibility of the Development from these directions. This is demonstrated by Viewpoint 19 (from paragraph 4.203).

4.140 Overall the topography of the Study Area serves to restrict visibility of the Development to a relatively small proportion of the Study Area as a whole and this is demonstrated by the ZTV diagrams (analysed in the following section of this chapter) and by the distribution of potential viewpoints (illustrated in Figure 4.3 and described from paragraph 4.146). The visual effects of the Development on the baseline visual character of the Study Area are included in both the analysis of the Zone of Theoretical Visibility below and then in greater detail in relation to views and visual receptors in the analysis of Viewpoints.

The Zone of Theoretical Visibility

4.141 ZTV diagrams have been produced at radii of 15 km and 30 km to illustrate visibility for both the maximum blade-tip and hub-height dimensions being considered for the Development (Figures 4.6 and 4.7). Blade tip visibility illustrates any parts of the Study Area where at least one blade tip would theoretically be visible without taking account of screening provided by contour variations within 50m intervals or land cover elements such as trees and hedgerows. It shows the highest potential levels of theoretical visibility but not necessarily the most realistic because blade tips may be counted even where they protrude only a small amount above a skyline and, in practice, may be visually imperceptible or not easily discernible. This type of visibility will also change as the turbines rotate. Hub height ZTV diagrams represent a more realistic illustration because they show theoretical visibility of all points of the turbines to the hub/ nacelle, and therefore also include the upper parts of the turbine blades as a minimum. They represent more constant levels of visibility. Reverse ZTVs are included in Figure 4.8 to clearly illustrate areas where there would be no theoretical blade tip or hub height visibility of the Development.

4.142 The ZTV diagrams are the starting point for the baseline visual assessment and were also used to assist the selection of PVPs. They illustrate the theoretical visibility and non-visibility of the Development as a standalone wind farm, unrelated to any others in the Study Area. They indicate comparatively low levels of theoretical visibility across the Study Area as a whole and, in particular, from land-based parts of the Study Area as opposed to views from open sea. For this reason, versions of the ZTV diagrams have also been produced to illustrate the difference between Study Area-wide visibility and land-based visibility. The latter exclude visibility from the open sea from where the Development is unlikely to be an easily discernible feature. Coastal visibility, where some of the most sensitive visual receptors are located, has already been noted as being extremely limited:

- Within a 15 km radius from the Development, 53.84 % the Study Area is likely to have some theoretical blade tip visibility of the Development and the majority of this - 34.94 % - would be of 11 - 14 turbine blade tips (refer to Figure 4.6, page 1 of 4). The ZTV diagram illustrates how there is potential visibility of a large number of proposed turbines from higher ground facing towards the Development and areas of visual shadow in lower parts of the Study Area beyond that immediately adjacent to the Development. This reflects the lower position of the Development in relation to the Garron plateau as a whole and the screening effects of higher ground to the north, south and south west. The ZTV also suggests theoretically clear views from the rural landscape to the south of the A42 road corridor between Broughshane and Carnlough, although land cover elements in this part of the Study Area would typically restrict views (see Viewpoint 19 from paragraph 4.203).
- Sea-based visibility forms 16.92 % of total visibility within 15 km and the majority of this would be in open sea to the north east of Carnlough. The ZTV diagrams illustrate how a lesser number of blade tips are visible near the coast, and little or no visibility is apparent on the coastline to the south of Carnlough. When sea-based visibility is excluded and land-based visibility alone is considered, only 36.92% of the Study Area within 15 km of the Development would experience any type of blade tip visibility, and only 22.91% of this would be of 11 – 14 turbines (refer to Figure 4.6, page 2 of 4). When sea-based visibility is excluded, 63.08% of the Study Area would experience no theoretical blade tip visibility of the Development;
- Other areas within the 15 km ZTV where limited visibility is indicated are the side slopes of the uplands to the north, south, east and west, including the outward facing edges of the AONB and the uplands to the north of Trostan. No visibility is indicated within Glenarm or Glenariff or from any parts of the coastal landscape beyond that in proximity to Carnlough;
- Within a 15 km radius from the Development overall visibility would reduce to 47.66 % if hub height calculations are used and visibility of 11-14 turbines would reduce to 24.47 % (refer to Figure 4.6, page 3 of 4).

Furthermore, when land-based visibility alone is considered, only 31.24% of the Study Area would experience any type of hub height visibility, and only 16.91% of this would be of 11 – 14 turbines (refer to Figure 4.6, page 4 of 4). When sea-based visibility is excluded, 68.76% of the Study Area would experience no theoretical hub height visibility of the Development;

- Within a 30 km radius from the Development blade tip visibility would reduce to 45.18 % of the Study Area with only 27.76 % representing visibility of 11 - 14 turbines (refer to Figure 4.7, page 1 of 4). Visibility to the north, south and west would become patchier beyond 15 km and would be limited to upland areas. Potential visibility in the sea to the north east of Carnlough and to the south west of Ballymena would fan out beyond 15 km but would, in practice, be limited by both distance and land cover elements such as trees, hedgerows and urban settlement. When sea-based visibility is excluded the theoretical blade tip visibility of the Development would reduce drastically to only 17.38% of the Study Area as a whole (refer to Figure 4.7, page 2 of 4) with the majority of the Study Area – 82.62% - experiencing no visibility;
- With a 30 km radius from the Development overall visibility would reduce further to 36.94 % if hub height visibility calculations are used with 19.77% of this being visibility of 11-14 turbines (refer to Figure 4.7, page 3 of 4). The majority of this visibility would be sea-based (24.53 %). When sea-based visibility is excluded the theoretical hub height visibility of the Development would reduce drastically to only 12.41% and 87.59% of the Study Area as a whole wold experience no visibility of the Development (refer to Figure 4.7, page 4 of 4).
- The 30 km blade tip and hub height diagrams also illustrate levels of theoretical visibility within the AONB which covers an area totalling 72,488 hectares and the majority of this is located within the Study Area (Rathlin is the only part of the AONB located beyond the Study Area). Figure 4.7 page 1 of 4 indicates that theoretical blade tip visibility of the Development would occur across just 36.40 % of the AONB. Figure 4.7 page 3 of 4 indicates that theoretical hub height visibility would occur across just 30.32 % of the AONB.

4.143 The reverse ZTVs (Figure 4.8) clearly illustrate that many parts of the AONB located beyond 15 km to the north of the Development, and also the southern and western sides of the AONB would have limited theoretical visibility of the Development or the absence of visibility. Coastal areas beyond those in proximity to Carnlough would also have no theoretical visibility of the Development. Lower-lying side slopes and rural lowlands in the western and southern parts of the Study Area would also experience very limited theoretical visibility of the Development.

4.144 It is noted that all the ZTV diagrams illustrate theoretical visibility and that levels would be further reduced by topographical variations and land cover elements.

Detailed site assessment indicates that heavy tree and hedgerow cover along some parts of the A42 in close proximity to the Development and in the pastoral landscape around the foot of Slemish would often prevent clear views of the Development. Urban settlement, vegetation and localised variations in the underlying topography would also screen views in proximity to Ballymena and Broughshane. There would be limited blade tip visibility from some elevated viewpoints to the north and south, such as near the summit of Trostan, and from such locations the Development is unlikely to be immediately noticeable or clearly discernible.

Table 4.1 - Zone of Theoretical Visibility of the Development

ZTV Diagram	No. of turbines theoretically visible	% of Study Area with visibility	% if sea-based visibility excluded	
15 km blade tip Figure 4.6 (page 1 & 2/4)	1 - 3	6.59 %	5.41 %	Total % of 15 km Study Area with theoretical blade tip visibility = 53.84 % = 36.92 % ex. sea-based visibility)
	4 - 7	6.51 %	4.93 %	
	8 - 10	5.80 %	3.67 %	
	11 - 14	34.94 %	22.91 %	
Reverse blade tip Figure 4.8 (page 1/2)	0 turbines	46.16 %	63.08 %	
15 km hub height Figure 4.6 (page 3 & 4/4)	1 - 3	8.24 %	6.12 %	Total % of 15 km Study Area with theoretical hub height visibility = 47.66 % = 31.24 % ex. sea-based visibility)
	4 - 7	7.54 %	4.87 %	
	8 - 10	7.41 %	3.34 %	
	11 - 14	24.47 %	16.91 %	
	0 turbines	52.34 %	68.76%	
30 km blade tip Figure 4.7 (page 1 & 2/4)	1 - 3	8.04 %	3.92 %	Total % of 30 km Study Area with theoretical blade tip visibility = 45.18 %
	4 - 7	5.17 %	2.67 %	
	8 - 10	4.21 %	1.70 %	
	11 - 14	27.76 %	9.09 %	

ZTV Diagram	No. of turbines theoretically visible	% of Study Area with visibility	% if sea-based visibility excluded	
				= 17.38 % ex. sea-based visibility) Percentage of total AONB with visibility = 36.40 %
Reverse blade tip Figure 4.8 (page 2/2)	0 turbines	54.82 %	82.62 %	
30 km hub height Figure 4.7 (page 3 & 4/4)	1 - 3	6.20 %	3.00 %	Total % of 30 km Study Area with theoretical hub height visibility = 36.94 %
	4 - 7	5.11 %	2.18 %	
	8 - 10	5.86 %	1.33 %	
	11 - 14	19.77 %	5.90 %	
	0 turbines	63.06 %	87.59 %	= 12.41 % ex. sea-based visibility) Percentage of total AONB with visibility = 30.32 %

Viewpoint Selection Process

4.145 The Baseline Assessment identified parts of the Study Area most likely to experience visibility of the Development and contain key visual receptors due to the theoretical levels of visibility indicated by the ZTV diagrams, the potential sensitivity of either the location and / or the visual receptors likely to be present in these areas. These include:

- Locations within the AONB which, with the exception of Rathlin, lies almost entirely within the Study Area. AONBs are statutorily designated as nationally recognised high quality landscapes. They are likely to attract visitors by virtue of this designation and contain various visitor amenity sites and attractions;

- Locations from which the Development would be seen within the wider landscape context of the Study Area, i.e. upland parts of the Antrim Plateau from where there are views towards the Sperrins, Lough Neagh, Belfast hills and the North Channel seascape;
- The series of Glens and river valleys which dissect these uplands and which are a defining feature of the AONB, providing a unique sense of place and a physical connection between coastal and upland parts of the landscape;
- Locations from public rights of way, scenic drives and cycling routes where viewers are likely to be present for the primary purpose of appreciating scenic views. Such locations include: the Ulster Way network of waymarked trails across the Antrim Plateau and along the coastline; the National Cycle Network which largely hugs the coast but also includes routes between Ballymena and Glenarm in the centre of the Study Area and over the hills between Larne and Carrickfergus in the south eastern part of the Study Area; the A2 scenic coastal drive which covers the entire coastal section of the Study Area as well as an upland section across the glens in the north;
- Residential properties and the rural road network in close proximity to the Development where viewers may either be static or obtain views for prolonged periods of time and where the Development may form a key element in these views;
- Areas of settlement where viewers may also be static and obtain views for long periods of time and where the landscape in proximity to the Development is likely to form a key element within the landscape setting for these settlements.

4.146 These locations guided the selection of Provisional Viewpoints (PVPs). The initial desk-based selection of PVPs, including the selection criteria used, is described in Technical Appendix 4.4 and illustrated on Figure 4.3. Fifty eight PVP locations were identified and analysed through the production of a preliminary ZTV diagram. Draft wirelines for all these locations were prepared and checked by site visits to confirm the nature of receptors and potential visibility of the Development. These draft wirelines were used as working documents and are not reproduced in this LVIA but they were used to form a detailed understanding of the nature of visibility throughout the Study Area.

Final Viewpoint Selection

4.147 Following the initial assessment described above 20 Viewpoints were shortlisted for inclusion in the LVIA and detailed analysis. They include a proportionate number of locations which are intended to be representative of typically occurring views within the Study Area, views experienced by key visual receptors, and also views from specific locations that merit inclusion in the LVIA by virtue of their contribution to the key landscape and visual qualities of the Study Area and the AONB in particular. With the exception of Viewpoint 20, all viewpoints are located within the AONB boundary. The majority are located to the south east and within approximately 10 km of the Development. Many occupy elevated upland positions but there are few lowland and coastal locations. The locations of the final shortlisted viewpoints reflect the topography, land cover in the Study Area and the location on the Development in relation to the baseline landscape character, i.e. the ZTV. PVPs were not usually shortlisted if they were found to provide no actual view of the Development despite visibility being indicated by the ZTV. The reasons for this absence of visibility usually arose from differences between theoretical and actual visibility which is explained in Technical Appendix 4.2 (ES Volume 2). Other PVPs were not shortlisted if a more typical view was demonstrated elsewhere, where no safe stopping place was available to take photographs or where the viewpoint location would not be easily accessible to the public.

4.148 A detailed description of the methodology for viewpoint selection is included in Technical Appendix 4.2 starting at paragraph 4.24. A summary analysis of all PVP locations and the rationale for shortlisting particular viewpoints is provided in Technical Appendix 4.4, Table 4.4.1. The locations of final viewpoints are indicated on all map-based figures which accompany this LVIA chapter (Figures 4.1 - 4.10). Wirelines and photomontages of each viewpoint have also have been presented in Figures 4.11 - 4.30. These are intended to assist in the understanding of, but not to replace, the detailed written descriptions of effects on viewpoints which are contained in the subsequent paragraphs of this chapter. It is important to recognise the limitations of visualisations and this is further described in Technical Appendix 4.2, paragraphs 4.42 - 4.49. They should not be relied upon as the primary means to determine visual effects and it is expected that all locations will be visited by the decision-maker and any interested third parties in order to be fully understood.

4.149 The Development includes the removal of several small areas of coniferous forestry to facilitate the construction of an access track to Turbine 8 and the base of Turbine 10. Where this forestry is visible in the existing view two pages are included in the relevant viewpoint figure. Page 1 illustrates the wireline and photomontage of the Development with the relevant forestry removed. Page 2 is a baseline photograph of the existing view, including the forestry in question and highlighting the approximate areas that would be removed. This is intended to provide as accurate an illustration as possible of the changes to the view that would result from the removal of forestry.

4.150 In the analysis of visual effects cognisance is also taken of the SPPS and PPS 18: BPG. These policy and guidance documents note that whilst wind farms are, by their nature, highly visible and are likely to be relatively prominent at distances of up to 5 km, this does not necessarily preclude them from being acceptable features. The choice of viewpoints is intended to represent the manner in which the Development is experienced when travelling around the Study Area and not just from locations in close proximity where it may naturally be expected to be clearly visible.

4.151 For ease of analysis the shortlisted viewpoints have been categorised as follows so that the different types of views, receptors, and specific areas they represent can be accurately described and understood without unnecessary repetition:

A. Views in close proximity to the site boundary;
B. Views on approaches to coastal settlements;
C. Views from coastal settlements;
D. Views from the Antrim Glens;
E. Elevated views from the Antrim Plateau;
F. Views from the south-western edge of the AONB and wider Study Area.

Category A: Views in close proximity to site boundary

Description of Existing Views

4.152 Category A includes Viewpoints 1 -3 which are illustrated in Figures 4.11 – 4.13. They represent views from the nearest public roads to the Development which border the south eastern side of the site boundary.

4.153 Viewpoints 1 and 2 are located on Slane Road which skirts the lower edge of the Garron Plateau at distances of 0.88 km – 1.28 km to the south east of Turbine 10 whilst Viewpoint 3 is located on the adjacent A42 which is the main route between Ballymena and Carnlough. Together these Viewpoints represent the closest available views of the Development from publicly accessible viewpoints and also from residential properties in the area. Residential properties are primarily clustered around the north eastern end of Slane Road in close proximity to Viewpoint 2 and within the rural landscape between the A42 and Slane Road. Properties at the south western end of Slane Road were initially assessed via PVP 13 (see Technical Appendix 4 Table 4.4.1) but would not experience the same open views as those obtained from Viewpoints 1 or 2. From this end of the Slane Road views in the direction of the Development are typically screened or partially screened by rising ground (a combination of Mullaghboy Hill and Curraghvohil which would be positioned in front of the southern end of the Development). Similarly, the A42 road corridor in proximity to Slane Road (PVP 48) would also experience views that are partially screened by these hills in addition to being a road with faster-moving traffic and fewer opportunities to appreciate views in the direction of the Development. PVP 16 was initially selected to represent views from residential properties on the more elevated Killycarn Road to the south west of the site boundary and a photomontage was prepared to inform the Cultural Heritage chapter due to the presence of a portal tomb in this location (ES Volume 4, Appendix 5.2, Heritage Viewpoint 3). However, whilst the elevated nature of this road means that there are clear views across the southern part of the AONB and the countryside around Slemish, views towards the Development are largely screened by Ticloy Hill and it was not shortlisted for further analysis in the LVIA. There is no sense of proximity to the coast from any Category A Viewpoints. Typical on approaches to coastal settlements, including the A42, are represented by Category B Viewpoints.

4.154 Slane Road is a quiet rural road which runs largely parallel with the A42. It has a relatively remote upland character due to the simplicity of landform and land-cover. It also occupies a slightly more elevated position in the landscape than the main A42 and, hence, allows clearer views to the north west in the direction of the Development and south east across the Larne Glens towards uplands in the southern part of the AONB formed by the Larne Basalt Moorlands. Viewpoint 1 is located in the central part of Slane Road which is characterised almost entirely by simple upland grazing and moorland stretching north westwards from the road corridor into the site of the Development and south eastwards either side of the A42 road corridor. There are wide views from this location including the rising slopes on the southern side of Garron Plateau where Cleggan Forest is a defining feature. Smaller areas of forestry at Ticloy are also clearly visible in the middle distance. Slemish is a prominent landmark rising out of the more pastoral landscape of the Central Ballymena Glens approximately 8 km to the south west. The A42 road corridor and surrounding rural landscape is partially concealed by variations in the foreground landform and views beyond this are contained by the side slopes of the Larne Basalt Moorland uplands which form the southern part of the AONB.

4.155 Viewpoint 2 has a similar character but there are a number of rural properties concentrated along and around this end of the road and the foreground has a more complex pattern of trees, hedgerows and stone walls. Houses are generally orientated to take advantage of open and expansive views across the Central Ballymena and Larne Glens. Views in the direction of the Development are partially screened by Mullaghboy Hill and Curraghvohil which are prominent foreground features.

4.156 Viewpoint 3 is located within LCA 123 Larne Glens in close proximity to the fringes of the Garron Plateau and would be 1.72 km from Turbine 5. It is at a lower elevation than Slane Road and views from this location are tightly constrained by roadside vegetation and rising ground to the north of the road corridor. Views of the southern portion of the Development would be entirely screened by Curraghvohil. The northern portion of the site would be partially visible above trees and hedgerows on the hillside rising above the road corridor. Views would become clearer as the A42 descends into Carnlough but there are few safe stopping places along this fast-moving section of road and these views become more strongly defined by the coastline and eastern fringes of Garron Plateau overlooking Carnlough itself. These latter types of views are represented by Category B Viewpoints rather than Viewpoint 3. Instead, Viewpoint 3 has been selected to represent the views of tourists and other road users in close proximity to the proposed site entrance, where views will be affected by the proposed removal of existing vegetation at this location and who may also be using Doonan Leap layby and picnic area as a stopping point.

Sensitivity of Visual Receptors: ranging from Medium to High

4.157 Visual receptors at Viewpoint 1 would primarily comprise of local road users and farm workers as well as residents travelling to and from properties located on other parts of Slane Road. They are deemed to be of medium sensitivity because, although located within the AONB their existing views would be transitory and / or experienced whilst undertaking activities not associated with the enjoyment of the landscape or visual quality. The character of their existing views to the north side of Slane Road are heavily influenced by the presence of forestry in proximity to the Development site and by significantly more expanse views southwards across other parts of the upland landscape.

4.158 The sensitivity of visual receptors would be higher in proximity to Viewpoint 2 where there are a number of properties where residents would experience relatively clear views either of part or the whole Development at distances of around 1.2 km. The sensitivity of visual receptors in proximity to Viewpoint 3 would vary from medium to high and would include general road users, residents in proximity to the road corridor and tourists. This is a tourist amenity location but it is also located on a relatively busy main road and there are few opportunities for outdoor recreation in immediate proximity. The majority of receptors are therefore likely to be relatively transitory and views are typically restricted by roadside vegetation from this section of the road corridor.

Magnitude of Visual Effect: ranging from High to Low

4.159 The Development would be located in close proximity to these viewpoints at distances ranging from 0.88 – 1.72 km. Therefore, where views are available one would reasonably expect the Development to be a prominent feature. From Viewpoint 1 the Development would be visible in its entirety and across a relatively large section of the northern side of the view. The turbine layout would have a simple, uncluttered appearance and turbines would be relatively evenly and logically space in relation to the underlying topography thus creating a layout that would be visually suitable for the receiving landscape. Removal of some of the forestry visible in the foreground around the bases of turbines T10 and 11 would simplify the appearance of the landscape and create slightly more open and expansive views in this direction. However, this would have little effect on the overall levels of visibility of these turbines. There would be open and uninterrupted views across similar upland landscapes in the other direction but the Development would nevertheless define one side of the views available from this location. Therefore the magnitude of effect on Viewpoint 1 is deemed to be high.

4.160 The magnitude of visual effect on Viewpoint 2 would be medium because the Development would be less visible and located at a greater distance with a flatter area of grazing land and scrubby vegetation in the foreground providing a greater degree of visual separation between the Development and the viewpoint location. There would also be only partial visibility. Whilst the blade tips of turbines T10 and 11 would protrude slightly above the profile of Mullaghboy Hill in the foreground, turbines T8, 9, 12 and 13 would be entirely screened. There would also be wider views in the opposite direction. The Development would become more visible for a short period of time if travelling in a northerly direction along Slane Road towards Viewpoint 3 but would not appear within the main (south easterly) focus of views and would also quickly become concealed by denser roadside vegetation around the end of Slane Road. Six of the 14 proposed turbines would be clearly visible against a rising backdrop of upland moorland with turbines T2 and T4 being the most prominently located on the skyline.

4.161 The magnitude of visual effect on Viewpoint 3 would be low because views from the A42 road corridor and the parking layby are heavily restricted by trees and hedgerows. Although a small portion of woodland would be removed as part of the proposed site entrance works this would have little effect on the visibility of the turbines. The majority of existing vegetation would be retained and additional planting which is proposed further into the site would be at a higher elevation in relation to the road and would provide additional screening. The proposed site entrance works are further detailed in Chapter 1 and summarised at paragraph 4.21. The approximate extent of existing planting that would be removed is indicated on Figure 4.13 and new planting proposed to mitigate this removal is described from paragraph 4.225.

Significance of Visual Effect: Significant at Viewpoints 1 and 2; Not Significant from Viewpoint 3

4.162 Viewpoints 1 and 2 and located in closest proximity to wind farm and would experience medium to high magnitude of change. Although there would be a relatively small number of visual receptors present at these locations in comparison to the adjacent A42 road corridor, they are deemed to be of medium to high sensitivity and the overall visual effects are therefore deemed to be significant. Visual effects on receptors present in proximity to Viewpoint 3 are not deemed to be significant because, although some would be of high sensitivity the magnitude of effect would be low.

Category B: Views on approaches to coastal settlements

Description of Existing Views

4.163 Category B includes Viewpoints 4 and 5 which are illustrated in Figures 4.14 – 4.15. They have been selected to represent views on approach and exit from the only two coastal settlements within the Study Area which would experience views of the Development – Carnlough and Glenarm. Viewpoints within Carnlough village are represented by Category C Viewpoints.

4.164 Viewpoint 4 is located on Dickeystown Road 6.02 km to the east of the Development. This is an elevated tertiary road which, for much of its length, skirts around the northern finger of uplands within the Larne Basalt Moorlands overlooking the Southern Glens Coast SCA and open sea. It climbs up the side of these uplands from lower parts of the road network in proximity to the A2 Coast Road and views are typically characterised by steep-sided cliffs overlooking the open sea. There are rural houses scattered along the road corridor which are orientated to take advantage of these views. Only the upper part of Dickeystown Road would experience views in the direction of the Development when the road corridor rounds the base of Crockandoo hill. From this location the primary focus are the expansive views that are obtained across the scenic pastoral landscape which characterises the upper parts of Glenarm with views to the uplands in the central part of the AONB forming part of the skyline above the glen. There are glimpsed views along the sequence of cliffs and escarpments which form the eastern side of the AONB overlooking the coast towards Garron Point but this are largely screened by foreground trees and hedgerows in this location. Viewpoint 4 has been selected to represent these types of views which would be available from the road corridor and adjacent residential properties for a relatively short period of time before the road descends into Glenarm and views become progressively more focussed on the side slopes of Glenarm rather than the upland parts. Viewpoint 4 also represents similar views obtained at PVP 46 where the Ulster Way and Appalachian Trail cross Feystown Road.

4.165 Viewpoint 5 is located 2.01 km to the south east of the Development on the A42 which is one of the main routes through the AONB providing access to Carnlough. Views from this location are less expansive because the A42 in proximity to this location is at a lower elevation and is more enclosed by rising land to either side of road corridor. The uplands which form the northern section of the Development site would be visible beyond the farmland which fringes the road corridor. The eastern-facing edge of these uplands, which overlooks the coast, is largely obscured by trees and hedgerows either side of the road and views to the south and east are restricted by steeply rising hills which form the western side of Glenarm. Views from the road corridor below this point (i.e. closer to Carnlough) are further restricted due to roadside vegetation and topography (see Viewpoint 3).

Sensitivity of Visual Receptors: ranging from High to Low

4.166 In proximity to Viewpoint 4 visual receptors would include residents of properties located along the road corridor and on elevated sites adjacent to the road which are typically orientated to take advantage of views across Glenarm towards the coast and upland parts of the Antrim Plateau. They are deemed to be highly sensitive. There are unlikely to be large numbers of tourists present on this road but potentially more in proximity to Feystown Road which provides access to waymarked trails and a number of locations and would be the primary route between outdoor visitor attractions around Knockdhu. They are also deemed to be of high sensitivity. Also present in proximity to this viewpoint are general road users and outdoor works on adjacent farmland that are deemed to be of Low sensitivity. Visual receptors on the A42 in proximity to Viewpoint 5 would include general road users, tourists and residents of a relatively small number of properties located on and around the road corridor. Many visual receptors would experience transitory views from fast moving vehicles for brief periods of time. However, they would also be located at closer range to the Development than in Viewpoint 4 and are more likely to include tourists because the A42 is a key route through the AONB. Therefore visual receptors at Viewpoint 5 are deemed to be of medium to high sensitivity.

Magnitude of Visual Effect: ranging from Medium to High

4.167 From Viewpoint 4 the Development would have a medium magnitude of visual effect. The northern group of turbines would be clearly visible on the uplands in the centre of this view. The lower parts of the turbine towers would be seen against a backdrop of rising ground (the highest summits within the Garron Plateau) and they would be visually separate from views of the eastern edge of the plateau which overlooks the coastline and views into the settlements of Glenarm or Carnlough. The southern group of proposed turbines (turbines T8 - T11) would be less visible. Only the hubs and upper parts of the rotors would appear above the skyline. The majority of these four turbines would be screened by the pastoral upper slopes of Glenarm which are one the primary focus of views from this location and of proportionally larger in scale that the section of view which would become occupied by the Development. Within this context and from this distance the Development would be clearly visible but not prominent. It is also noted that there are no views from the opposite side of the Glen or from lower parts in closer proximity to the village. There are no views into the wider AONB except partial views towards the coastline to the north east but the Development is visually separate and detached from this part of the view. Views towards the coast briefly become a more prominent feature of views as the road descends into Glenarm as views of the uplands on which the Development would be located become less visible. PVP 47, located approximately 800 m from Viewpoint 4 on a slightly lower part of Dickeystown Road, was visited during the initial site assessment but was not shortlisted for detailed analysis because it illustrates the steady decline in visibility of the Development as the road network descends into Glenarm.

4.168 From Viewpoint 5 the Development would have a high magnitude of visual effect because there would be a clear view of majority of Development from closer range. Although the view from this location is less expansive than that obtained at Viewpoint 4 it is also location at closer range and the Development would be a more prominent feature because views into the wider landscape are more restricted. Viewpoint 5 also represents similar views which would be obtained on lower parts of the A42 between Viewpoint 3 and the outer parts of the village (PVPs 54, 56 and 57) although these preliminary locations were not shortlisted because the extent of the Development apparent from this locations would be less than that represented by Viewpoint 5 or, in the case of PVP 54, very short-lived from a busy section of the road corridor with no safe stopping place.

Significance of Visual Effect: Not Significant at Viewpoint 4; Significant at Viewpoints 5

4.169 The sensitivity of visual receptors at Viewpoint 4 would vary from high to low and the Development would be clearly visible but not prominent within the wider view. It would not encroach into the main areas of visual quality – the glen or the coastal parts of the view – and this type of view would occur over a relatively limited area. Therefore, the overall effects are not deemed to be significant. However, visual receptors at Viewpoint 5 are deemed to be of higher sensitivity, the Development would be prominent and visible at closer range. Magnitude of effect from this location is deemed to be high and, although they occur over a relatively short section of the overall length of the A42 road corridor, they are therefore deemed to be significant.

Category C: Views from the coastal settlement of Carnlough

Description of Existing Views

4.170 Category C includes Viewpoints 6 -8 which are illustrated in Figures 4.16 – 4.18. They have been selected to represent the typical extent of views from Carnlough which is the nearest and only settlement within the Study Area that would experience view of the Development. There is a notable absence of views from any other coastal settlements within the Study Area as demonstrated by the ZTV diagrams and PVP 8 in the centre of Glenarm (see Technical Appendix 4 Table 4.4.1)

4.171 Viewpoint 6 is located on the A2 Coast Road at the Straidkilly - Ballyvaddy Road junction at the southern entrance to Carnlough. It is one of the only locations on the A2 Coast Road to experience views of the Development (PVPs 8, 10 and 11 were initially selected but the provisional wirelines prepared for these locations confirmed the ZTV diagrams which illustrated that most of the A2 and the adjacent seascape would be outwith the ZTV. On the northern side of Carnlough views from the Coast Road would be screened by rising ground and this is the case for the majority of the coastal part of the AONB as noted in the ZTV analysis (from paragraph 4.140). The foreground comprises the highly scenic coast road with Carnlough beach to the east framed by the arc of Carnlough Bay and with the east-facing edge of Garron Plateau forming the skyline. There is a single residential property to the immediate left-hand side of the view which is orientated to take advantage of these coastal views and the view illustrated by the photomontage in Figure4.16 would provide the setting for these coastal views. Inland views comprise of the flat pastoral base of Glencloy in the foreground framed by the prominent rounded slopes of Binnagee Hill which have a relatively rich and visually complex pastoral in character in lowland parts and become simpler and exposed around the summit. The steeply wooded hill which forms Straidkilly Point encloses views in the other direction and encloses inland views that would be obtained from more southerly sections of the A2 when travelling towards Glenarm. There are a number of residential properties located further up Straidkilly Road that would not experience similar views to those represented by Viewpoint 6 due to the wooded nature of the hillside. However, houses along the lower part of Ballyvaddy Road would experience similar views in the direction of Binnagee but without the same extensive views towards the coast.

4.172 Viewpoints 7 and 8 represent the extent of views likely to be obtained within the main settlement area of Carnlough rather than on the southern outskirts. This includes the lower parts of the A42 road corridor where there are a number of residential streets and a caravan park (PVPs 50, 53 and 55). Whitehill caravan park, which is located on the lower Garron Plateau slopes behind the main settlement (PVP 51), would experience very similar views to Viewpoint 8. There are also elevated parts of Largy Road on the northern side of Carnlough which would experience similar views (PVP 50 and Heritage Viewpoint 5 from which a photomontage has been produced to support the Cultural Heritage chapter). Viewpoint 7 is located within the elevated Harbour Park area in the centre of the village which is accessed via steps and walkways crossing the main street. Views to the open sea and in both southerly and northerly directions along the coast which encloses Carnlough Bay can be appreciated from this location. The beach and historic harbour area are also visible in the coastal foreground. When looking away from the sea towards the land-side of Viewpoint 7 the historic vernacular buildings which form the centre of Carnlough make up the foreground. The east-facing escarpment of Garron Plateau creates the backdrop to the village. This comprises of the same pastoral lower slope and the distinctive stepped upland moorland that is visible from a slightly different angle in Viewpoint 6.

4.173 Viewpoint 8 is located in proximity to a carpark, residential area, children's play area and public footpath on an elevated site behind the main street. The footpath provides access to part of the upper slopes on the central eastern edge of the Garron Plateau at Cranny Falls from a. Views from this location are less defined by the coast and more by the contrast between the east-facing escarpment overlooking open sea and other upland parts of the landscape which are visible to the north and south and which visually enclose Carnlough Bay. At this location the well-vegetated pastoral lowland slopes which formed the middle ground seen in Viewpoint 7 comprise the foreground landscape. This includes farmsteads, a caravan park (PVP 51) and rural properties orientated to look eastwards toward the sea. There are higher levels of screening provided by mature trees within this foreground landscape but the skyline formed by Binnagee summit is a prominent feature creating an exposed backdrop to seaward views. This would be the focus of landwards views when walking towards Cranny Falls.

Sensitivity of Visual Receptors: ranging from High to Medium

4.174 Visual receptors present at Viewpoint 6 and 8 are deemed to be of high sensitivity because they would comprise primarily of residents of houses and caravans in proximity to these Viewpoints, people present at these locations for the purpose of various types of outdoor recreation and travellers on the A2 Coast Road which is an internationally renowned scenic drive. Visual receptors at Viewpoint 7 are deemed to be of medium sensitivity because foreground views are more strongly influenced by built settlement and feature a wide range of man-made elements. Views from the lowest-lying coastal areas will primarily be focussed within the village and towards the coastline and open sea views which are framed but not dominated by the cliffs/ uplands to the west.

Magnitude of Visual Effect: Ranging from Medium to Low

4.175 The magnitude of visual effects on Viewpoint 6 is deemed to be medium but the magnitude of effects on Viewpoints 7 and 8 is deemed to be low. At Viewpoint 6 the Development would be a prominent addition to the view located 2.87 km to the south east at its nearest point and stretching some distance inland. However, not all the turbines would be clearly visible. Only four of the proposed turbines in the northern grouping would be clearly visible in so far as the majority of the towers, hubs and rotors would be apparent. The hubs and upper blades of a further five turbines would be only partially visible and only the blade tips of the remaining five turbines would protrude slightly above the skyline. The Development would occupy a relatively small proportion of the overall view and would not encroach upon the open sea, Carnlough Bay and beach. It would appear to be well set-back from the east-facing side of Binnagee hill and the position of the lower parts of the turbines below the visible skyline means it would be visually detached from the relatively complex foreground landscape comprising the side slopes of Glencloy which is the dominant land-side feature of the foreground view and which would ensure a relatively high degree of visual separation.

4.176 The Development would be located at a similar distance as Viewpoint 6 - 2.83 km to the south east of Viewpoint 7 and 2.65 km from Viewpoint 8. In both cases only the two turbines located on the highest parts of the site – T1 and T2 - would be clearly visible (although from Viewpoint 7 the very tips of turbines T3 and T4 are also visible but less discernible). The majority of the Development would be screened by the east-facing edge of the Garron Plateau which provides a backdrop to the coastal landscape, the latter being the main focus of views from these locations. Visual separation between the Development and the foreground is created by the steeply rising sides of Garron Plateau. The lower slopes are relatively visually complex in term of vegetation and land uses and the foreground in Viewpoint 7 is particularly strongly influenced by the various man-made elements and activities associated with built settlement. Although a small number of the proposed turbines would be clearly visible the majority of the Development would not. The Development would occupy a very small proportion of the views available from these viewpoints and would not encroach upon the main focus of views which would be orientated seaward and in the opposite direction to the Development.

Significance of Visual Effect: Significant at Viewpoint 6; Not Significant at Viewpoints 7 and 8

4.177 At Viewpoint 6 the Development would be prominent. Although it is noted that not all turbines will be clearly visible in their entirety the majority would be visible to some extent and would stretch some distance inland. Visual receptors are deemed to be of high sensitivity and are likely to occur in relatively large numbers because Carnlough is a key tourist destination within the AONB. Therefore, visual effects are deemed to be significant. However, locations represented by Viewpoints 7 and 8 would occur in more instances around Carnlough. The sensitivity of visual receptors would be medium and high respectively and the magnitude of effect would, in both cases also be medium. However, the Development would be far less visible from these locations and would not appear within the same direction of view as the coast. Only the upper parts of the two highest turbines in the Development would be visible and they would not encroach upon coastal views. Therefore, the overall effects on these Viewpoints are not deemed to be significant effects.

Category D: Views from the Antrim Glens

Description of Existing Views

4.178 Category D includes Viewpoints 9 -12 which are illustrated in Figures 4.19 – 4.22. They have been selected to represent views from other parts of the Antrim Glens that haven't been included in consideration of Category A viewpoints in closest proximity to the site within Glencloy and Category B which considered approaches to the settlements of Glenarm and Carnlough. Generally views from the lower parts of these glens are constrained by their steeply incised nature and tend to be channelled along the length of each Glen but do not permit views into the wider landscape or the uplands to either side. There is also a complete absence of views from the other 7 Glens within the AONB. Therefore, this Category necessarily only includes representative views obtained from upper parts of Glencloy and Glenarm which are located to the south of the Development.

4.179 Viewpoint 9 is located on Ballyvaddy Road which traverses the middle slopes on the southern side of Glencloy. It is 2.33 km from the Development at its nearest point. The lower part of the road corridor overlook the Glencloy River corridor and the opposite side of the glen. Views in a northerly direction, where the Development would be located, are largely contained by the glen's rising side slopes and have a scenic pastoral character which is richly vegetated by mature trees, hedgerows and small areas of woodland (see Figure 4.19 page 1/2). The Garron Plateau beyond the glen is only partially visible and forms the skyline in this part of the view but there is no perception of its full expanse from this location and these uplands are of less prominence than the Glen itself, which is extensively visible. Views are channelled north-eastwards to the base of the Glen where they become more open and expansive. In this part of the view (see Figure 4.19 page 2/2) the settlement of Carnlough around Carnlough Bay is clearly visible backed by a sequence of rising uplands formed by the east-facing side of the Garron Plateau stretching along the coastline towards Garron Point. The rounded summit of Binnagee is the closest of this sequence but the subsequent summits of Little and Big Trosk, Craigatinnel and

Knockmore are also prominent. The wooded side slopes and exposed limestone quarry escarpment above Carnlough are distinctive elements of views from this location.

4.180 Viewpoint 10 is located on Feystown Road in proximity to the section of the Ulster Way which traverses Crockandoo and Scawt Hill within the Larne Basalt Moorlands area of uplands overlooking the coast in the south eastern part of the Study Area. It is located approximately 5.84 km from the Development and is an elevated viewpoint with views across the middle section of Glenarm towards the Garron Plateau on which the Development would be located. Its elevated position means that views into the lower parts of Glenarm are not experienced and rising ground on the opposite side of Glenarm prevents any visibility of Glencloy. Viewpoint 11 is located on Glenview Road which is located approximately 6.83 km to the south east of the Development. It occupies a slightly more elevated position than Viewpoint 10 and is on a road corridor approaching Glenarm from a southerly direction so it achieves more channelled views along the length of this Glen. However Viewpoint 12, which is positioned on the upper slopes between Glenarm and Glencloy only 2.73 km to the south west of the Development, would have no visibility of either glen because views into lower parts of the landscape are screened by higher ground in the foreground.

4.181 Due to their elevation both Viewpoints 10 and 11 include views of Glenarm in the context of wider panoramic views across the southern and middle parts of the AONB including the upper side slopes of the glen, Garron Plateau, the Larne Basalt Moorlands and the coastline. Viewpoint 12 includes views of the uplands to the north west and south east and also includes relatively clear partial views of Elginny Hill and Rathsherry wind farm in the middle distance to the left-hand side of the view illustrated in Figure 4.22. The foreground landscape in all three Viewpoints features a higher proportion of drystone walls, windswept stands of beech trees, hedgerows and rough grazing land as well which characterise the transition between the lowland pastoral landscape character that is predominant in Viewpoint 9 to the upland landscape character than becomes more dominant in Category E viewpoints.

Sensitivity of Visual Receptors: ranging from High to Low

4.182 There are a wide range of visual receptors present at all viewpoints in this category. Due to the pastoral nature and network of tertiary roads in the foreground landscape outdoor workers and general road users will be present in relatively high numbers and are deemed to be of relatively low sensitivity. Aside from the Ulster Way in proximity to Viewpoint 10 there are no specific visitor amenity sites in proximity to these types of viewpoints. However, they are all located in scenic locations from where high quality views of different parts of the AONB can be obtained and tourists are deemed to be of high sensitivity. There are also rural properties scattered throughout the landscape in proximity to these viewpoints. Those present in proximity to Ballyvaddy Road tend to be orientated to take advantage of scenic views across and along the length of the Glen towards the coast and are deemed to be of high sensitivity. Those located in proximity to Viewpoints 10 and 11 are deemed to be of medium sensitivity due to the existing expansive nature of views and distance from the Development. There would be a greater proportion of outdoor workers and general road users in proximity to Viewpoint 12 and visual receptors here are deemed to range from low to medium sensitivity.

Magnitude of Visual Effect: ranging from Medium to High

4.183 The Development would be clearly visible at relatively close range to Viewpoint 9 as two distinct groups of turbines; a group of four turbines (turbines T8 – T11) would be partially beyond the skyline on the left-hand side of view which forms the south-western edge of the pastoral landscape. Three of these turbines would be largely screened from view by the rounded hill in the foreground and would be visible but not prominent features of the view. T10 and T11 in particular would appear either side of an existing area of forestry on the skyline which further reduces their visual effect on the skyline. Turbine T8 in this group would be more prominent because the upper parts of the tower, hub and rotor would be visible but still in the context of a complex foreground landscape. The larger group of 10 turbines would be a prominent feature at a higher elevation and on a broader part of the skyline. Whilst the base of the majority of these turbines would be screened from view by the edge of this upland area, Turbines T1 and T2, which would be visible in their entirety. The Development as a whole would not encroach on the main orientation of views along Glencloy towards the coastal lowlands or on the majority of the uplands which frame the coastal part of the view Despite its visual prominence on one side of the view available from the lower section of Ballyvaddy Road the Development would overall appear as a distinct and separate element from the key components of this view including the scenic and richly vegetation pastoral glen sloping down to a coastal landscape framed by expansive upland escarpments and summits. The overall existing character of the view would continue to be more strongly defined by these elements rather than the Development. However, the two turbines at the north eastern end of the Development would appear to be more clustered together than the other turbines in the Development, thereby forming a visually dominant vertical feature. These two turbines would occupy a relatively elevated position in closest proximity to the main focus of views from this location. For this reason and because this Viewpoint is one of the few locations from which the Development would be clearly visible in conjunction with both the glens, coastal and upland parts of the AONB simultaneously and the magnitude of effect is deemed to be high.

4.184 The Development is deemed to have a medium magnitude of visual effect on Viewpoints 10 and 11. In these types of views the Development would be located at greater distances from the viewpoints in question. Whilst it would be a prominent feature in one part of the available view, its scale would be subordinate to the overall extent of views available from these more elevated positions at the upper parts of the glen landscape. Therefore, it is considered to be visible rather than visually prominent when considered in the context of the extensive views that would be obtained from the locations represented by these viewpoints. Viewpoints 10 and 11 are also the first viewpoints considered in this LVA where existing wind farms and single turbines would appear within the same, albeit wide, field of view as the Development. Therefore the Development would not introduce a completely new visual element to views but would continue the existing pattern of wind energy development within upland parts of the Antrim Plateau.

4.185 At Viewpoint 12 the Development would be clearly visible in its entirety. The lower parts of some of the turbines would not be screened form view in the same manner as they are in Viewpoint 9. Views would also be more limited her to upland parts of the glens and adjacent plateau so the Development would be a prominent addition to a larger proportion of the available view and would have a high magnitude of effect.

4.186 It is noted that lower parts of Ballyvaddy Road, in closer proximity to Carnlough would have less frequent or clear views of the Development because the road corridor becomes more heavily vegetated until the junction with the A2 at the edge of Carnlough (see Viewpoint 6). Views from the higher southern section of Ballyvaddy Road would be partially or wholly screened by variations in topography adjacent to road corridor and the road corridor here becomes more upland in character. However, there are houses here that are located on lanes off the main road corridor where residents are likely to experience clear but much wider angles of view similar to those represented by Viewpoints 10 and 11. These types of views are also likely to include other wind farms (Elginny Hill, Rathsherry and Carnalbanagh in particular).

Significance of Visual Effect: Significant at Viewpoints 9 and 12; Not Significant at Viewpoints 10 and 11

4.187 The Development would have a significant effect on the lower section of Ballyvaddy Road as represented by Viewpoint 9, based on the conclusion that a large proportion of visual receptors within this part of the Study Area would be highly sensitive. Turbines T1 and T2 would be visually dominant features and the overall magnitude of visual effect would be high.

4.188 Effects on Viewpoint 12 would also be significant because the Development is prominent, located at relatively close range and would occupy a much greater proportion of the available view than in Viewpoints 10 and 11. Although visual receptors here are generally deemed to have a medium to low sensitivity the Development and the viewpoint are still located within the AONB and the overall magnitude of effect is deemed to be high. However, it is also noted that effects of this magnitude and significance would occur over a relatively limited area. Elsewhere along Munie Road and other adjacent road corridors effects would not be as significant.

4.189 Effects on Viewpoints 10 and 11 would not be significant because, although the magnitude of effects would be medium, the Development would be less prominent and there would be a wider range of visual receptors with sensitivities ranging from low to high. The Development would be subordinate to the overall scale of views available from these locations and would not introduce and entirely new visual element because wind energy development is already a pattern across other parts of these views.

Category E: Elevated views from the Antrim Plateau

Description of Existing Views

4.190 Category E includes Viewpoints 13 -18 which are illustrated in Figures 4.23 – 4.28. This category contains the largest and most representative selection of views of the Development. As demonstrated by previous viewpoint categories, there are limited opportunities to experience views of the Development, and particularly clear views of the whole Development, from lowland and coastal areas, coastal settlements and from the landscapes within the Glens. Upland parts of the AONB, such as those represented in this category, offer clearer and more elevated viewpoint locations from where the full extent of the AONB can be better appreciated. In all instances the viewpoints in this category provide views of the Development in the context of the wider landscape including the AONB. They also allow a greater appreciation of the pattern of wind farm development and forestry across other parts of the AONB and the wider Study Area.

4.191 All Viewpoints in this category are located on footpaths except Viewpoint 16, which is located in proximity to a cycle route. Viewpoint 13 is located on the Moyle Way footpath near the summit of Trostan which is the highest summit in the Glens of Antrim and it has been selected for this reason. It is positioned in the northern half of the AONB and is a remote location not easily accessible due to a lack of a clear path and difficult ground conditions. However, from this location there are extensive uninterrupted views across the entire southern half of the AONB and wider Study Area. Views into the northern section of the AONB are more restricted by the actual summit of Trostan (the Moyle Way does not cross the summit) and other uplands within the Moyle Moorlands and Forests LCA which screen all views towards the north eastern coastal landscape. Views in this direction are strongly characterised by large swathes of forestry in Slieveannorra Forest. The cluster of existing wind farms at Gruig and Corkey are clearly visible at close range to the south west and in the wider landscape there are distant views to existing wind farms on Long Mountain Ridge, Elliott's Hill, Carn Hill and Corby Knowe near Antrim but likely only in very clear weather conditions and at such a distance that they would generally be undiscernible to the casual observer.

4.192 Viewpoint 14, which forms part of the Dungonnell Way is also accessible by road (Skerry East Road) and may be considered as a scenic driving route. It is located 8.24 km to the north west of the Development and is easily accessible from the A43 which is the main route between Ballymena and Cushendall/ Glenariff. It is also in close proximity to other outdoor amenity attractions in the AONB including Glenariff Forest Park and short walks and scenic drives on Slieveannorra, although no views were found in these areas (either by the ZTV or via initial analysis of PVPs 38, 40 and 42). Viewpoints 13 and 14 are characterised by extensive upland landscapes featuring large swathes of visually detractive coniferous forestry, rush-infested rough grazing, heather moorland and extensive areas of peatbog. There is an absence of rural properties or settlement although the villages of Cargan and Newtown Crommelin and the busy A43 road corridor are in close proximity to Viewpoint 14. There is single turbine located in relatively close proximity to Viewpoint 14 and a number of other wind farms visible at greater distances from both Viewpoints 13 and 14. The physical condition of the foreground landscape at Viewpoint 14 is particularly degraded.

4.193 Viewpoint 15 is located on the summit of Slemish, which is a distinctive volcanic plug located 7.86 km to the south of the Development. It is positioned on the north-west facing edge of the Larne basalt Moorland overlooking the Central Ballymena Glens LCA. It has been selected because it offers 360-degree views across the central and western side of the AONB in the context of its setting which is the pastoral landscape around Ballymena and Broughshane. Slemish is a visitor attraction, cultural heritage site and prominent physical landmark visible from many parts of Northern Ireland. The Antrim Hills way crosses the summit and then takes a route around the western side of the Larne Basalt uplands to the southern edge of the AONB overlooking the Belfast Hills. Similar views would be obtained from the carpark and visitors centre at the base of Slemish. There are wide range of elements to views from Slemish including a perception of the AONB as a broad expansive sequence of upland areas partially covered by forestry and partially by open moorland which merges into a more pastoral landscape of fields divided by fences, hedgerows and trees which spreads around the base of Slemish and towards the settlements of Ballymena and Broughshane. There is limited perception of the intervening Glens or coastline from this angle of view or distance. Both upland and lowland parts of the landscape appear to be very large in scale due to the extensive nature of views from this location. Existing wind turbines and wind farms are visible in proximity to Ballymena along with other types of built development associated with a large urban settlement. There are also four single turbines present or consented in the lowlands visible in the same direction and within 5 km of the Development.

4.194 Viewpoint 16 is located on the tertiary road network in close proximity to Carnalbanagh village 3.89 km to the south of the Development. It is on an upland are within the Central Ballymena Glens LCA which wraps around the more elevated upland plateau areas of the Garron Plateau to the north and the Larne Basalt Moorlands to the south. There rural properties scattered at relatively low densities across other parts of the view but the angle of view illustrated in Figure 4.26 is largely characterised by extensive rough grazing land, some small shelter belts of trees and a small but prominent mast on a low hill which form the finger of uplands which divide Glencloy from Glenarm. Beyond this the broad profile of the Garron Plateau forms the skyline and Cleggan Forest is prominent on the south western side. The rounded knolls overlooking the coastal landscape are partially visible to the north east but there are only glimpses of more pastoral landscapes to the far right and left-hand sides of the view illustrated in Figure 4.26 in the middle distance and the coast and glens are not very perceptible from this location.

4.195 Viewpoints 17 and 18 are located on the section of the Ulster Way/ International Appalachian Trail which crosses the northern finger of uplands within the Larne Basalt Moorland LCA. These uplands occupy a prominent position in the southern part of the AONB overlooking the south eastern coastline near Ballygalley and Cairncastle. They offer more elevated experiences of the types of views represented by Viewpoint 10 on Feystown Road but are strongly characterised by the extensive upland landscape – largely extensive sheep grazing - of the foreground. The topography here is varied and complex. The simpler pastoral upland slopes that enclose Glenarm form the middle distance and these are framed to the south west by the prominent volcanic plug of Slemish (clearly visible in Viewpoint 17). The broad Garron Plateau forms much of the backdrop to views from these locations and there is little visibility into the northern part of the AONB beyond this. The topography here also appears relatively simple in profile from this distance and individual summits which form this plateau are less distinguishable. The existing wind farms at Elginny Hill and Rathsherry are clearly visible in the distance to the south west and there are a number of single turbines visible across the landscape in the middle distance.

Sensitivity of Visual Receptors: ranging from Medium to High

4.196 Visual receptors in this category will generally be of high sensitivity because they will, with the exception of Viewpoint 16, be located on footpaths and scenic driving routes where their activities are directly associated with appreciation of the landscape. Although there may be some outdoor workers of low sensitivity associated with areas of rough grazing present in proximity to some viewpoints these are likely to occur in very low numbers.

Magnitude of Visual Effect: Negligible at Viewpoints 13 and 14; Medium elsewhere

4.197 In Viewpoints 13 or 14 the Development would be partially visible but not clearly so. The Development would be located 10.30 km from Viewpoint 13 and six of the turbines would only be visible only as blade tips. The upper blades and hubs of the other 8 turbines would protrude above the Garron Plateau and the upper parts of the towers of the four turbines positioned at the higher north eastern end of the development site (T1 – T4) would also be visible. However, all would be viewed against a backdrop of the more distant uplands within the Larne Basalt Moorlands LCA which forms much of the skyline in this direction of view and also in the context of large swathes of forestry in the foreground and middle distance and also in other directions. It is also noted that Viewpoint 13 in particular is not easy to access and so is unlikely to attract large numbers of visual receptors for this reason. The Development would not be similarly visible from roads in proximity to Trostan because they would be located at substantially lower elevations and views would be contained by intervening topography. For these reasons the overall magnitude of visual effect is deemed to be Negligible.

4.198 In Viewpoint 14 the Development would be even less visible with only the hub and upper blades of turbine T2 being easy to discern with the naked eye. The blade tips of a further 5 turbines would protrude above the skyline in a small section of the overall view above the area of forestry in the middle ground. Magnitude of visual effect is deemed to be Negligible.

4.199 From Viewpoint 15 the Development would be visible in its entirety but not prominent. From this angle of view the Development would appear as a single cluster of turbines rather than two distinct groups and its geographical extent would be dwarfed by the 360-degree nature of views available from the summit of Slemish. However, the Development would be located in closer proximity than the majority of other viewpoints in this category at a distance of 7.86 km and would be readily noticeable as a new element without changing the overall nature of views from this location. The magnitude of effect is therefore deemed to be medium.

4.200 The Development would be located 3.89 km from Viewpoint 16. At this distance the partial removal of some of the forestry around Turbines T10 and T8 would be evident and would have a positive visual effect because it would further simplify the appearance of the upland landscape in this part of the view. From this angle of view the southern and northern groups of turbines would appear as one coherent group on a relatively even plane and only the base of T2 would appear on the skyline. The rest of the turbines would appear against a rising backdrop of higher ground and be concentrated in one part of a much wider view. However, due to the relatively close proximity of this Viewpoint to the Development in comparison with other viewpoints in this category the Development would be visually prominent and the.

4.201 The Development would be located 9.37 km and 10.45 km from Viewpoints 17 and 18 respectively. In both cases the Development would be clearly visible in its entirety. However, with the exception of turbines T 1 – T4 at the north eastern end of the Development, the turbines would appear almost completely against a backdrop of rising ground and would not protrude substantially above the skyline. There would also be an expansive landscape in the foreground and middle distance providing substantial visual separation between the Development and these 2 Viewpoints. Existing wind farms and single turbines would appear within the same, albeit wide, field of view as the Development. Therefore the Development would not introduce a completely new visual element to views but would continue the existing pattern of wind energy development within upland parts of the Antrim Plateau. However, the Development would represent a large group of turbines in the central part of the AONB which forms the focus of views from these Viewpoints. Therefore, the overall magnitude of effect is deemed to be medium

Significance of Visual Effect: Not Significant

4.202 There are no significant effects on viewpoints in this category because, although the sensitivity of visual receptors is deemed to be either medium or high, the expansive nature of views obtained from all Viewpoints in this category means that individual features present within these views typically become subordinate to the overall view and are diminished in terms of visual prominence and overall magnitude of effect for this reason.

Category F: Views from the south-western edge of the AONB and wider Study Area

Description of Existing Views

4.203 Category F includes Viewpoints 19 and 20 which are illustrated in Figures 4.29 – 4.30. They have been presented to represent views beyond the AONB boundary and within the wider Study Area which makes up approximately a third of the Study Area as a whole. However, there is a noticeable absence of views in this part of the Study Area and, although a number of PVP locations were initially reviewed very few viable viewpoints could be identified (see Figure 4.3). Key findings of the viewpoint analysis were that firstly, there are not that many locations beyond 10 - 15 km which are likely to experience views of the Development and, secondly that the sequence of plateau to the north, including the higher summits on Garron Plateau provide screening of the Development from the northern part of the AONB and wider Study Area. The two Viewpoints included in this category are therefore not truly representative of typical views from these parts of the Study Area but have been selected because they have some visibility of the Development.

4.204 Viewpoint 19 is located in the rural lowlands between Ballymena and Slemish at the south western edge of the AONB and approximately 7.50 km to the south west of the Development. The foreground landscape is richly vegetated and topography is varied so clear views across the landscape are not typical. The existing wind farms at Elginny Hill and Rathsherry would be more noticeable elements at close range and on a more prominent skyline to the north west of the angle of view illustrated in Figure 4.29.

4.205 Viewpoint 20 is located on Long Mountain Ridge approximately 23.13 km to the west of the Development. It is included for context because it is one of the few locations outside the AONB where views would be obtained but it is only illustrated by a wireline figure because views of the Development from this distance are unlikely to be clearly discernible. It clearly illustrates the pattern of clustering wind farms along the western edge of the AONB and is also located in close proximity to a cluster of wind farms on Long Mountain itself, demonstrating that wind farms are a recurring pattern across the wider Study Area also.

Sensitivity of Visual Receptors: ranging from Medium to Low

4.206 Visual receptors at Viewpoint 19 will include residents of rural properties, road users, outdoor workers and visitors to Slemish which is in proximity to the pastoral landscape around Broughshane. Whilst the wider upland landscape provides some containment of views, visual character tends to be defined by the densely vegetated rural foreground. Visual receptors are therefore deemed to be of medium to low sensitivity. At Viewpoint 20 visual receptors are deemed to be of low sensitivity due to their distance from the Development and the presence of a substantial number of existing wind farms in many parts of the view available from this location.

Magnitude of Visual Effect: Low

4.207 The magnitude of effect on both Viewpoints 19 and 20 is deemed to be low. There would be recurring glimpses of the Development throughout the Study Area in proximity to Viewpoint 19 but very few clear open views. Due to the undulating nature of the foreground topography and the high levels of tree and hedgerow cover the Development would appear to be situated at a much lower elevation and therefore less prominent despite the majority of the turbines being partially visible from this location. From Viewpoint 20 only the upper parts of two blade tips would be visible and these are unlikely to be easily discernible due to distance. Furthermore, the Development would appear in the context of a wide panoramic view incorporating several clusters of existing wind farms.

Significance of Visual Effect: Not Significant

4.208 There would be no significant visual effects on Viewpoints 19 or 20. The sensitivity of visual receptors ranges from medium to low, the prominence of the Development is not substantial and magnitude of effect is, in both instances also deemed to be low.

Table 4.2: Summary of Visual Effects on Viewpoints

Viewpoint		Approx. distance to nearest turbine (km)	Visual Prominence	Sensitivity of key visual receptors	Magnitude of visual effect	Significance of visual effect
Category A: Views in close proximity to the site boundary						
1	Middle section of Slane Road	0.88 km to T10	Prominent	Medium	High	Significant
2	North eastern section of Slane Road	1.28 km to T10	Prominent	High	Medium	Significant

Viewpoint		Approx. distance to nearest turbine (km)	Visual Prominence	Sensitivity of key visual receptors	Magnitude of visual effect	Significance of visual effect
3	Doonan Leap Carpark, A42 Glencloy	1.72 km to T5	Visible	Medium to High	Low	Not Significant
Category B: Views on approaches to coastal settlements						
4	Dickeystown Road, Glenarm	6.02 km to T1	Visible	High to Low	Medium	Not Significant
5	Approach into Carnlough on A42	2.01 km to T10	Prominent	Medium to High	High	Significant
Category C: Views from the coastal settlement of Carnlough						
6	Straidkilly Road, Carnlough	2.87 km to T1	Prominent	High	Medium	Significant
7	Harbour Park, Carnlough	2.83 km to T1	Visible	Medium	Low	Not Significant
8	Lane to Cranny Falls, Carnlough	2.65 km to T1	Visible	High	Low	Not Significant
Category D: Views from the Antrim Glens						
9	Ballyvaddy Road overlooking Glencloy	2.33 km to T1	Prominent	High to Low	High	Significant
10	Ulster Way at Crockandoo, Feystown Road	5.84 km to T10	Visible	High to Low	Medium	Not Significant
11	Glenview Road, Glenarm	6.83 km o T10	Visible	Medium to Low	Medium	Not Significant
12	Munie Road	2.73 km to T10	Prominent	Medium to Low	High	Significant
Category E: Elevated views from the Antrim Plateau						
13	Moyle Way near Trostan summit	10.30 km to T13	Visible	High	Negligible	Not Significant
14	Skerry East Road,	8.24 km to	Visible	High	Negligible	Not

Viewpoint		Approx. distance to nearest turbine (km)	Visual Prominence	Sensitivity of key visual receptors	Magnitude of visual effect	Significance of visual effect
	Dungonnell Way	**T13**				**Significant**
15	**Slemish summit**	**7.86 km to T11**	**Visible**	**High**	**Medium**	**Not Significant**
16	**Carnalbanagh**	**3.89 km to T10**	**Prominent**	**Medium**	**Medium**	**Not Significant**
17	**Ulster Way at Scawt Hill**	**9.37 km to T10**	**Visible**	**High**	**Medium**	**Not Significant**
18	**Ulster Way at Knockdhu**	**10.45 km to T10**	**Visible**	**High**	**Medium**	**Not Significant**
Category F: Views from the south-western edge of the AONB and wider Study Area						
19	**Carnalbanagh Road near Broughshane**	**7.50 km to T11**	**Visible**	**Medium to Low**	**Low**	**Not Significant**
20	**Glenbuck Road, Long Mountain Ridge**	**23.13 km to T13**	**Not Visible**	**Low**	**Low**	**Not Significant**

4.209 Of the 20 Viewpoints which have been selected to represent typical views of the Development within the Study Area only six would experience significant visual effects resulting from the Development. These are Viewpoints 1, 2, 5, 6, 9 and 12 which are all located within 3 km and from where the Development would be both prominent and visible in its entirety or near-entirety. These viewpoints are also all located to the south of the Development and in close proximity to Carnlough. However, it is noted that there are no significant effects from other close range Viewpoints within Carnlough, along other parts of the A42 road corridor or from more elevated viewpoints overlooking Glenarm and Glencloy at higher elevations. From the majority of the Study Area and the majority of the AONB the Development would either have no visibility or no significant visual effects. There is a noticeable absence of visibility from coastal areas aside from Carnlough or from the lower parts of any of the Glens except Glencloy where visibility is also not widespread. Therefore, the effects of the Development on the AONB as a whole are limited.

The Cumulative Baseline and Analysis of Effects

4.210 The Cumulative Baseline refers to all existing, consented and proposed wind farms within the 30 km Study Area. There are a total of 22 wind farms considered to be part of the Cumulative Baseline for this LVIA, of which 16 are existing, 3 are consented and 3 are proposed. There are also 4 existing or consented single turbines located within 5 km of the Development which have also been included in the Cumulative Baseline. Full details of all wind farms included in the Cumulative Baseline are provided in Technical Appendix 4.5 and a summary below. These have has been used in conjunction with the analysis of Cumulative ZTV diagrams and Viewpoints to reach a number of conclusions in relation to cumulative effects.

Table 4.3: Summary of Cumulative Baseline

Wind Farm (see Technical Appendix 4.5 for full details)	No. of turbines	Approx. distance from Development (km between nearest turbines)
Existing Wind Farms, 16no.	Total no. of turbines = 99	
Altaveedan	9	17.18 km to NW of T13
Ballymena Wind Park	2	13.10 km to SW of T11
Carn Hill	6	26.00 km to S of T10
Connaught Road	2	24.45 km to SW of T11
Corby Knowe	3	20.46 km to SW of T11
Corkey	10	14.30 km to NW of T13
Corkey Extension	1	16.32 km to NW of T13
Elginny Hill	10	10.22 km to SW of T11
Elliot’s Hill	10	15.93 km to SW of T11
Garves	5	24.5 km to W of T13
Glenbuck I	1	23.45 km to W of T13
Glenbuck II	4	23.14 km to W of T13
Gruig	10	13.12 km to NW of T13
Long Mountain	12	22.79 km to W of T14
Rathsherry	9	8.41 km to SW of T11
Wolf Bog	5	15.93 km to SW of T11

Consented Wind Farms, 3no.	Total no. of turbines = 13	
Ballykeel	7	12.95 km to SE of T10
Castlegore	4	15.93 km to S of T11
Craigs and Extension	2	23.39 km to W of T11
Proposed Wind Farms, 3no.	Total no. of turbines = 25	
Ballygilbert	14	7.43 km to SE of T10
Carnalbanagh	7	4.08 km to S of T11
Whappstown	4	15.93 km to SW of T11
Existing & Consented Single Turbines within 5 km of the Development, 4no.	Total no. of turbines = 4	
Total no. of turbines in Study Area	137	

Cumulative Landscape Effects

4.211 The majority of the wind farms in the Study Area are located in visually and / or physically distinct clusters around the outer edges of the AONB. They are a recurring and defining feature of the western edge of the AONB, particularly from the pastoral landscape and settlements in the western half of the Study Area and on approaches towards the AONB from southerly and westerly directions. This clustering of wind farms reflects landscapes, ground conditions and wind speeds that are favourable for wind energy development. It also reflects a general principle that is implemented by planning authorities to consolidate and group new and established developments together as a means to achieve sustainable development and mitigate potential adverse cumulative effects on scenic landscapes which can result from a sporadic approach to siting new developments.

4.212 The Development would not be located in close proximity to any existing or consented wind farms and, at present, there are only 4 existing or consented single turbines within 5 km of the Development. However, single turbines are a characteristic feature of the rural landscape in the wider Study Area, particularly around the Larne coast and within the farmland around Ballymena. It is therefore noted that wind turbines are not a new or unusual feature element of landscape character. There are a number of other wind farms located in the western part of the Study Area, most notably a cluster on the Long Mountain Ridge overlooking the A26 road corridor which is a key route between Ballymena and the north Antrim coast. The clusters of wind farms on the edge of the AONB are also a feature of views from this part of the Study Area. A further consented wind farm at Ballykeel would be located within the southern part of the AONB, 12.95 km to the south east of the Development. The positioning of wind farms on upland plateau and edges overlooking more populated rural landscapes is a common and repeated pattern throughout this Study Area and across Northern Ireland.

4.213 Furthermore, the SPG's recommendation for LCA 122 is that the large scale horizontal form of the uplands are well suited to wind energy development and that areas adjacent to Cleggan Forest are of medium sensitivity - the least sensitive part of the LCA, one of the less sensitive LCAs within the AONB and also the lowest level of sensitivity defined by the SPG across Northern Ireland. If more than one wind farm were to be developed in this LCA, the SPG notes that clustering would be beneficial to avoid undermining or fragmenting the open and expansive nature of the plateau.

4.214 The overall magnitude of cumulative effect on landscape character resulting from the Development is deemed to medium magnitude and not significant. It would be immediately apparent on a small part of the Garron Plateau LCA and would have no direct physical effect on adjacent LCAs in conjunction with other wind farms or turbines. Neither would it be significantly visible from adjacent LCAs in conjunction with any existing, consented or proposed wind farms that would cause indirect effects on landscape character of any more than low magnitude.

Cumulative Visual Effects

4.215 Existing wind farms form the majority of the cumulative baseline that is considered in this LVIA. There are 16 existing wind farms in the Study Area and these are described as an integral part of the baseline views in the assessment of Viewpoints starting at paragraph 4.146. There are a further 3 consented wind farms located between approximately 13 km and 23 km from the Development. These are Ballykeel, Castlegore and Craigs /Craigs Extension. Whilst they would, in some instances, appear in different parts of views obtained from representative Viewpoints they would generally not be easily discernible. The Development would have no significant cumulative effects in conjunction with these wind farms or vice versa.

4.216 Two cumulative ZTV diagrams have been produced. The first illustrates the combined effect of other existing and consented wind farms within the Study Area and the incremental effect of the Development on this cumulative baseline (Figure 4.9). The second diagram (Figure 4.10) illustrates the theoretical visibility of proposed wind farms and the incremental effect of the Development on the level of visibility of proposed wind farms across the Study Area. These ZTVs are calculated using theoretical blade tip visibility in order to consider the highest possible levels of visibility and cover a radius of 30 km from the centre of the Development(refer to the LVIA methodology in Technical Appendix 4.2 for further details). Similarly to the baseline ZTVs, which have been prepared to illustrate visibility of the Development as a standalone wind farm, the cumulative ZTVs indicate comparatively low levels of theoretical visibility from land-based parts of the Study Area as opposed to views from open sea.

4.217 Figure 4.9 shows the cumulative ZTV for the Development in conjunction with all existing and consented wind farms in the Cumulative Baseline. It clearly illustrates the conclusion that has already been made in relation to cumulative landscape effects, i.e. that clusters of wind farms are a characteristic feature on westward facing uplands and these are visible in the western part of the Study Area where the Development would tend not to be visible. There are few discernible parts of the Study Area (8.35 %) where the Development would increase overall theoretical visibility and this would reduce further if sea-based visibility is excluded. Existing and consented wind farms are already theoretically visible across 74.75% of the Study Area, and therefore only 25.25 % of the Study Area is without visibility of existing or consented wind farms to some extent, whereas the Development would be visible across a total of only 45.18% of the Study Area.

4.218 The ZTV suggests that the areas of additional theoretical visibility will be located primarily between 5 – 10 km off the coast between Carnlough and Glenarm and further into open sea beyond Cushendun approximately 20 – 30 km from the Development. There would be smaller areas of additional visibility on elevated uplands which face towards the Development within 10 – 12 km and along the A42 road corridor in close proximity to the Development. It is these parts of the Study Area where the majority of representative viewpoints are located and the cumulative effects here form an integral part of the viewpoint analysis described in the preceding section of this LVIA.

4.219 The EIA Regulations do not require account to be taken of proposed wind farms and they are afforded less weight in the assessment of cumulative visual effects. However, it is noted that there are 3 proposed wind farms in the Study Area. Figure 4.10 shows the cumulative ZTV in conjunction with these wind farms. Carnalbanagh is the nearest, located approximately 4.08 km to the south. Ballygilbert would be located approximately 7.43 km to the south east on a more elevated finger of uplands overlooking the coastline above Ballygalley. Carnalbanagh and Ballygilbert would rarely be clearly or simultaneously visible with the Development except from other elevated viewpoints encompassing much wider views of the AONB and Study Area. They would also invariably appear with areas of 'undeveloped' land providing adequate visual separation from the Development. Whappstown is located approximately 15.67 km to the south and would form part of the Elliot's Hill/ Wolf Bog cluster. However, it would rarely be visible in conjunction with the Development and Viewpoints 13 and 20, which are on elevated ground, are the only locations to indicate blade tip visibility with such wide separation distances that it would have no significant cumulative visual effects. When considered alongside these proposed wind farms the Development would increase overall theoretical visibility of proposed wind farms by only 2.29 %. The other proposed wind farms would be theoretically visible across 64.22% of the whole Study Area. The visibility of both the Development and proposed wind farms would reduce significantly sea-based visibility were excluded.

Table 4.4: The Development's Cumulative Zone of Theoretical Visibility

<table>
<tr><th>Cumulative ZTV Diagram (30 km radius, blade tip)</th><th>No. of turbines theoretically visible</th><th colspan="3">% of Study Area with visibility</th></tr>
<tr><td rowspan="4">Existing and Consented Wind Farms
Figure 4.9</td><td>Visibility of existing and consented wind farms where there is no visibility of the Development</td><td>37.92 %</td><td rowspan="2">Total % of 30 km Study Area where existing and consented wind farms are theoretically visible
= 74.75 %</td><td></td></tr>
<tr><td>Visibility of the Development together with other wind farms</td><td>36.83 %</td><td rowspan="2">Total % of 30 km Study Area where the Development is theoretically visible
= 45.18 %</td></tr>
<tr><td>Additional visibility of the Development</td><td>8.35 %</td><td></td></tr>
<tr><td>0 turbines visible</td><td>16.90 %</td><td colspan="2"></td></tr>
<tr><td rowspan="4">Proposed Wind Farms
Figure 4.10</td><td>Visibility of proposed wind farms where there is no visibility of the Development</td><td>21.33 %</td><td rowspan="2">Total % of 30 km Study Area where other proposed wind farms are theoretically visible
= 64.22 %</td><td></td></tr>
<tr><td>Visibility of the Development together with other proposed wind farms</td><td>42.89 %</td><td>Total % of 30 km Study Area where the Development is theoretically visible
= 45.18 %</td></tr>
<tr><td>Additional visibility of the Development</td><td>2.29 %</td><td></td><td></td></tr>
<tr><td>0 turbines visible</td><td>33.49 %</td><td colspan="2"></td></tr>
</table>

4.220 Of the 20 Viewpoints which have been selected to represent typical views of the Development within the Study Area the same six viewpoints that would experience significant visual effects would also experience significant cumulative effect resulting from the Development. This is because, from these locations there is currently no/ so significant visibility of other existing, consented or proposed wind farms and the Development would therefore result in these views becoming considerably influenced by wind turbines when they previously were not.

4.221 However, it is noted that the other 16 representative viewpoints analysed in this LVIA would experience no significant cumulative visual effects. A number of single turbines have also been included in the cumulative baseline. These would often appear in the same field of view but in distinctly separate parts of the landscape with adequate separation distances between them and the Development. In the majority of instances, across all parts of the Study Area, the Development would not appear within the same field of view as other wind farms in the cumulative baseline and would be viewed as a completely distinct element from other wind farms. Any other wind farms that are visible from the same viewpoints are located at some distance around the southern and western edges of the AONB where the viewer must look to other parts of the views. The only instances where the Development would appear behind another wind farm would be in Viewpoints 13 and 17 which are elevated upland areas located 10.30 km and 9.37 km to the north and south respectively. From these locations the Development would appear in front or behind the proposed Ballygilbert wind farm. In Viewpoint 13 there would be very limited blade tip visibility of the Development and Viewpoint 17 is located within the Ballygilbert site and the Development would therefore be visible when looking across the wider landscape.

4.222 The proposed Carnalbanagh wind farm would be located in closest proximity to the Development - approximately 4.08 km to the south on a lower lying area of moorland that forms part of LCA 123 Larne Glens. It is likely to be visible either simultaneously or in sequence from a total of 12 representative Viewpoint locations although not always clearly visible. From some elevated Viewpoints would it be clearly visible in a different part of the same view as the Development and in these cases always with an area of 'undeveloped' land in between. Due to its lower lying position it is often the case that only upper parts of some of the turbine blades would be visible and/ or that it would be located in a very different part of the available view whereby the viewer would have to look in different directions to appreciate either Carnalbanagh or the Development.

4.223 The overall magnitude of cumulative visual effects resulting from the Development is deemed to medium magnitude and not significant overall. There are few instances where the Development would be visible in conjunction with other wind farms in the cumulative baseline and where this does occur it is from elevated viewpoints located at a greater distance from the Development where the Development itself is less visually prominent.

Table 4.5: Summary of Cumulative Visual Effects on Viewpoints

Viewpoint		Approx. distance to nearest turbine (km)	Visual Prominence	Sensitivity of key visual receptors	Magnitude of cumulative visual effect	Significance of cumulative visual effect
Category A: Views in close proximity to the site boundary						
1	Middle section of Slane Road	0.88 km to T10	Prominent	Medium	High	Significant
2	North eastern section of Slane Road	1.28 km to T10	Prominent	High	High	Significant
3	Doonan Leap Carpark, A42 Glencloy	1.72 km to T5	Visible	Medium to High	Low	Not Significant
Category B: Views on approaches to coastal settlements						
4	Dickeystown Road, Glenarm	6.02 km to T1	Visible	High to Low	Medium	Not Significant
5	Approach into Carnlough on A42	2.01 km to T10	Prominent	Medium to High	High	Significant
Category C: Views from the coastal settlement of Carnlough						
6	Straidkilly Road, Carnlough	2.87 km to T1	Prominent	High	High	Significant
7	Harbour Park, Carnlough	2.83 km to T1	Visible	Medium	Medium	Not Significant
8	Lane to Cranny Falls, Carnlough	2.65 km to T1	Visible	High	Medium	Not Significant
Category D: Views from the Antrim Glens						
9	Ballyvaddy Road overlooking Glencloy	2.33 km to T1	Prominent	High to Low	High	Significant
10	Ulster Way at Crockandoo, Feystown Road	5.84 km to T10	Visible	High to Low	Medium	Not Significant

Viewpoint		Approx. distance to nearest turbine (km)	Visual Prominence	Sensitivity of key visual receptors	Magnitude of cumulative visual effect	Significance of cumulative visual effect
11	Glenview Road, Glenarm	6.83 km o T10	Visible	Medium to Low	Medium	Not Significant
12	Munie Road	2.73 km to T10	Prominent	Medium to Low	Medium	Not Significant
Category E: Elevated views from the Antrim Plateau						
13	Moyle Way near Trostan summit	10.30 km to T13	Visible	High	Low	Not Significant
14	Skerry East Road, Dungonnell Way	8.24 km to T13	Visible	High	Negligible	Not Significant
15	Slemish summit	7.86 km to T11	Visible	High	Medium	Not Significant
16	Carnalbanagh	3.89 km to T10	Prominent	Medium	Medium	Not Significant
17	Ulster way at Scawt Hill	9.37 km to T10	Visible	High	Medium	Not Significant
18	Ulster way at Knockdhu	10.45 km to T10	Visible	High	Medium	Not Significant
Category F: Views from the south-western edge of the AONB and wider Study Area						
19	Carnalbanagh Road near Broughshane	7.50 km to T11	Visible	Medium to Low	Medium	Not Significant
20	Glenbuck Road, Long Mountain Ridge	23.13 km to T13	Not Visible	Low	Low	Not Significant

Information Gaps

4.224 There are no known gaps in the information that has been used in this LVIA. However, the DTM data which has been used to produce the ZTVs, wirelines and photomontages does not appear to reflect the complexity of the topography around the summits of Scawt Hill and Knockdhu. Whilst this has no discernible effect on overall visibility the view height settings have been adjusted to ensure that the wirelines match the baseline photographs used for Viewpoints 17 and 18 as closely as possible.

Future Baseline – The 'No Change' Scenario

4.225 Under the "no change" scenario, were the Development not to be constructed, it is anticipated that the site would be continued to be used in much the same manner as it currently is. However, the existing landscape and visual character of the site and the wider Study Area will continue to be influenced by human activity which is constantly changing the landscape and it is important that the implications of these changes are considered and understood so that the intrinsic qualities of the landscape may be retained and enhanced where possible rather than destroyed or compromised. The key trends are identified in the NILCA, SCA and RLCA and are also implied by the baseline character of the Study Area at present:

- There are existing wind farms within and surrounding the Study Area. Based on the number of consented wind farms in the cumulative baseline it is likely that more wind farms will be developed within the Study Area and across Northern Ireland to meet climate change commitments. Some of these are likely to be intervisible with the Development and they will continue to influence the overall landscape and visual character of the Study Area. The dimensions of wind turbines will continue to increase in order to maximise efficiency and productivity. It is also likely that the current trend of developing cleaner renewable energy sources will continue and become more environmentally acceptable given the predicted effects of climate change and the necessity to tackle these effects;
- Climate change is likely to have the biggest implications on the landscape and its users in the future. Broadly, climate change will be characterised by a general increase in unpredictable weather conditions which will inevitably impact upon all areas of life. River levels are likely to rise and there will be an associated loss of buildings in the flood plain. There will be a loss of habitats associated with the erosion of river banks, lough shores and coastlines which support unique combinations of plants and animals. Migrant species, in particular birds, may also be affected and warmth-loving species will gradually replace those currently adapted to colder climates. Flooding will become more frequent and cause damage to the interiors and structures of buildings which will, in turn affect both the appearance and presence of vernacular buildings which are currently an integral part of the physical landscape character;
- Demographic change is creating the need for a large number of additional dwellings in the countryside which creates pressures on infrastructure. In particular the rural landscape at the edge of existing settlements will continue to experience pressure for built development and ribbon

development along road corridors that link these settlements together. In the open countryside the presence of derelict buildings signifies a loss of traditional built vernacular and a loss of biodiversity and vegetation associated with a decline in the management of rural field boundaries and farmland;

- Continued expansion of the road network is likely to occur alongside built development. Improvements to existing secondary roads are also likely (e.g. straightening, widening and increased signage) will have cumulative negative impacts on local landscape character by eroding local patterns and causing the loss of roadside trees, hedgerows, stonewalls and bridges;
- There is an ongoing trend towards the amalgamation of small farms with the associated loss of traditional buildings and vernacular features, loss of hedgerows and trees to create larger fields. This is having a detrimental impact on the general quality and condition of the rural landscape character. There is also a trend, however, for farmers to diversify into more traditional farming techniques, husbandry of traditional breeds, and the provision of tourist attractions and accommodation. This often has positive landscape impacts. Current forestry grant schemes encourage farmers to plant more broadleaved trees for amenity and wildlife benefits and in the future this should strengthen the character of farmed landscapes. However, converting fields to coniferous plantations or selling it for housing development will continue to be a detrimental force, particularly if wetter weather renders areas of rough grazing land unviable for livestock. The development of renewable energy projects such as wind and solar farms will continue to allow landowners the means to manage and use land for farming in conjunction with energy generation;
- Commercial forestry on a large scale is detrimental to landscape character as it conceals the intricate pattern of the landscape and often occupies visually prominent positions in upland areas. Peat cutting alters the undulating topography and creates abrupt and artificial changes in level. This activity, particularly as it has become mechanised, also destroys natural vegetation and habitats. Where land becomes too wet to farm forestry is likely to become an attractive alternative. This may provide the opportunity to continue the current shift from coniferous plantations to broadleaved forestry which will in turn have a potentially positive impact on landscape character, visual amenity and ecological function;
- Agriculture is one of Northern Ireland's major industries. Pasture is likely to remain the dominant agricultural land-use but warmer temperatures will also enable spring cereal crops to be grown as well as an increase in the use of pesticides. This has the potential to alter the appearance of agricultural parts of the Study Area in the future.

Mitigation and Enhancement Proposals

Mitigation Proposals

4.226 The Development would address two of the key challenges identified by the current AONB Management Plan by assisting in the mitigation of climate change and being an intrinsically sustainable development (see paragraph 4.96). Mitigation proposals in specific response to landscape and visual effects include:

- The exterior surfaces of the turbines will be painted in a recessive, non-reflective light grey colour to minimise their visual prominence against the sky in most weather conditions;
- Ancillary facilities, such as the control building, substation and energy storage compounds, have been designed in a manner that is sensitive to the immediate landscape character with regards to location, scale, colour, and choice of materials. The sub-station and control building and energy storage compound will be located to the south of Turbine T14 which is one of the lower turbines in the layout at 237.44 m AOD. This compound will be positioned on lower lying ground between T14 and Curraghvohil Hill, the latter being likely to screen views of the compound from most parts of the Study Area;
- A new site entrance will be formed off the A42 near the Slane Road – Doonan Leap junction. This will include the partial removal of a small bank of existing trees which will be mitigated by proposals to create a new belt of mixed woodland on the southern side of this embankment, and to extend an existing belt of Scots Pine on the northern side to ensure that the site entrance and access track will steadily become more screened from view as the planting establishes and matures.

Enhancement Proposals

4.227 The AONB Management Plan also suggests that afforestation would be an appropriate response to the challenges posed by climate change within the AONB although the SPG notes that coniferous forestry is generally regarded as being detrimental to landscape character. The relatively low level of broadleaf woodland cover as opposed to coniferous plantations also adversely affects biodiversity within the Garron Plateau Area. Therefore, the proposed removal of some areas of coniferous forestry and the woodland planting proposals noted above would simultaneously contribute to this objective of the Management Plan, enhance biodiversity and address the issues noted by the SPG. During the operational phase of the Development farming practices on the site can continue below the operational turbines which will ensure the long term viability of farming practices that have created the AONB’s special character.

Residual Effects

4.228 Potential landscape and visual effects were addressed through a comprehensive feasibility study and through iterative design development. This resulted in the Development as it is now proposed and therefore potentially significant effects have been avoided prior to the LVIA being carried out as part of the EIA. Beyond this, the proposed mitigation measures will help to minimise the effect of certain aspects of the Development. However, there would be no resulting change in the overall significance of effects. Therefore the residual effects are the same as those already identified.

Overall Significance of Landscape and Visual Effects

4.229 In terms of both landscape and visual effects the Development conforms to the general principles laid out in the policy and best practice guidance which are broadly promotive of renewable energy developments as a means of mitigating against the effects of climate change. The BPG states that, given their importance, is it important for society at large to accept wind farms as a feature of the Region for the foreseeable future and that, whilst some locations may be highly visible, this does not necessarily render them unacceptable. The BPG also notes that groups of turbines can normally appear acceptable as single isolated features in open, undeveloped landscapes and this principle can be applied to the Development's position within its landscape and visual context. The Development also conforms to seven of the 9 landscape and visual character issues that the SPG notes should be considered for wind energy developments within the Antrim Plateau region. Furthermore, its visibility from key parts of the Study Area such as the coast and within glens, and also from locations beyond approximately 10 km is particularly limited.

4.230 The SPPS requires that a cautious approach be taken to siting renewable energy developments in designated landscapes such as AONBs and the supporting policy principles in PPS 2 states that permission will only be granted in AONBs where the Development would be sympathetic to the character of the AONB in general and also of the particular locality. PPS 2 defers to the descriptions of LCAs and AONB Management Plans for further information on these elements.

4.231 The LVIA concludes that the Development is located in conformance with the SPG's guidance for LCA 122 Garron Plateau which is noted as being suitable for wind energy development in theory. The proposed site location is of medium and lesser sensitivity than other parts of LCA 122. This is the lowest level of sensitivity included within the SPG (no LCA in Northern Ireland is deemed by the SPG to be of Low or no sensitivity). Therefore, whilst the Development would have a direct physical effect on the part of the LCA within which it is located, it would be well located and its overall effect on landscape character would be medium and not significant.

4.232 The Development would have a direct and significant physical effect on the part of the Study Area and LCA 122 within which it is located because the magnitude of change would be high and because this part of the LCA would become largely defined by the Development. However, its overall effects on LCA 122 are deemed to be of medium magnitude and not significant. Based on the SPG's description the Garron Plateau is deemed to be of Outstanding Landscape Value by virtue of its location within the AONB. It is in good physical condition the Development would be in close proximity to Cleggan Forest which is noted as being a particularly detractive feature which lessens the sensitivity of the landscape in close proximity to it. The SPG notes that this part of the LCA is the most suitable location for wind energy development. For these reasons the physical landscape character of the Garron Plateau is deemed to be sufficiently robust and capable of absorbing some degree of change without affecting its overall landscape character. The Development would also be located in a manner that would minimise its effects on the key physical components of LCA 122 including the prominence of the east-facing cliffs when viewed from adjacent coastal settlements, the coast road and the seascape. The positioning of the turbines below and to the south-eastern side of taller summits within the LCA would minimise the prominence of the Development in relation to wider views and also views both from and towards the coast and from within Glencloy. Although it would become a prominent vertical feature from some parts of the A42 approach to Carnlough, from many parts of this key route through the AONB there would be more limited visibility of the Development.

4.233 The Development may have indirect effects on the landscape character of some other parts of the Study Area amounting to small areas of four other LCAs and one SCA which are in proximity to it, or which contain viewpoints used in this LVIA. These LCAs are listed in Appendix 4.3 Table 4.3.1 and illustrated in Figure 4.2. The SPG's description of these LCAs is very similar to LCA 122 in many respects including their value and levels of sensitivity to wind energy development. LCAs 117, 118, 123 and 124 are largely within the AONB and form other parts of the Antrim Plateau regional landscape. The majority of these LCAs are also upland plateaus from where there would be visibility of the Development from the sides which face the Development but less so from other parts which are orientated in other directions. In many instances views in the direction of the Development may be screened by taller summits including those within LCA 122 to the north west of the Development. Furthermore, the physical prominence of the Development would be lessened by the availability of very expansive views across the Antrim Plateau and AONB from these upland LCAs.

4.234 LCA 123 Larne Glens includes Glencloy and effects on the setting of this LCA would be experienced from the higher parts of the glen's slopes and in proximity to Carnlough. From elsewhere the Development would have a negligible influence on landscape or visual character. The Development would have similar effects on the landscape around Slemish within LCA 117 Ballymena Glens but negligible effects across the LCA as a whole. Furthermore, other LCAs already accommodate wind farm developments. The west-facing edges of LCA 117 and 118 include clusters of wind farms around Corkey and Elginny Hill/ Rathsherry and the western setting of LCA 124 features another cluster around Elliott's Hill. Whilst the Development would be a new location for a wind farm, there is already a pattern of wind energy development around the edges of the AONB and on other parts of the Antrim Plateau regional landscape. It is also noted that the sites of Elginny Hill and Rathsherry wind farms, which are located in the adjoining LCA 117 Central Ballymena Glens, are specifically identified by the SPG as being particularly highly sensitive but have nevertheless been subject to planning consents.

4.235 In relation to these other LCAs the magnitude of effects resulting from the Development would range from medium to negligible. Sensitivity would range from high to negligible depending on whether the LCAs would be located in relatively close proximity to the Development or at a greater distance and to what extent existing and consented wind farms define the physical landscape character of these LCAs and their settings (see Technical Appendix 4.3 table 4.3.1). However, in no instances are the physical effects on landscape character deemed to be significant.

4.236 The AONB Management Plan defines special characteristics and identifies mechanisms by which changes and developments can take place whilst maintaining the AONB's special character. The special characteristics that are identified in the Management Plan include the area's relative isolation from the rest of the country and its visual links with the Scottish coastline; the distinctive character of each of the nine Glens and the sequence of cliffs, headlands and bays along the coastline which are framed by the Antrim Plateau landscape which is located inland and above these parts of the landscape and overlooking this coastal landscape/ seascape.

4.237 The Development is located towards the south eastern edge of Garron Plateau below the highest parts of the plateau which would effectively prevent views of the turbines from much of the northern half of the AONB. Higher ground to the south of the Development would have a similar effect on visibility from the southern part of the AONB. Whilst the Development would be clearly visible from some close to medium range views, predominantly from other elevated upland parts of the Study Area, it becomes less visible at distances beyond approximately 10 – 15 km where visibility is often restricted to blade tips or entirely absent. There is also a notable absence of views of the Development from the Glens and visibility across the AONB as a whole is also very limited. Visibility from coastal areas is also distinctly absent with the exception of views in proximity to Carnlough. When views from open sea are excluded from the ZTV calculations, theoretical land-based (blade tip) visibility of the Development covers only 17.4% of the Study Area.

4.238 Of the 20 Viewpoints which have been selected to represent typical views of the Development within the Study Area only six would experience significant visual effects resulting from the Development. These are Viewpoints 1, 2, 5, 6, 9 and 12 which are all located within 3 km and from where the Development would be both prominent and visible in its entirety or near-entirety. These viewpoints are also all located to the south of the Development and in close proximity to Carnlough. However, it is noted that there are no significant effects from other close range Viewpoints within Carnlough, along other parts of the A42 road corridor or from more elevated viewpoints overlooking Glenarm and Glencloy at higher elevations. From the majority of the Study Area and the majority of the AONB the Development would either have no visibility or no significant visual effects. There is a noticeable absence of visibility from coastal areas aside from Carnlough or from the lower parts of any of the Glens except Glencloy where visibility is also not widespread. Therefore, the effects of the Development on the AONB as a whole are limited.

4.239 In relation to cumulative effects the overall magnitude of cumulative effects on both landscape and visual character is deemed to medium magnitude and not significant. Whilst the Development would be immediately apparent on a small part of the Garron Plateau LCA it would have no direct physical effects on adjacent LCAs in conjunction with other wind farms or turbines. Neither would it be significantly visible from adjacent LCAs in conjunction with any existing, consented or proposed wind farms that would cause indirect effects on landscape character of any more than low magnitude. There are few instances where the Development would be visible in conjunction with other wind farms in the cumulative baseline and where this does occur it is from elevated viewpoints located at a greater distance from the Development where the Development itself is less visually prominent.

4.240 It is also noted that wind farms are not an uncommon feature in approaches to the AONB and there is already a pattern of wind farms and single turbines in the Study Area. Existing and consented wind farms are generally located along the south western and western edges of the AONB and are closely associated with the lowlands around the A26 road corridor. The closest existing wind farms, Rathsherry/ Elginny Hill, are sometimes visible from the same locations as the Development but rarely in the same field of view and always with approximately 8 - 10 km separation distance. The nearest consented wind farm would be Ballykeel, located approximately 12.95 km to the south east and not clearly discernible from parts of the Study Area with clear views of the Development. The nearest proposed wind farm would be Carnalbanagh, located approximately 4 km to the south west. It would also usually be viewed with an area of 'undeveloped' land in between, and in these instances from elevated viewpoints encompassing wider views of the Study Area and the landscape beyond the AONB. The Development's position on the east-facing edge of the Garron Plateau, on lower ground means that close range views tend to be more restricted in their extent and visibility of the Development from most parts of the AONB is limited.

4.241 Taking into account that no parts of the Study Area are deemed to experience significant landscape or cumulative effects and only six of the 20 viewpoints assessed as part of the LVIA are deemed to experience significant visual effects, the LVIA concludes that the Development is acceptable in landscape and visual terms.

5

Archaeology & Cultural Heritage

5 Archaeology and Cultural Heritage

Introduction

5.1 This chapter of the ES assesses the likely significant effects of the Proposed Development in terms of Archaeology and Cultural Heritage, and incorporates an assessment of baseline conditions and potential effects provided by a Cultural Heritage Baseline Appraisal, which is included in Appendix 5.1. A number of heritage visualisations of the Proposed Development have also been produced to inform the assessment provided in the baseline assessment and in this chapter, and these are provided in Appendix 5.2.

5.2 These vary in scope from buried archaeological remains up to late 20th century industrial structures. Cultural heritage can be broadly divided into the following two categories:

Archaeology

- Scheduled Ancient Monuments (SAMs) (statutory); and
- Archaeological finds and site (non-statutory).

Built Heritage

- Conservation Areas (statutory);
- Listed Buildings (statutory);
- Registered Parks and Gardens
- Non-designated built heritage assets (non-statutory).
- Registered Historic Battlefields, Shipwrecks, World Heritage Sites and Locally Listed Buildings are not considered within this Chapter because there are no such designations within, or adjacent to the Application Site.

5.3 This Chapter describes the methods used to establish baseline conditions currently existing on the Application Site; the methodology used to determine potential effects and the mitigation measures required to prevent, reduce or offset (where possible) any significant adverse effects; and the likely residual effects after these measures have been implemented.

Scope of Assessment

Legislation and Policy Framework

Legislation

5.4 The Historic Monuments and Archaeological Objects (Northern Ireland) Order 1995 protects the fabric of Scheduled Monuments, but does not afford statutory protection to their settings. Relevant policies relating to the protection of the setting of scheduled monuments are contained within national and local development plans and are set out below.

5.5 The Planning (Northern Ireland) Order 1991 sets out provisions relevant to the protection of listed buildings and conservation areas and their setting. The following sections are relevant to the Application Site.

5.6 Section 45 states that:

"In considering whether to grant planning permission for development which affects a listed building or its setting, and in considering whether to grant listed building consent for any works, the Department shall have special regard to the desirability of preserving the building or its setting or any features of special architectural or historic interest which it possesses"

Regional Planning Policy

Planning Policy Statements (PPS)

5.7 In March 1999 the Planning Service (an agency within the Department of the Environment for Northern Ireland) published Planning Policy Statement 6 (PPS 6), 'Planning, Archaeology and the Built Heritage'.

5.8 Planning Policy Statements set out the policies of the DoE on particular aspects of land use planning and apply to the whole of Northern Ireland. Their contents will be taken into account in preparing development plans and are a material consideration in determining individual planning applications and appeals.

5.9 PPS 6 sets out the DoE's planning policies for the protection and conservation of archaeological remains and built heritage.

5.10 Section 3 of PPS 6 relates to archaeological sites and monuments and provides guidance for property owners, developers, their professional advisors and others on the preservation and investigation of archaeological remains.

5.11 The Department's relevant policies on this topic are set out below:

Policy BH1 – The preservation of archaeological remains of regional importance and their settings.

The department will operate a presumption in favour of the physical preservation in situ of archaeological remains of regional importance and their settings. These comprise monuments in state care, scheduled monuments and other important sites and monuments which would merit scheduling. Development which would adversely affect such sites of regional importance or the integrity of their settings will not be permitted unless there are exceptional circumstances.

Policy BH2 – The protection of archaeological remains of local importance and their settings.

Development proposals which would adversely affect archaeological sites or monuments which are of local importance or their settings will only be permitted where the department considers the importance of the proposed *development or other material considerations outweigh the value of the remains in question.*

Policy BH3 – Archaeological Assessment and Evaluation

Where the impact of a development proposal on important archaeological remains is unclear, or the relative importance of such remains is uncertain, the department will normally require developers to provide further information in the form of an archaeological assessment or an archaeological evaluation. Where such information is requested but not made available the department will normally refuse planning permission.

Policy BH4 – Archaeological Mitigation

Where it is decided to grant planning permission for development which will affect sites known to contain archaeological remains, the department will impose conditions to ensure that appropriate measures are taken for the identification and mitigation of the archaeological impacts of the development, including where appropriate the completion of a licensed excavation and recording of remains before development commences.

Policy BH6 - The Protection of Parks, Gardens and Demesnes of Special Historic Interest

The department will not normally permit development which would lead to the loss of, or cause harm to, the character, principal components or setting of parks, gardens and demesnes of special historic interest. Where planning permission is granted this will normally be conditional on the recording of any features of interest which will be lost before development commences.

Policy BH11 - Development Affecting the Setting of a Listed Building

The department will not normally permit development which would adversely affect the setting of a listed building. Development proposals will normally only be considered appropriate where all the following criteria are met:

- *The detailed design respects the listed building in terms of scale, height, massing and alignment;*
- *The works proposed make use of traditional or sympathetic building materials and techniques which respect those found on the building; and*
- *The nature of the use proposed respects the character of the setting of the building.*

5.12 PPS 6 also includes policy statements on Northern Ireland's World Heritage Sites. However, this topic is not relevant to the scope of this particular assessment.

5.13 Planning policy relating to renewable energy is set out in PPS 18: Renewable Energy. The relevant policies are presented below.

5.14 Policy RE 1: Renewable Energy Development states:

Development that generates energy from renewable resources will be permitted provided the proposal, and any associated buildings and infrastructure, will not result in an unacceptable adverse impact on:

[…]

(c) Biodiversity, nature conservation or built heritage interests;

[…]

Where any project is likely to result in unavoidable damage during its installation, operation or decommissioning, the application will need to indicate how this will be minimised and mitigated, including details of any proposed compensatory measures, such as a habitat management plan or the creation of a new habitat. This matter will need to be agreed before planning permission is granted.

The wider environmental, economic and social benefits of all proposals for renewable energy projects are material considerations that will be given significant weight in determining whether planning permission should be granted.

The publication best practice guidance to planning policy statement 18 'renewable energy' will be taken into account in assessing proposals.

Strategic Planning Policy Statement for Northern Ireland (SPPS)

5.15 The SPPS is a statement of the Department's policy on important planning matters that should be addressed across Northern Ireland (SPPS paragraph 1.3). Paragraph 1.5 of the SPPS notes that the provisions within the SPPS apply to the whole of Northern Ireland and must be taken into account in the preparation of Local Development Plans, and are also a material consideration in all planning applications and appeals.

5.16 All local councils in Northern Ireland are in the process of developing new local plans which conform with the SPPS. Once these are all completed and adopted, they, together with the SPPS, will replace the Planning Policy Statements, which will be cancelled (SPPS paragraph 1.9).

5.17 Paragraphs 1.10 to 1.12 of the SPPS set out that until the adoption of the new local plans by the eleven local councils in Northern Ireland, the existing adopted local plans and Planning Policy Statements will continue to apply alongside the SPPS. However, where a policy within an existing local plan or PPS conflicts with that set out in the SPPS, the policy in the SPPS Should be accorded greater weight in the decision making process (SPPS paragraph 1.12).

5.18 SPPS policy in relation to archaeology and built heritage is set out in paragraphs 6.1 to 6.30 of the SPPS. It sets out the aim of the SPPS in relation to archaeology and built heritage in paragraph 6.3:

"The planning system has a key role in the stewardship of our archaeological and built heritage. The aim of the SPPS in relation to Archaeology and Built Heritage is to manage change in positive ways so as to safeguard that which

society regards as significant whilst facilitating development that will contribute to the ongoing preservation, conservation and enhancement of these assets."

5.19 Paragraph 6.4 sets out the regional strategic objectives for archaeology and built heritage as to:

- *secure the protection, conservation and, where possible, the enhancement of our built and archaeological heritage;*
- *promote sustainable development and environmental stewardship with regard to our built and archaeological heritage; and*
- *deliver economic and community benefit through conservation that facilitates productive use of built heritage assets and opportunities for investment, whilst safeguarding their historic or architectural integrity.*

5.20 The SPPS goes on to set out policy in relation to the determination of planning applications in relation to different types of archaeological and built heritage assets in paragraphs 6.6 through 6.25. Key elements of the policies set out in this section are reproduced below for ease of reference:

World Heritage Sites

6.6 Development that would adversely affect the Outstanding Universal Value of a World Heritage Site (WHS) or the integrity of its setting must not be permitted unless there are overriding exceptional circumstances.

Archaeology

6.8 Archaeological remains of regional importance include monuments in State Care, scheduled monuments and Areas of Significant Archaeological Interest (ASAIs). Such sites (or constituent parts of them) benefit from statutory protection. Development which would adversely affect such sites or the integrity of their settings must only be permitted in exceptional circumstances. The scheduling programme is an ongoing process and there are archaeological remains of regional importance yet to be scheduled. In order to make sure that the most up to date information is taken into account when determining applications, this policy approach should also apply to such sites which, whilst not scheduled presently, would otherwise merit such statutory protection.

6.9 Development proposals which would adversely affect archaeological remains of local importance or their settings should only be permitted where the planning authority considers that the need for the proposed development or other material considerations outweigh the value of the remains and/or their settings.

6.10 Planning authorities should seek all necessary information from applicants in making well informed planning judgements, particularly where the impact of a development proposal on archaeological remains is unclear, or the relative significance of such remains is uncertain. Should an applicant fail to *provide a suitable assessment or evaluation on request, the planning authority should adopt a precautionary approach and refuse planning permission.*

6.11 Where a planning authority is minded to grant planning permission for development which will affect sites known or likely to contain archaeological remains, it should ensure that appropriate measures are taken for the identification and mitigation of the archaeological impacts of the development. Where appropriate, this may involve the preservation of remains in situ, or a licensed excavation, recording examination and archiving of the archaeology by way of planning conditions.

Listed Buildings

6.12 Listed Buildings of special architectural or historic interest are key elements of our built heritage and are often important for their intrinsic value and for their contribution to the character and quality of settlements and the countryside. It is important therefore that development proposals impacting upon such buildings and their settings are assessed, paying due regard to these considerations, as well as the rarity of the type of structure and any features of special architectural or historic interest which it possesses.

6.13 Development involving a change of use and / or works of extension / alteration may be permitted, particularly where this will secure the ongoing viability and upkeep of the building. It is important that such development respects the essential character and architectural or historic interest of the building and its setting, and that features of special interest remain intact and unimpaired. Proposals should be based on a clear understanding of the importance of the building/place/heritage asset, and should support the best viable use that is compatible with the fabric, setting and character of the building. Applicants should justify their proposals, and show why alteration or demolition of a listed building is desirable or necessary.

Historic Parks, Gardens and Demesnes

6.16 Planning permission should not be granted for development that would lead to the loss of, or cause harm to, the overall character, principal components or setting of Historic Parks, Gardens and Demesnes.

Conservation Areas

6.18 In managing development within a designated Conservation Area the guiding principle is to afford special regard to the desirability of enhancing its character or appearance where an opportunity to do so exists, or to preserve its character or appearance where an opportunity to enhance does not arise. Accordingly, there will be a general presumption against the grant of planning permission for development or conservation area consent for demolition of unlisted buildings, where proposals would conflict with this principle. This general presumption should only be relaxed in exceptional circumstances where it is considered to be outweighed by other material considerations grounded in the public interest. In the interests of protecting the setting of designated

> *Conservation Areas, new development in proximity needs to be carefully managed so as to ensure it respects its overall character and appearance. Important views in and out of the Conservation Area should be retained.*
>
> *Areas of Townscape Character (ATC)*
>
> *6.21 In managing development within ATCs designated through the LDPs process, the council should only permit new development where this will maintain or enhance the overall character of the area and respect its built form.*
>
> *Non-Designated Heritage Assets*
>
> *6.24 The effect of an application on the significance of a non-designated heritage asset such as an unlisted vernacular building, or historic building of local importance should be taken into account in determining the application. In weighing applications that affect directly or indirectly non-designated heritage assets, a balanced judgement will be required having regard to the scale of any harm or loss and the significance of the heritage asset. Councils may wish to bring forward bespoke local policies for such buildings.*
>
> *Enabling Development*
>
> *6.25 Enabling Development is a development proposal that is contrary to established planning policy and in its own right would not be permitted. Such a proposal may however be allowed where it will secure the long term future of a significant place and will not materially harm its heritage value or setting. Enabling development typically seeks to subsidise the cost of maintenance, major repair, conversion to the optimum viable use of a significant place where this is greater than its value to its owner or market value.*

5.21 The SPPS also provides policy in relation to renewable energy developments in paragraphs 6.214 through 6.234. Paragraph 6.224 makes specific reference to how effects of renewable energy developments to the historic environment should be weighed (emphasis added for clarity):

> *6.224 Development that generates energy from renewable resources will be permitted where the proposal and any associated buildings and infrastructure, will not result in an <u>unacceptable adverse impact</u> on the following planning considerations:*
>
> - *public safety, human health, or residential amenity;*
> - *visual amenity and landscape character;*
> - *biodiversity, nature conservation or <u>built heritage interests</u>;*
> - *local natural resources, such as air quality, water quality or quantity; and,*
> - *public access to the countryside.*

Local Planning Policy

5.22 Local planning policy is provided by the Larne Area Plan 2010, until the adoption of the emerging Local Development Plan to 2030. The 2010 plan contains the following policy relating to archaeology and cultural heritage:

Policy MAN EN1

The department will protect areas of significant archaeological interest from inappropriate development.

The designation of the overall setting in which a number of individual and related monuments are located, or an area of historic landscape, as an Area of Significant Archaeological Interest, is intended to protect the individual sites or monuments and their setting from inappropriate development. An upland area containing a number of prehistoric and later archaeological sites and monuments in the townlands of Dunteige, Ballycoos, Drains Bog, Linford, Loughduff, Sallagh and Ballyhackett and known as Knockdhu, is designated as an Area of Significant Archaeological Interest. (map 1)

Policy MAN EN2

The Department will protect sites and the settings of monuments in state care or which may be taken into state care. Proposals for development in the vicinity of these monuments which would be likely to have an adverse effect on the sites or their settings will not be permitted. Particular attention will be paid to the impact of the proposal on:-

1. *the area of historic landscape in which the site or monument functioned*
2. *critical views of and from the site or monument*
3. *the access and public approaches to the site or monument*
4. *the understanding and enjoyment of the site or monument by visitors.*

Larne Borough has at present two monuments in state care, Olderfleet Castle on Curran Point, Larne, the remains of a tower house and Ballylumford Dolmen, a portal tomb.

Policy MAN EN4

The Department will protect the following historic parks, gardens and demesnes in Larne Borough:-

Garron Point, Glenarm Castle, Carnfunnock, Drumalis, Magheramorne, Red Hall, Kilwaughter.

Country Houses set in landscaped parkland or within demesnes are an important part of the landscape in Larne Borough. The Department has identified a number of these parks, gardens and demesnes which are considered to represent a significant historic and landscape resource.

Other parks, gardens and demesnes retain only some elements of their original form. In the event of development being approved within these, the co-operation of developers in arranging the evaluation and recording of particular *features or landscaped areas may be sought, so that knowledge of this part of our landscape heritage is not lost.*

5.23 Changes in planning policy and updates to development plans are expected to take place over the coming months and years as Planning Policy Statements, supplementary guidance and existing Development Plans become superseded by emerging Local Development Plans, which will be primarily informed by the SPPS. The SPPS sets out transitional arrangements where this is the case to ensure continuity of planning policy and decision making and notes that decisions should be taken in line with the SPPS and relevant PPSs until such time as a plan strategy for the whole council area has been adopted.

5.24 Mid and East Antrim Borough Council published a Draft Plan Strategy for the Local Development Plan (LDP) in September 2019 which set out the Council's strategic intentions for development within the Borough and representations submitted in response to this are currently being considered by the Council. The Draft Strategy, representations and counter representations were forwarded to the DfI for Independent Examination in March 2021 to determine whether or not the Plan satisfies statutory requirements and the outcome of this is awaited. The SPPS notes that decisions should continue to be taken in line with the SPPS and relevant PPSs until such time as a Plan Strategy for the whole Council area has been adopted and the timescale for this is, as yet, unknown. Therefore, for the purpose of this chapter it is considered that the Draft Plan Strategy is at too early a stage to be afforded weight.

Consultation

5.25 Consultations were held with the Northern Ireland Environment Agency in order to agree the scope of the assessment work, and also the key elements of the historic environment that would require consideration. The liaison comprised:

- Email correspondence to agree the area around the Application Site that should be examined for potential indirect impacts; agreed to be 10km.

Assessment Methodology

Scope of Study

For the Assessment of Archaeological Potential

5.26 The archaeological potential of the Application Site will be assessed by reviewing available relevant evidence, both from within the Application Site, and also from the surrounding area, and using this to assess the potential the Application Site has to contain buried archaeological remains. The evidence will be drawn from the following resources, where relevant and available:

- Data from the Historic Environment Record of Northern Ireland (HERoNI);

- The results of previous archaeological investigations (if available and relevant);
- Consultation of the schedule of ancient monuments and lists of listed buildings and other designated heritage assets held by the Historic Environment Division of the Department for Communities of Northern Ireland;
- Local studies and record office research;
- Satellite imagery (if available and relevant);
- A site walk over (where possible and appropriate); and
- Review of historic mapping.

5.27 In addition, information about the topography and geology of the Application Site will also be collated and considered alongside the archaeological evidence. These records and resources will be examined in relation to the Application Site, and a suitable buffer zone (the study area) around the Application Site. This is to ensure that the baseline information used to inform the assessment of potential for the Application Site includes sufficient information with which to understand the context of the evidence discussed. The extent of the study area needed to inform the assessment will depend on the quantity and quality of the evidence available, as well as the size of the Application Site among other factors.

5.28 The standard extent of the study area is usually 1km from the Application Site's boundary. However, this may be varied depending on the nature of the evidence available; for example in some urban settings there may be a high quantity of evidence in the immediate vicinity of the Application Site, meaning that the extent of the study area can be reduced and more focussed on the Application Site and the immediately surrounding area. On this occasion, a 1km search radius from the Application Site boundary is considered appropriate for the study area.

For the Assessment of Setting Impacts

5.29 This assessment will also consider the potential effects of development within the Application Site on the significance of heritage assets, through effects to their settings. This will include any heritage assets within the Application Site, and those in the surrounding area, whose setting may be affected. The heritage assets which require assessment have been selected with reference to the Northern Ireland Sites and Monuments Record and the Northern Ireland Buildings Record, as well as information held by the LPA on conservation areas and heritage assets.

5.30 A basic search radius of 10km from the Application Site boundary was used to establish which heritage assets required assessment for impacts. This is normally sufficient to ensure all assets which require consideration are properly assessed, as beyond this distance the residential development is rarely discernible to the degree that it would affect the heritage value of a view.

5.31 Designated heritage assets of the high significance, comprising listed buildings and registered parks and gardens graded A and B+, scheduled ancient monuments, world heritage sites and conservation areas within the whole 10km search radius are assessed for potential impacts from the proposed development. This is because such assets tend to either be prominent or have heightened sensitivity to change before their significance is affected.

5.32 Other designated heritage assets, such as grade B listed buildings and registered parks and gardens and conservation areas are assessed for impacts within a 5km search radius from the Application Site boundary. This is because assets at this level of designation tend to have a lower sensitivity to change than higher graded assets.

Methodology for assessment of setting

5.33 This assessment will consider the potential effects of development within the Application Site on the significance of heritage assets, through effects to their settings. This will include any heritage assets within the Application Site, and those in the surrounding area, whose setting may be affected.

5.34 Heritage assets and potential impacts will be assessed using best practice, including that set out in the HED's Guidance on Setting and the Historic Environment (2018 HED). This defines setting as:

5.35 *The term 'setting' applies to the physical space that is part of – and contributes to – the significance and distinctive character of a heritage asset, and through which the asset may be seen, experienced, understood and enjoyed.*

5.36 The guidance goes on to set out a three stage process for the assessment of the setting of heritage assets, and of development impacts to the significance of heritage assets through changes to their setting:

- Stage 1: identify the heritage assets that might be affected.
- Stage 2: define the setting by establishing how the surroundings contribute to the significance of the heritage assets in the ways they are understood, appreciated and experienced.
- Stage 3: assess how any change would impact upon that setting.

5.37 As part of stage 1, set out above, the heritage assets which require assessment have been selected with reference to the heritage data for the Application Site and surrounding area provided by the HED and held by the Northern Ireland Environment Agency. A basic search radius of 10km from the Application Site boundary was used to establish which heritage assets required assessment for impacts, which is usually sufficient to ensure all assets which require consideration are properly assessed.

5.38 Not all designated heritage assets within this radius will require full assessment for impacts; where a designated heritage asset has been excluded, a clear justification will be provided, for example if the asset is sufficiently far, and well screened from the Application Site. Also, not all assets will require the same level of assessment; more complex and/or significant assets which may be subject to a higher level of impact will require more detailed consideration than those of less significance, or which are not highly affected by the proposed development.

5.39 The scope of study and assessment of effects will also be informed by a Zone of Theoretical Visibility (ZTV) for the proposed development. The ZTV models the potential visibility of the wind turbines in the wider landscape, taking account of local topography, which may prevent intervisibility in some areas. The proposed development would be a wind farm, which would not produce noise or light pollution, or generate increased traffic, or other effects which could adversely affect these assets in a way unrelated to visibility. Therefore, where heritage assets fall outside the ZTV it is considered that the proposed development would not affect their significance.

Methodology for assessment of archaeological potential

5.40 The available evidence will be reviewed and used to determine what potential the Application Site has to contain buried archaeological remains. Regard must be had to the reliability of the evidence reviewed, any limitations inherent in the methods used to generate that evidence, and to the relevance of the evidence in informing the assessment of archaeological potential of the Application Site. The assessment will consider the available archaeological evidence by historical period.

5.41 It is not necessary to describe all available evidence available for each period exhaustively; the assessment of potential should focus on the evidence which helps to clarify the archaeological potential of the Application Site.

5.42 The historical periods referred to in this assessment are set out below:

Prehistoric period

- Mesolithic 8,000 BC to 4,000 BC
- Neolithic 4,000 BC to 2,500 BC
- Bronze Age 2,500 BC to 500 BC
- Iron Age 500 BC to AD 400

Historic period

- Early Medieval AD 400 to AD 1100
- Medieval AD 1100 to AD 1600
- Post-Medieval AD 1600 to AD 1901
- Modern AD 1901 to present

5.43 The potential for the Application Site to contain buried remains will be categorised as either known, moderate, general, low, limited, no potential or unknown potential, based on the criteria set out below.

- **Known potential**: where a site is known to have archaeological remains, for example from evidence provided by archaeological investigations.
- **Moderate potential**: where the available evidence suggests there is a strong possibility for a site to contain archaeological remains, but it is not conclusive or certain. For example, an adjacent field to that being assessed has been subject to archaeological field investigations and is known to have evidence of occupation remains. But there is no clear evidence in the results of the investigations that these remains continue into the site being assessed.

- **General potential**: where the available evidence suggests that archaeological remains may be present in the Application Site, but the evidence is not clear enough to determine whether the Application Site is likely or unlikely to contain associated buried remains. For example there may be a general potential for archaeology, evidenced by residual finds in nearby investigations and other evidence in the wider area, but no clear evidence close to the Application Site, which would help to determine whether their presence within the Application Site is likely or unlikely.
- **Low potential**: where the available evidence suggests that the presence of archaeological remains within a site is unlikely, but this is not certain or conclusive.
- **No potential**: where a site is known to have no archaeological remains, for example due to past mineral extraction, or when previous archaeological works demonstrate that no remains are present.
- **Unknown potential**: where there is insufficient information to provide any assessment of the archaeological potential of a site.

5.44 The assessments of potential set out above can refer to the potential across the whole of the Application Site, or to only part of it. For example, potential for evidence from a particular period may be focussed in a specific part of the Application Site, or there may be evidence of localised mineral extraction.

Methodology for the assessment of impacts

Significance of heritage assets

5.45 Ultimately the assessment of the significance of archaeological remains and other heritage assets is a matter of professional judgement, having regard to the available evidence, including research priorities, guidance, as well as any designation the asset may have. The assessment will be made with reference to the Historic Environment Division’s Criteria for the Scheduling of Historic Monuments and the Listing of Buildings of Special Architectural or Historic Interest, with associated procedures (DfC 2019a), and research priorities set out in the relevant regional and local archaeological research frameworks, as appropriate.

5.46 The levels of significance used in this assessment are defined in table 1, below.

Table 5.1: Criteria for appraisal of level of importance of heritage assets

Importance / value	Description
Very High	World Heritage Sites
High	Scheduled Monuments and archaeological sites of demonstrable schedulable quality & importance; Protected Wreck Sites Listed buildings graded A and B+ Designated registered parks and gardens Registered Historic Landscapes of high interest

Table 5.1: Criteria for appraisal of level of importance of heritage assets	
Importance / value	Description
	Conservation Areas
Medium	Local Authority designated sites and their settings; Listed buildings graded B; Undesignated sites of demonstrable regional importance
Low	Sites with specific and substantial importance to local interest groups; Sites whose importance is limited by poor preservation and poor survival of contextual associations.
No importance	Sites with no surviving archaeological or historical component.

Assessment of effects

Adverse effects

5.47 Assessments of the degree of adverse effects on the significance of heritage assets are based on the extent to which the proposed development would affect the nature, extent and level of significance of the asset.

5.48 The degree of effect will vary in severity, depending on the extent, nature and level of effect to the significance of the heritage asset. Understanding the degree of effect is important to determine whether a potential effect is acceptable or not, as well as whether mitigation measures should be implemented, and what form them should take.

5.49 In order to inform this process, a spectrum of effects is provided in Table 2, below, along with brief descriptions of the terms used. Where this assessment determines that an adverse effect would result from the implementation of the proposed development, the level of effect will be assigned based on the terms used in table 5.2.

5.50 By nature this process is not quantitative but relies on professional judgement. However, this judgment is informed by accepted, observable facts, such as spatial relationships and designations, the extent of any physical impacts, and the extent of changes to the surroundings of heritage assets.

Table 5.2: Criteria for appraisal of degree of adverse effect on heritage assets	
Level of effect	Description
Major Adverse	Total or substantial loss of the significance of a heritage asset. Harm to a heritage asset through effects to its setting, such that the significance of the asset would be totally lost or substantially reduced (e.g. the significance of a designated heritage asset would be reduced to such a degree that its designation would be questionable; the significance of an undesignated heritage asset

Table 5.2: Criteria for appraisal of degree of adverse effect on heritage assets	
Level of effect	Description
	would be reduced to such a degree that its categorisation as a heritage asset would be questionable).
Moderate Adverse	Moderate harm to a heritage asset, such that the asset's significance would be materially affected/considerably devalued, but not totally or substantially lost.
Minor Adverse	Low level of harm to the significance of a heritage asset. This could include the removal of fabric that forms part of the heritage asset, but that is not integral to its significance (e.g. the demolition of later extensions/additions of little intrinsic value). Some harm to the heritage asset’s setting, but not to the degree that would result in a meaningful devaluation of its significance.
Slight Adverse	A slight effect to the significance of a heritage asset. An example would be limited disturbance of an archaeological asset, but which does not actually damage the archaeological interest of the asset in any way. A limited degree of effect through changes to setting, but the degree of effect would not be readily discernible, or meaningfully affect appreciation.
Negligible	A change to a heritage asset or its setting that involves no loss of significance or any harm.
No Impact	No change to a heritage asset or its setting.

Beneficial effects

5.51 In addition to adverse effects, a development may also have beneficial effects on the significance of a heritage asset. For example, a development may involve the repair and restoration of the fabric of a historic building which is at risk.

5.52 Furthermore, there are often instances where the effects of a development on the significance of a heritage asset are multifaceted, with both adverse and beneficial effects. In these instances it is necessary to come to an overall understanding of the impact of a proposed development, which considers both positive and negative effects. To inform such a judgment, it is not sufficient to understand that an effect is beneficial, it is also necessary to understand the scale of the benefit in order to understand how a harmful effect compares to a beneficial one.

5.53 Therefore, where a beneficial effect to a heritage asset is identified it will categorised as either major, moderate or low, mirroring the degrees of adverse effects set out in table 2, above. Where a benefit is categorised, this will be justified within the assessment. The categorisation of a benefit will follow the broad criteria set out below in table 5.3.

Table 5.3: Scale of heritage benefits	
Level of effect	Description
Major benefit	Benefits that enhance key elements of a heritage asset's significance to a substantive degree. This would include effects

Table 5.3: Scale of heritage benefits	
Level of effect	Description
	such as substantial repairs or restoration of original fabric of a listed building which is at risk, or works that allow a central part of an asset's special interest to be appreciated or understood where this was not previously possible.
Moderate benefit	Benefits that provide a moderate enhancement to important elements of a heritage asset's significance. Examples would be realising the research value of remains of archaeological interest through archaeological investigation, modest repairs and restoration of key parts of the fabric of a heritage asset, and works that better reveal key elements of the significance of a listed building, either by removing unsympathetic extensions or by sympathetically modifying the building's setting.
Minor benefit	Benefits that either provide minor enhancements to important elements of a heritage asset's significance, or which benefit more peripheral elements of the asset's significance. Examples would include removing unsympathetic elements from the setting of a heritage asset which allow for generally enhanced appreciation of the asset's significance, or minor repairs and restoration of a historic building's fabric.
Slight benefit	Benefits that provide a minor benefit to peripheral elements of the asset's significance. Examples would include limited improvements to the setting of a heritage asset which allow for a small enhancement in appreciation of the asset's significance.

5.54 It is important to note that the descriptions and categories above are for guidance, and that assessments of benefits must ultimately be based on professional judgment which is informed by a thorough understanding of the heritage asset's significance, and of the effects of the proposed development.

Zone of Theoretical Visibility

5.55 This assessment has been informed by a model Zone of Theoretical Visibility (ZTV) for the surrounding area. Further details on the ZTV for the proposed development are provided in Volume 3, Section 4, in the Landscape and Visual Impact Assessment. The site visit confirmed that the ZTV model produced for the Application Site represents a “safe” representation of potential intervisibility, with several areas indicated as tentatively intervisible, which in practice were well screened.

Impacts other than visual

5.56 The proposed wind farm would not produce significant noise or light pollution, or generate increased traffic, or other effects which could adversely affect these assets in a way unrelated to visibility. Therefore, where these assets fall outside the ZTV it is considered that the proposed development would not affect their significance.

Photos

5.57 A Landscape and Visual Impact Assessment (LVIA) has also been produced for the Application Site (Ref Vol 2, Chapter 4 LVIA), in conjunction with this assessment. Any viewpoints taken as part of the LVIA used to illustrate effects within this assessment are cross referenced using the same viewpoint numbers as in the LVIA.

5.58 A series of Heritage View Points (HVPs) have also been produced, to provide additional input to the views provided in the LVIA. The HVPs have been agreed with the NIEA during the consultation process and are numbers HVP1 through HVP7 (add ref location). The HVPs are provided under a separate cover due to the size of the file, and should be read in conjunction with this assessment.

Understanding the significance of adverse effects

5.59 The assessment of the overall impact of the proposed wind farm on the significance of heritage assets is evaluated by taking into account both the heritage significance of the heritage asset in question, and the magnitude of the predicted effect on that significance. As is set out in policy in relation to the determination of renewable energy developments with regard to effects to heritage assets (SPPS paragraph 6.224 and PPS 18 policy RE1), it is important to understand whether a development would result in an unacceptable adverse impact on the significance of built heritage interests.

5.60 To understand whether an effect to a heritage asset is unacceptable, it is necessary to understand the degree of effect a development would have on the significance of a heritage asset, as well as of the level of importance of the heritage asset in question. Due to the higher protection provided to heritage assets of higher importance, the significance of an adverse effect to the planning balance will vary depending on the importance of the asset in question (as defined in table 5.1, above), as well as the level of adverse or beneficial effect identified (as defined in tables 5.2 and 5.3).

5.61 Table 5.4 uses these factors to provide a framework for the identification of the significance of effect of an identified effect on the significance of a heritage asset, which would result from the proposed development.

5.62 The categories of significance of effect defined in Table 5.4, below, have been devised with reference to best practice as set out in ICOMOS Guidance on Heritage Impact Assessments for Cultural World Heritage Properties (ICOMOS 2011) as well as the Design Manual for Roads and Bridges volume 11 (Standards for Highways).

5.63 The categories of significance of effect are not meant to be proscriptive, but are rather meant to allow the professional judgement of the assessor to be articulated clearly and consistently across different types of effects to heritage assets of varying nature, quality and significance, allowing for nuance where necessary. In recognition of this, where there are two options within a category of significance of effect, the assessor will provide evidence for one or the other of the options. For example, if an asset of high importance is subject to a moderate degree of adverse effect, the significance of that effect may be Moderate or Large, depending on the nature of the effect and of the asset in question. Ultimately, the most appropriate categorisation of the significance of effect must be chosen, using professional judgement which is informed by a thorough understanding of the significance of the heritage asset and the nature of the effect.

Table 5.4: Criteria for determining the significance of effect

Degree of adverse and of beneficial effects (tables 5.2 and 5.3)	Level of importance (table 1)			
	Very High	High	Medium	Low
Major Adverse	Very Large Adverse	Large Adverse	Moderate/ Large Adverse	Moderate/ Minor Adverse
Moderate Adverse	Large Adverse	Moderate/ Large Adverse	Moderate/ Minor Adverse	Minor Adverse
Minor Adverse	Moderate/ Large Adverse	Moderate/ Minor Adverse	Minor Adverse	Slight Adverse
Slight Adverse	Moderate/ Minor Adverse	Minor Adverse	Slight Adverse	Neutral
Negligible/No impact	Neutral	Neutral	Neutral	Neutral
Slight beneficial	Moderate/ Minor Beneficial	Minor Beneficial	Slight Beneficial	Neutral
Minor beneficial	Moderate/ Large Beneficial	Moderate/ Minor Beneficial	Minor Beneficial	Slight Beneficial
Moderate beneficial	Large Beneficial	Moderate/ Large Beneficial	Moderate/ Minor Beneficial	Minor Beneficial
Major beneficial	Very Large Beneficial	Large Beneficial	Moderate/ Large Beneficial	Moderate/ Minor Beneficial

5.64 Where the significance of effect is assessed as being Moderate or higher, this is considered to be a significant effect as referred to in the Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2017.

Baseline Assessment

Introduction

5.65 This chapter is informed by a Cultural Heritage Baseline Assessment (CHBA), which considered the potential effects the Proposed Development would have on the historic environment. It considered both indirect effects, which would result from changes to the setting of heritage assets in the wider area, as well as potential direct physical impacts on buried archaeological remains. The CHBA is provided as an appendix to this chapter, in Vol 4 Appendix 5.1.

5.66 The assessment of potential indirect effects provided in the CHBA comprised a comprehensive assessment of the potential indirect impacts the proposed development could have on the significance of designated heritage assets in the wider area due to changes to their settings. The baseline assessment comprised a staged assessment process, consisting of a detailed consideration of 163 designated built and archaeological heritage assets in the wider area around the Application Site, followed by the detailed assessment of 47 designated heritage assets, which are provided in Appendix 1 of the CHBA (see Vol 4 Appendix 5.1). This process has found that in most cases, the degree of effect which would result from the proposed development would be no more than slight, and in no instance would the proposed development result in a significance of effect higher than minor adverse. The assessment of indirect effects was informed by a site visit and walkover, visualisations of the proposed development within the LVIA (see Vol 2 Chapter 4), as well as additional visualisations produced to inform the assessment of heritage impacts, which are provided in Appendix 5.2. The LVIA visualisations (Vol 4 Section 4) are referenced by viewpoint (VP) number. Likewise, the visualisations produced for heritage assessment are referenced by heritage viewpoint (HVP) number.

5.67 The assessment of designated heritage assets provided in the CHBA highlighted a number of assets that required more detailed assessment due either to their proximity to the proposed development, their sensitivity, or the complexity of the issues surrounding their assessment which meant that they would benefit from fuller assessment. A total of eight such assets were identified, as follows:

- ANT 029:004 – Doonan Fort scheduled monument
- ANT 029:031 – The Stone House scheduled monument
- ANT 029:092 – Court Tomb scheduled monument
- ANT 029:039 – Wedge Tomb scheduled monument
- HB06/01/020 – Lemnalary House, Grade B+
- HB06/01/055 – House near Ballymena Road, Grade B2
- Carnlough Conservation Area
- AN/121 – Cleggan Lodge Registered Park

5.68 The CHBA recommended that all of these heritage assets should be considered in detail in the EIA. Therefore, these assets are described in detail below, together with the effects the Proposed Development would have on their significance. The potential for indirect effects to the remaining heritage assets in the wider study, which could result from the Proposed Development, was considered in detail in the CHBA. It was concluded that the Proposed Development would have no more than a slight effect on the remaining heritage assets in the wider area, which would not comprise significant environmental effects. As such, it is not necessary to consider these effects in detail within this chapter. However, the CHBA is provided in Vol 4

Appendix 5.1, where detailed assessments of all the remaining heritage assets can be found if needed.

5.69 The CHBA also considered the potential for the Proposed Development to result in direct physical impacts to buried archaeological remains. A summary of the potential for buried archaeological remains within the Application Site is provided below, and the potential effects of the proposed development are also considered below.

Cultural Heritage Baseline

ANT 029:004 – Doonan Fort scheduled monument

5.70 Doonan Fort is located 220m to the east of the Application Site, but the nearest proposed turbine would be located 1.9km to the west. The monument comprises a large, oval mound, 6m in height (see plate 5.1, below).

5.71 The fort is of high significance, as is evidenced by its designation. It has high archaeological interest, and the monument will contain considerable associated artefactual and environmental evidence of high research value. The fort also has both architectural and historic interest.

5.72 The fort is well preserved and highly visible from the immediate vicinity. It is located on the west facing slope of a valley of the Glencloy River, with rising topography to the west and east. The setting of the fort comprises the experience provided by the immediately surrounding area, in particular by views from the farm track immediately to the east, in which the archaeological and architectural interest of the fort can be readily appreciated.

Plate 5.1 Looking S towards Doonan Fort from small lane off of Slane Road

5.73 There is also an information board in a layby off the Carnlough Road (A42) which provides information on the monument. The fort is also a public attraction and an information board is located in a layby on the Carnlough Road, located between the monument and the Application Site (see plate 5.2).

Plate 5.2 Looking S towards information boards and layby adjacent to Slane Road

ANT 029:031 – The Stone House scheduled monument

5.74 The Stone House scheduled monument is a portal tomb located on a gradual south facing slope of Ticloy Hill, with extensive views across the Braid River Valley to southwest. The tomb is located approximately 1.75km to the west of the nearest turbine location.

5.75 The remains of this portal tomb consist of the two side stones, one on the north side and one on the southern side, plus a slightly gabled backstone. This single chamber is roofed by 2 large capstones, of which the western stone appears partly displaced. There is no visible trace of a cairn (see plate 5.3, below).

5.76 The tomb is of high significance and has a high level of archaeological interest, with good preservation, and the monument will contain additional associated artefactual and environmental evidence of high research value. The monument is legible and visible from the immediate vicinity and the public footpath located to the west (see plate 5.3 above). Views of the tomb provide appreciation of the preservation and archaeological interest of the tomb, however the partly displaced stones somewhat obscure the orientation of the tomb from publicly accessible areas. As is noted in the description of the tomb in the HERoNI, the tomb has commanding views to the south-west, across the Braid River Valley, when viewed from the entrance to the tomb.

Plate 5.3 Looking east forwards Stone House portal tomb

ANT 029:092 – Court Tomb scheduled monument

5.77 This court tomb is located approximately 2km to the south of the nearest proposed turbine location. It is situated in a field of heather and rough grazing on northwest facing slope of a hill, with extensive views in an arc from west to east. The tomb consists of a large trapezoidal cairn of boulders aligned ENE/WSW, and is preserved to a maximum height of 2.2m. The cairn measures 70m long by 12.6m wide at the front tapering to approximately 4m in width at the rear. The forecourt is formed by fourteen upright slabs and one toppled slab. The exact length of the gallery or number of chambers could not be discerned due to cairn material. The monument is legible and its orientation is readily appreciated at present. The tomb is of high significance, and will preserve additional archaeological evidence of high research value.

5.78 The tomb is orientated ENE to WSW, and the court opening preceding the burial chamber is at the eastern end. As such the key view of the tomb is looking into the court entrance, towards the burial chambers, looking west of southwest, which is a commanding prospect thanks to the local topography. This view is key to appreciation of the monument's archaeological interest. The immediately surrounding area also provides a good appreciation of the tomb's archaeological interest, although this is not readily discernible from the wider area.

ANT 029:039 – Wedge Tomb scheduled monument

5.79 This wedge tomb is located 2.9km to the south of the nearest proposed turbine location. It is situated in improved grassland on top of an eminence, with good views in all directions. The monument comprises the well-preserved remains of a wedge tomb, however the SE side of the cairn has been removed when the hill was quarried. It comprises twelve upright slabs forming outer walling, which averages 1m in height. Outside the side stones of the gallery is formed by eleven slabs. The entrance to the tomb is at the north-eastern end, facing towards the southwest.

5.80 The tomb is of high significance, and will contain additional associated artefactual and environmental evidence of high research value. The monument is legible from the immediate vicinity, however there is no meaningful experience of the tomb from the wider area, and public access to the monument was not possible during the site visit.

5.81 However, at close quarters the good preservation of the remains is evident as is its orientation, aligned SW-NE, which would have been a key part of experiencing the asset in the past as well as the present (based on information from HERoNI record ANT 029:039). The entrance was located at the north-eastern end of the tomb, and so views towards the southwest are significant, and are aligned with the past experience of the monument.

HB06/01/020 – Lemnalary House, Grade B+

5.82 Lemnalary House is a two-storey five-bay house with attics and basement, located approximately 3.77km to the northeast of the nearest proposed turbine location. The main frontage of the house faces eastwards, towards the Irish Sea. The house has high architectural and historic interest and is of high significance (Table 1)

5.83 The list description notes that the farmhouse is situated on an elevated location with distant views to the sea, to the east. The farmstead is surrounded by rural fields, and ruinous walls are present to the rear, which date to the 17th century construction of the house. The immediate setting provides the best experience of the farmhouses' architectural interest, and the group value it has with the nearby farm building and walls. The wider area provides a more limited experience of the farmhouse's special interest, but provides a rural setting which is sympathetic to its historic function.

HB06/01/055 – House near Ballymena Road, Grade B2

5.84 The listed house near Ballymena Road is located approximately 2.2km to the southeast of the nearest proposed turbine location, close to the Doonan Fort scheduled monument. It consists of a two-storey vernacular farmhouse, of probable pre-1832 construction but which is likely to have assumed its present enlarged two-storey form in the early 1900s (HERoNI HB06/01/055). The house is considered to be of medium significance, as evidenced by its designation at Grade B2.

5.85 Originally various outbuildings were attached to the house, enclosing a small farmyard. Some of these buildings have collapsed while others are in a state of advanced decay. To the immediate north there is a much later dwelling, now abandoned and entirely overgrown. The main façade of the house faces east, towards the Irish Sea, following the local topography. Views of the house from the surrounding area are very limited due to the presence of trees and other buildings. As a result views of the property from the surrounding area are limited (see plate 5.4, below).

Plate 5.4 Looking ESE along track towards listed house near Ballymena Road; listed building is just visible on the right. The Application Site is not visible, and would be in the opposite direction

Carnlough Conservation Area

5.86 The Carnlough Conservation Area includes the historic core of the settlement of Carnlough and is located approximately 2.2km to the northeast of the nearest proposed turbine location. The Carnlough Conservation Area (CA) guide from 1981 highlights the key features which give special character to the village such as the harbour piers, the railway bridge, former Town Hall and the former quarry office, which are all built in local stone. Key buildings noted in the appraisal are the large house at 58 High Street, the Londonderry Arms Hotel on Harbour Road, the Waterfall Bar at the end of High Street, and McAuley's Bar.

5.87 The CA has high architectural interest, and contains a number of historic buildings and structures, which have group value and contribute to the character and special interest of the area. The CA also has high historic interest, and the historic buildings and other structures also preserve physical evidence of key persons and events in local village history.

5.88 During the site visit the key views and approaches within the CA were considered, and are set out below:

- The approach along the Harbour Road, which is flanked by historic buildings, as well as the listed bridge and telephone kiosk.
- The approach along the High Street, which is also flanked by a number of historic buildings, including no 58, and has a grade B2 listed bridge.
- The harbour area and nearby park and listed bridge, which provide elevated views of the historic building frontages along the Harbour Road, and an appreciation of the historic interest and development of the settlement (see plate 5.5, below).

5.89 The wider area provides a limited appreciation of the character and appearance of the area. The surrounding landscape does, however provide a rural context and backdrop to some views within the area, such as the harbour (see plate 5.6, below).

Plate 5.5 Looking SW from listed bridge along the Harbour Road towards listed buildings there; Application Site is located in the distance behind the houses on the right

Plate 5.6 Looking SW from park near harbour towards Application Site

AN/121 – Cleggan Lodge Registered Park

5.90 Cleggan Lodge registered park was first built as a shooting lodge for Shane's Castle. The park dates to before 1777, and has a number of areas of landscaping as well as extensive tree planting. The main house dates to 1830 and is located on a fine site with views of Slemish (HB07/05/006). The park contains a ha-ha, a pond which dates to before 1859, a glen and rockery which date to after 1927, as well as a cultivated productive garden with herbaceous borders and a gate lodge. The scheduled multivallate rath is located in the eastern part of the park (ANT 029:033). As such the park has a moderate architectural and historic interest, and high archaeological interest due to the presence of the scheduled monument. The park is therefore considered to be of high significance.

5.91 Key views within the park are from the main house to the south towards Slemish, and the main elevation of the house is to the south. Views to the south of the house also include the pond and ha-ha, reinforcing the importance of this view. The remainder of the park consists of areas of woodland and informal open space, creating habitats for game, and locations for hunting. The southern fields of the park are enclosed arable fields, and so do not provide a strong appreciation of the historic interest of the park. As a result, appreciation of the park's special interest is limited from within its wider setting.

5.92 The proposed turbines would not be visible from the setting of the lodge in the centre of the park due to the presence of the substantive wood immediately to the east of the lodge, meaning that they would not materially affect the setting or significance of the lodge, or the key views from the lodge to the south towards the pond and ha-ha. The ZTV suggests that a few turbines may be visible in peripheral areas of the park, however much of the parkland is also bounded by areas of woodland, meaning that most views would be filtered even in winter views, and the turbines not discernible. However, some turbines would be visible in more open peripheral parts of the park.

5.93 Therefore the proposed development would not affect the architectural, historic or archaeological interest of the park, nor would it significantly affect the experience provided within the park, or its setting. Views of the proposed development in the distance would be noticeable in some peripheral areas, but not in key parts of the park. Also, any views of the turbines in peripheral parts of the park would not interfere meaningfully with appreciation of the park's heritage interest.

5.94 It is therefore considered that the proposed development would not affect any of the key elements of the significance of the park, and would only have a slight effect on its setting, which would not meaningfully affect appreciation of the tomb's significance or archaeological interest. On this basis the overall assessment of the degree of effect of the proposed development (Table 2) is considered to be **slight adverse**, with a **minor adverse** significance of effect (Table 4), due to the high significance of the park. This is not considered to be a significant effect.

Archaeological Heritage Assets

5.95 The CHBA provided a detailed desk-based assessment of the archaeological potential of the Application Site. The CHBA:

- Assessed the potential for the Application Site to contain buried archaeological remains from each period based on available evidence;
- Assessed impacts the Proposed Development would have on the identified buried archaeological remains;
- Assessed the significance of any identified impacts; and
- Set out any appropriate mitigation measures which could be deployed to reduce the significance of the effect.

5.96 The resources reviewed to inform the assessment of potential comprise the following:

- The Northern Ireland Sites and Monuments Record (NISMR);
- Historic Environment Record of Northern Ireland (HERoNI);
- Historic mapping available from record offices and the Northern Ireland Historic Map Viewer;
- The results of previous archaeological investigations where relevant from the HERoNI and from the online database of Irish Excavation Reports (if available); and
- A site walk over.

5.97 In reviewing the available evidence, the CHBA concluded that the Application Site has a known potential to contain the remnants of agricultural activity from the

Post-Medieval period (recorded under NISMR ANT 025:022). There is also a general potential for the Application Site to contain as yet unknown prehistoric remains. It found that the Application Site has a low potential for the presence of buried remains of archaeological interest from other periods.

5.98 There is no evidence of well-preserved prehistoric remains of high significance within the Application Site, such as a cairn, or tomb. As such it is considered that the remains present and likely to be present within the Application Site are of low interest as defined in Table 5.1, meaning remains which make a meaningful contribution to local research objectives.

Summary of Cultural Heritage Receptors

5.99 A table summarising the cultural heritage resources and their significance is provided below.

Table 5.5: Summary of Identified Receptors and their Significance/Sensitivity

Ref.	NIEA/LPA reference if applicable	Description	Assessment of significance/ sensitivity
SM1	ANT 029:004	Doonan Fort scheduled monument	High
SM2	ANT 029:031	The Stone House scheduled monument	High
SM3	ANT 029:092	Court Tomb scheduled monument	High
SM4	ANT 029:039	Wedge Tomb scheduled monument	High
LB1	HB06/01/020	Lemnalary House, Grade B+	High
LB2	HB06/01/055	House near Ballymena Road, Grade B2	Medium
CA1	HB06/02/084	Carnlough Conservation Area	High
RP1	AN/121	Cleggan Lodge Registered Park	High
A1	ANT 025:022	Recorded non-designated archaeological heritage assets within northern part of the Application Site	Low
A2	-	As yet undiscovered buried archaeological remains within Application Site.	Low

Assessment of Development Effects

Construction Phase Effects

Assessment of Direct Physical Effects to Buried Archaeological Remains

5.100 The proposed development comprises a wind farm, with up to 14 turbines measuring to a maximum of 180m in height, to be placed across the Application

Site, together with a BESS and associated access an infrastructure. These turbines will be set on foundations, and will be accessed using a modest track, which will make use of existing routes where possible. There will also be additional construction phase impacts during the erection of the turbines, to stabilise them, and transport the turbine parts to the Application Site and put them into place, any compound which is constructed. The development would be sparsely distributed throughout the Application Site, with a low below ground impact relative to the area. Full details of the proposed development are provided under a separate cover in ES Volume 2, Chapter 1. There will also be a cable route leading from the turbines to connect them to the grid. The cable route trench would make use of existing road routes (See Vol 2 Appendix 2.1).

5.101 These activities have the potential to result in the localised removal of any archaeological remains which may be present where any impact is planned. The Proposed Development's impacts have been designed to avoid all recorded buried archaeological heritage assets whose location is confirmed, and so would not affect these. The potential Post-Medieval field system recorded within the Application Site (ANT 025:022) could be affected, however the exact extent of this feature is not clear on present evidence.

5.102 Given this and the potential for the presence of as yet undiscovered buried remains of local/low interest within the Application Site (references A1 and A2 in Table 5.5), these impacts could result in a **minor** to a **moderate significance** of effect, depending on the nature of the remains in question, and whether the localised impacts would result in a substantive loss of remains (see Table 5.4).

Indirect Effects

5.103 The construction phase of the Proposed Development would be short lived, taking less than one year, and the effect of this on the setting of heritage assets in the wider area would be temporary. Furthermore, any effects in terms of the prominence and visibility of the turbines would be less than is the case during the operational phase. As such, the indirect construction phase effects of the Proposed Development do not need detailed assessment, and are adequately covered by the assessment of operation phase effects below.

Operational Phase

Assessment of Indirect Effects due to Changes to Setting of Heritage Assets

ANT 029:004 - Doonan Fort scheduled monument

5.104 The proposed turbines would be largely screened and distant from the immediate setting of the fort, and the position of the turbines was amended to be set further back from the setting of the fort during the design stage in order to protect its setting.

5.105 The blade tips of 2 to 5 of the turbines may be visible in the distant backdrop in views from the layby with the information board, however these would be partially screened by intervening vegetation, and would not meaningfully affect appreciation of the fort's significance (see HVP 1).

5.106 The entrance to the proposed development would be located off the Carnlough Road (A42), 265m north of the monument. However, the entrance would also include substantive new planting, in an area which already has a number of trees. As such, this would not materially change the character of the lane. Therefore, the proposed development would not affect any of the key elements of the significance of the monument, and would only have a slight effect on the setting, which would not meaningfully affect appreciation of the fort's significance and archaeological interest. On this basis the overall assessment of the degree of effect of the proposed development (Table 5.2) is considered to be **slight adverse**, with a **minor adverse** significance of effect (Table 5.4), due to the high significance of the monument.

5.107 This is not considered to be a significant effect.

ANT 029:031 – The Stone House scheduled monument

5.108 Two of the proposed turbines would be visible in the distance behind the tomb when seen from the public footpath to the west, and so the proposed development would change the setting of the tomb (see HVP 3). The turbines would not affect the view towards the tomb's entrance, nor affect appreciation of its archaeological and architectural interest. Intervening vegetation in the vicinity would also provide partial screening. Therefore, while the turbines may be noticeable in the wider area, they would not affect how the setting contributes to the significance of the tomb.

5.109 Therefore, the proposed development would not affect any of the key elements of the significance of the tomb, and would only have a slight effect on its setting, which would not meaningfully affect appreciation of the tomb's significance or archaeological interest. On this basis the overall assessment of the degree of effect of the proposed development (Table 5.2) is considered to be **slight adverse**, with a **minor adverse** significance of effect (Table 5.4), due to the high significance of the monument.

5.110 This is not considered to be a significant effect.

ANT 029:092 – Court Tomb scheduled monument

5.111 The proposed wind turbines would be visible in the wider area, and so would change the setting of the tomb. However, the turbines would not interfere with the view toward the entrance of the tomb, which faces away from the Application Site, nor would it affect appreciation of the archaeological and architectural interest provided by its immediate setting. Therefore, while the turbines may be noticeable in the wider area, they would not affect how the setting of the tomb contributes to its significance.

5.112 Therefore, the proposed development would not affect any of the key elements of the significance of the tomb, and would only have a slight effect on its setting, which would not meaningfully affect appreciation of the tomb's significance or archaeological interest. On this basis the overall assessment of the degree of effect of the proposed development (Table 5.2) is considered to be **slight adverse**, with a **minor adverse** significance of effect (Table 5.4), due to the high significance of the monument.

5.113 This is not considered to be a significant effect.

ANT 029:039 – Wedge Tomb scheduled monument

5.114 The proposed wind turbines would be potentially visible in the distance to the north of the monument, and so would change the setting of the tomb. However, the turbines would not interfere with the view along the alignment of the tomb, nor affect appreciation of the archaeological and architectural interest provided by the immediate setting. Also, the proposed turbines would be located at a considerable distance, such that they would not be readily discernible from the setting of the tomb.

5.115 It is therefore considered that the proposed development would not affect any of the key elements of the significance of the tomb, and would only have a slight effect on its setting, which would not meaningfully affect appreciation of the tomb's significance or archaeological interest. On this basis the overall assessment of the degree of effect of the proposed development (Table 5.2) is considered to be **slight adverse**, with a **minor adverse** significance of effect (Table 5.4), due to the high significance of the monument.

5.116 This is not considered to be a significant effect.

HB06/01/020 – Lemnalary House, Grade B+

5.117 The turbines would not affect the key views from the house towards the sea to the east. The upper sweep of a couple of the turbines would be potentially visible in the distance from the immediate setting of the house. However, several buildings and areas of vegetation are present in the intervening landscape, such that they are unlikely to be particularly noticeable. Finally, the proposed development would not affect the appreciation of the house provided by the wider rural setting. Therefore, the proposed development may be noticeable, but would not detract from the contribution the setting makes to the significance of the house.

5.118 It is therefore considered that the proposed development would not affect any of the key elements of the significance of the house, and would only have a slight effect on its setting, which would not meaningfully affect appreciation its significance or heritage interest. On this basis the overall assessment of the degree of effect of the proposed development (Table 5.2) is considered to be **slight adverse**, with a **minor adverse** significance of effect (Table 5.4), due to the high significance of the building.

5.119 This is not considered to be a significant effect.

HB06/01/055 – House near Ballymena Road, Grade B2

5.120 The proposed development would not affect key views from the house towards the Irish Sea to the east. Key views of the house would likewise not be materially affected, as the extent of its setting is limited by intervening vegetation and buildings. The turbines would be visible to the north from some parts of the setting of the house, which could lead to temporary distraction, but would not prevent or interfere with appreciation of the building's special interest.

5.121 It is therefore considered that the proposed development would not affect any of the key elements of the significance of the house, and would only have a small effect on its setting, which would not meaningfully affect appreciation its significance or heritage interest. On this basis the overall assessment of the degree of effect of the proposed development (Table 5.2) is considered to be **minor adverse**, with a **minor adverse** significance of effect (Table 5.4), due to the medium significance of the building.

5.122 This is not considered to be a significant effect.

Carnlough Conservation Area

5.123 The hub of two of the proposed turbines, and the tips two other turbines of the proposed development would be visible in the distance from elevated views in the park near to the harbour (see HVP 2), although views of the tips are so minor that they are unlikely to be discernible in practice. The upper sweep of two turbines could also be visible in the background in elevated views from the bridge over the Harbour Road, and in some more open parts of the Harbour Road. This would not materially affect the experience within the conservation area, nor the ability to appreciate the architectural, historic or archaeological interest of the area, nor its character and appearance, nor the group value of its historic buildings.

5.124 Therefore, while noticeable in the wider area, the proposed development would not meaningfully detract from the contribution the area's setting makes to its significance, nor the integrity of the setting. While the proposed turbines would be noticeable, they would not change the character or appearance of the conservation area, nor affect appreciation of its architectural, historic or archaeological interest, or the group value of its historic buildings. Therefore, while noticeable in the wider area, the proposed development would not meaningfully detract from the contribution the area's setting makes to its significance, nor the integrity of the setting. This effect is considered a slight effect to the setting.

5.125 On this basis the overall assessment of the degree of effect of the proposed development (Table 5.2) is considered to be **slight adverse**, with a **minor adverse** significance of effect (Table 5.4), due to the high significance of the area.

5.126 This is not considered to be a significant effect.

AN/121 – Cleggan Lodge Registered Park

5.127 The proposed turbines would not be visible from the setting of the lodge in the centre of the park due to the presence of the substantive wood immediately to the east of the lodge, meaning that they would not materially affect the setting or significance of the lodge, or the key views from the lodge to the south towards the pond and ha-ha. The ZTV suggests that a few turbines may be visible in peripheral areas of the park, however much of the parkland is also bounded by areas of woodland, meaning that most views would be filtered even in winter views, and the turbines not discernible. However, some turbines would be visible in more open peripheral parts of the park.

5.128 Therefore the proposed development would not affect the architectural, historic or archaeological interest of the park, nor would it significantly affect the experience provided within the park, or its setting. Views of the proposed development in the distance would be noticeable in some peripheral areas, but not in key parts of the park. Also, any views of the turbines in peripheral parts of the park would not interfere meaningfully with appreciation of the park's heritage interest.

5.129 It is therefore considered that the proposed development would not affect any of the key elements of the significance of the park, and would only have a slight effect on its setting, which would not meaningfully affect appreciation of the tomb's significance or archaeological interest. On this basis the overall assessment of the degree of effect of the proposed development (Table 5.2) is considered to be **slight adverse**, with a **minor adverse** significance of effect (Table 5.4), due to the high significance of the park.

5.130 This is not considered to be a significant effect.

Summary of Effects

5.131 The effects of the Proposed Development on the cultural heritage baseline, as assessed above, are summarised in Table 5.8, below.

Table 5.6: Summary of effects of Proposed Development on Cultural Heritage Receptors

Ref.	NIEA/LPA reference if applicable	Description	Level of Importance (Table 5.1)	Degree of Effect (Table 5.2)	Significance of Effect (Table 5.4)
SM1	ANT 029:004	Doonan Fort scheduled monument	High	Slight Adverse	Minor Adverse
SM2	ANT 029:031	The Stone House scheduled monument	High	Slight Adverse	Minor Adverse

Table 5.6: Summary of effects of Proposed Development on Cultural Heritage Receptors					
Ref.	**NIEA/LPA reference if applicable**	**Description**	**Level of Importance (Table 5.1)**	**Degree of Effect (Table 5.2)**	**Significance of Effect (Table 5.4)**
SM3	ANT 029:092	Court Tomb scheduled monument	High	Slight Adverse	Minor Adverse
SM4	ANT 029:039	Wedge Tomb scheduled monument	High	Slight Adverse	Minor Adverse
LB1	HB06/01/020	Lemnalary House, Grade B+	High	Slight Adverse	Minor Adverse
LB2	HB06/01/055	House near Ballymena Road, Grade B2	Medium	Minor Adverse	Minor Adverse
CA1	HB06/02/084	Carnlough Conservation Area	High	Slight Adverse	Minor Adverse
RP1	AN/121	Cleggan Lodge Registered Park	High	Slight Adverse	Minor Adverse
A1	ANT 025:022	Recorded non-designated archaeological heritage assets within northern part of the Application Site	Low	Minor to moderate adverse if present	No effect
A2	-	As yet undiscovered buried archaeological remains within Application Site.	Low	Minor to moderate adverse if present	Minor to Moderate

Design Evolution and Mitigation Measures

Mitigation Responses to Direct Physical Effects

5.132 As has been noted above, the Proposed Development has been designed to avoid all recorded archaeological heritage assets whose location is confirmed, and so no known buried archaeological remains would be impacted by the Proposed Development.

5.133 It is possible that additional, as yet unknown remains may be present within the planned areas of impact, which could be impacted (potential cultural heritage receptors A1 and A2). Depending on the extent of the impact and the nature of the buried remains the significance of this impact has the potential to be minor or moderate adverse (Table 5.4).

5.134 In response, a programme of archaeological works can be implemented ahead of the development to detect and record any remains prior to any impact. The recording of archaeological remains serves to realise the research value of those remains, and enhance understanding and appreciation of the more significant remains in the wider area which would not be affected. While this benefit does not undo or fully outweigh the loss of any remains, it would serve to partially compensate for the loss, and would reduce any residual significance of effect to minor adverse to slight adverse. As such, such a programme of archaeological works would ensure that no significant effects would arise as a result of direct physical effects to buried archaeological remains.

5.135 Such a programme of archaeological works could be secured as a condition to planning consent and implemented ahead of development.

Mitigation Measures in Response to Indirect Effects

5.136 Given the scale of the proposed turbines, there is little scope for additional mitigation beyond the embedded mitigation undertaken by the design process, which sought to minimise the visibility of the turbines as much as possible, while also seeking to ensure the scheme remains viable.

Residual Impacts

5.137 The mitigation measures set out above would serve to reduce the significance of effect which would result from direct physical impacts of the proposed development.

5.138 The residual effects of the Proposed Development are set out in Table 5.7, below.

Table 5.7: Summary of effects of Proposed Development on Cultural Heritage Receptors

Ref.	Level of Importance (Table 5.1)	Degree of Effect (Table 5.2)	Significance of Effect (Table 5.4)	Mitigation measures	Residual Significance of Effect
SM1	High	Slight Adverse	Minor Adverse	None possible	Minor Adverse
SM2	High	Slight Adverse	Minor Adverse	None possible	Minor Adverse
SM3	High	Slight Adverse	Minor Adverse	None possible	Minor Adverse
SM4	High	Slight Adverse	Minor Adverse	None possible	Minor Adverse
LB1	High	Slight Adverse	Minor Adverse	None possible	Minor Adverse
LB2	Medium	Minor Adverse	Minor Adverse	None possible	Minor Adverse

Table 5.7: Summary of effects of Proposed Development on Cultural Heritage Receptors					
Ref.	**Level of Importance (Table 5.1)**	**Degree of Effect (Table 5.2)**	**Significance of Effect (Table 5.4)**	**Mitigation measures**	**Residual Significance of Effect**
CA1	High	Slight Adverse	Minor Adverse	None possible	Minor Adverse
RP1	High	Slight Adverse	Minor Adverse	None possible	Minor Adverse
A1	Low	Minor to moderate adverse if present	Minor to Moderate adverse	Programme of archaeological works	Slight Adverse to Neutral
A2	Low	Minor to moderate adverse if present	Minor to Moderate adverse	Programme of archaeological works	Slight Adverse to Neutral

Cumulative Impacts

Baseline

5.139 This application has collated existing and proposed developments that could result in cumulative effects within a 30km radius from the Application Site. This comprises the Cumulative Baseline. This baseline has been used to assess whether there is potential for cumulative effects to result to the identified cultural heritage receptors as a result of the combined effects of the Proposed Development and one or more developments recorded in the Cumulative Baseline).

Direct Physical Impacts

5.140 There are no proposed developments which would result in any additional physical impacts to the identified or potential buried archaeological remains within the Application Site. As such, the Proposed Development would not result in any cumulative effects to buried archaeological remains.

Indirect Effects

5.141 The Cumulative Baseline was reviewed in relation to the heritage assets in the wider area which would be subject to indirect effects as a result of the Proposed Development, to determine whether any cumulative effects would result. The Heritage Viewpoints provided in Vol 4 Appendix 5.2, provide descriptions of other extant and potential developments together with a visualisation of the Proposed Development, for ease of reference. Potential effects are discussed in relation to each asset below.

ANT 029:004 - Doonan Fort scheduled monument

5.142 No other wind farms were visible from the setting of the fort during the site visit to inform the CHBA. Furthermore, no proposed, or consented schemes are planned to the north or northwest, in the more open views from the monument, which would potentially affect the setting of the fort, or the experience of the information boards located by the roadside.

5.143 As such, the assessment of the effect of the Proposed Development to this heritage asset provided in Table 5.7 would not be affected by cumulative effects.

ANT 029:031 – The Stone House scheduled monument

5.144 The viewpoint provided in HVP3 confirms that a single turbine and the proposed wind farm at Ballygilbert would be visible in views of the monument from the footpath to the east. It may also be possible to see the proposed Carnalbanagh scheme in the wider view to the south. However, in practice, the single turbines, and the scheme at Ballygilbert are so distant that they would not be discernible as to affect the experience of the monument in the view. Likewise, the proposed Carnalbanagh scheme is also distant, and would not affect views of the tomb's entrance, which are to the southwest across the Braid River Valley.

5.145 As such, the presence of these developments in the wider landscape would not change the assessment of the effect of the Proposed Development on the significance of the standing stone which is provided in Table 5.7.

ANT 029:092 – Court Tomb scheduled monument

5.146 The court tomb would be located approximately halfway between the Proposed Development, and the proposed turbine scheme being considered at Carnalbanagh, which would be located approximately 2.5km to the south of the monument. The proposed turbines at Carnalbanagh would not be located along the alignment of the tomb, which is orientated from ENE to WSW, with key views to the west towards the entrance. As such, the scheme at Carnalbanagh would be noticeable in the wider area around the monument, but would not materially affect its significance. As such, it is likely that this would have no more than a slight effect to the setting of the monument, and the two schemes together would not result in more than a slight effect to the setting, as they would not affect how the setting of the tomb contributes to its significance.

5.147 On this basis, it is considered that the assessment of the effect of the Proposed Development to this heritage asset provided in Table 5.7 would not be affected by cumulative effects.

ANT 029:039 – Wedge Tomb scheduled monument

5.148 The wedge tomb would be located between the Proposed Development, and the proposed turbine scheme being considered at Carnalbanagh, which would be located approximately 1.8km to the SSE of the monument. The proposed turbines at Carnalbanagh would not be located along the alignment of the tomb, which is orientated from NE to SW, with key views to the southwest towards the entrance. As such, the scheme at Carnalbanagh would be noticeable in the wider area around the monument, but would not materially affect its significance. As such, it is likely that this would have no more than a slight effect to the setting of the monument, and the two schemes together would not result in more than a slight effect to the setting, as they would not affect how the setting of the tomb contributes to its significance.

5.149 On this basis, it is considered that the assessment of the effect of the Proposed Development to this heritage asset provided in Table 5.7 would not be affected by cumulative effects.

HB06/01/020 – Lemnalary House, Grade B+

5.150 No other wind farms were visible from the setting of the house during the site visit to inform the CHBA. Furthermore, no proposed, or consented schemes are planned in the vicinity of the house, which could affect its setting.

5.151 As such, the assessment of the effect of the Proposed Development to this heritage asset provided in Table 5.7 would not be affected by cumulative effects.

HB06/01/055 – House near Ballymena Road, Grade B2

5.152 No other wind farms were visible from the setting of the house during the site visit to inform the CHBA. Furthermore, no proposed, or consented schemes are planned in the wider area which would affect its setting, as it is located in a secluded location, with key views to the east towards the Irish Sea.

5.153 As such, the assessment of the effect of the Proposed Development to this heritage asset provided in Table 5.7 would not be affected by cumulative effects.

Carnlough Conservation Area

5.154 As can be seen in HVP2, no other proposed, consented or operational schemes would affect the setting of the conservation area. As such, the assessment of the effect of the Proposed Development to this heritage asset provided in Table 5.7 would not be affected by cumulative effects.

AN/121 – Cleggan Lodge Registered Park

5.155 As is noted in the CHBA and above, the key views from the Lodge are towards the south, from the main house, across the parkland the south. There are no proposed, consented or operational schemes close by to the south of the park, that would affect this part of its setting. The Wolf Bog and Elliots Hill wind farms are located more than 13km to the south of the park, however, at that distance they are not discernible and do not materially affect the significance of the park. Additional wind farm schemes are proposed close to these at Castlegore and Whappestown, however, these are also more than 13km to the south and would not materially affect the setting or significance of the park.

5.156 Two applications are also proposed to the northwest of the park, at Rathsherry and Elginny Hill, approximately 5.5km and 6km distant. However, these are screened by an intervening substantial area of woodland. Finally, the Carnalbanagh scheme is located 3.5km to the southeast of the park, and views south from the main house are screened on the eastern side by the presence of a mature tree belt within the park, such that this scheme would not materially affect the experience within the park.

5.157 Given this, the distance between schemes in the wider area and the park, and the fact that they are located away from any key views within the park, it is not considered that they would affect its significance.

5.158 As such, the assessment of the effect of the Proposed Development to this heritage asset provided in Table 5.7 would not be affected by cumulative effects.

Summary and Conclusions

Summary

5.159 This chapter has assessed the potential effects that the Proposed Development would have on the historic environment. It has considered potential direct physical impacts, indirect effects resulting from changes to the setting of heritage assets in the wider area, and the potential cumulative effects due to the presence of other extant or proposed developments.

Potential for Direct Physical Impacts

5.160 The potential for buried archaeological remains to be present within the Application Site was assessed by a review of the available evidence undertaken within the CHBA, which confirmed that the Application Site is unlikely to contain the buried archaeological remains of settlement activity from any period reviewed. However, the Application Site is known to contain Post-Medieval features of Low interest, and also has a general potential to contain additional, prehistoric, archaeological remains (features A1 and A2).

5.161 The Proposed Development has been designed to avoid all recorded archaeological heritage assets whose location is confirmed, and so no known buried archaeological remains would be impacted by the Proposed Development. There is potential for localised impacts to result to as yet unknown buried archaeological remains (A2), which could result in a minor to moderate effect. In response a programme of archaeological works is proposed, which would record any remains prior to construction, and would realise the research value of the remains. With the benefit of such a programme works, the significance of any effects to buried archaeological remains would be at most **slight adverse**.

Potential Indirect Effects due to Changes to the Setting of Heritage Assets

5.162 The assessment provided in this chapter was informed by a comprehensive assessment of the potential indirect impacts the Proposed Development could have on the significance of designated heritage assets in the wider area due to changes to their settings, which was provided by the CHBA provided in Appendix 5.1.

5.163 The assessment of designated heritage assets provided in the CHBA highlighted a number of assets that required more detailed assessment due either to their proximity to the proposed development, their sensitivity, or the complexity of the issues surrounding their assessment which meant that they would benefit from fuller assessment.

5.164 A total of eight such assets were identified, as follows:

- ANT 029:004 – Doonan Fort scheduled monument
- ANT 029:031 – The Stone House scheduled monument
- ANT 029:092 – Court Tomb scheduled monument
- ANT 029:039 – Wedge Tomb scheduled monument
- HB06/01/020 – Lemnalary House, Grade B+
- HB06/01/055 – House near Ballymena Road, Grade B2
- Carnlough Conservation Area
- AN/121 – Cleggan Lodge Registered Park

5.165 The CHBA recommended that all of these heritage assets should be considered in detail in the EIA, and as a consequence these were considered in detail by this chapter. This process has found that in most cases, the degree of effect which would result from the proposed development would be no more than **slight adverse**, and in no instance would the proposed development result in a significance of effect higher than **minor adverse**.

5.166 The potential for indirect effects to the remaining heritage assets in the wider study area, which could result from the Proposed Development, was considered in detail in the CHBA. It was concluded that the Proposed Development would have no more than a **slight adverse** significance of effect on the remaining heritage assets in the wider area, which would not comprise significant environmental effects. As such, it is not necessary to consider these effects in detail within this chapter. However, the CHBA is provided in Appendix 5.1, where detailed assessments of all the remaining heritage assets can be found if needed.

5.167 In all cases, the effects are medium term and reversible, and in no instance would the proposed development directly affect a key aspect of the significance of any of these assets.

Cumulative Effects

5.168 The potential for cumulative effects has been considered for each of the heritage assets assessed by this chapter. The assessment of potential cumulative effects has been made with reference to the cumulative baseline consisting of a consideration of consented and operational schemes within 30km of the application site, together with information provided in the heritage viewpoints and LVIA.

5.169 The potential for cumulative effects was considered in detail, and it was found that the developments within the cumulative baseline are sufficiently far and well screened, that they would not affect the impact assessments within this chapter. As a result, it is concluded that the presence of the developments within the cumulative baseline would not result in a materially higher level of effect to the identified heritage assets than what would result from the Proposed Development on its own.

Conclusion

5.170 In conclusion, the potential effects of the proposed development on the setting of heritage assets have been minimised by the design of the proposed development, and any archaeological impacts could be mitigated by a programme of archaeological works secured via planning condition. It would therefore be possible to implement the proposed development in accordance with the requirements set out in policy RE1 of PPS 18 and paragraph 6.224 of the SPPS.

References

General

The Northern Ireland Sites and Monuments Record (NISMR);

Historic Environment Record of Northern Ireland (HERoNI);

Northern Ireland Historic Map Viewer;

Online database of Irish Excavation Reports (if available); and

Bibliographic

CIfA 2014. Code of Conduct (Chartered Institute for Archaeologists [CIfA] [revised edition] 2014)

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Department for Communities 2018. Guidance on Setting and the Historic Environment

Department for Communities 2019. Register of Parks, Gardens and Demesne of Special Historic Interest in Northern Ireland

ICOMOS 2011. Guidance on Heritage Impact Assessments for Cultural World Heritage Properties

Landgage Heritage Limited 2021. Unshinage Wind Farm, County Antrim, Northern Ireland – Cultural Heritage Baseline Assessment

List of Figures and Appendices

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5.2 Heritage Viewpoints (HVPs)

6

Ecology

Ecology

Introduction

6.1 This chapter constitutes the ecology and nature conservation assessment for the Environmental Impact Assessment of a proposed wind farm at Unshinagh near Carnlough, hereinafter referred to as 'the Development'. The site occupies part of the extensive southern slopes of the Garron Plateau, below a peak called Binnagee which rises to a height of 346 m at (IGR D26583 17070). The initial studies within the site "Blue Line[1]," which encloses an area that is approximately 5.7km in length and is approximately 3.5km in width (at its widest point), identified extensive areas of valued habitat types, as outlined in **Figure 2: JNCC Phase 1 Habitat Map**. This early study described the habitats within an area of approximately 618ha. Further more detailed National Vegetation Classification (NVC) surveys, were primarily located with the planning application boundary (Red Line) which has an area of approximately 208.5ha.

6.2 The present proposal is for the construction of fourteen turbines and associated infrastructure within four sub-clusters, with an access road that will require land take totalling some 18.3ha. This study addresses the potential impacts of the proposal to erect fourteen turbines and associated access tracks and infrastructure on the habitats and species in this reduced study area, as shown in **Figure 6.3: NVC Phase 2 Habitat Map**.

6.3 Blackstaff Ecology Ltd was commissioned by RES UK and Ireland Ltd to undertake an Ecological Impact Assessment (EcIA) for this proposed wind farm. The ecological surveys used to describe the baseline conditions on site and to inform the EcIA were carried out during 2021. Full details can be found in **Chapter 1: Introduction and The Proposed Development**.

6.4 The chapter is supported by:

- Appendix 6.1: Ecology Annexes
    - Habitat Descriptions & Quadrat Data,
    - Static Bat Detector Results/Deployment & BRP Photos
    - Mammal Survey Results
    - Herpetofauna Survey Results
    - (outline) Habitat Management Plan
- Figure 6.1: Designated Sites (within 5km)
- Figure 6.2: JNCC Phase 1 Habitat Map
- Figure 6.3: NVC Phase 2 Habitat Map

[1] The Blue Line used in the chapter refers to the Land Under Applicant Control.

- Figure 6.4: NVC Quadrat Locations
- Figure 6.5: Static (Bat) Detector Locations (Spring & early Summer)
- Figure 6.6: Static (Bat) Detector Locations (late Summer & Autumn)
- Figure 6.7: Non-volant Mammal Survey Results
- Figure 6.8: Common Lizard Survey Results
- Figure 6.9: Smooth Newt Survey Results
- Figure 6.10: Habitat Management Areas
- Figure 6.11: Proposed Ditch Blocking

Statement of Authority

6.5 Initial vegetation surveys and habitat assessments were carried out by Karl Hamilton, with badger, smooth newt and viviparous lizard surveys carried out by Dr Erfan Fadaei and Traci Adams. Quadrat surveys in support of the habitat survey were carried out by Karl Hamilton and Dr Florentine Spaans. Jazmin Creaney, Catriona Porter and Michelle Duggan assisted with the smooth newt surveys and updated badger surveys (once the final infrastructure layout was known). Bat detector deployments and bat data analysis were completed by Philip Leathem, who also produced the figures to accompany the impact assessment. An initial site appraisal was carried out by Cormac Loughran, as well as a number of surveys for bats (thermal camera surveys) and development of the outline Habitat management plan.

6.6 The author of this chapter (and all surveys were planned and designed) by Cormac Loughran, a Chartered Environmentalist (CEnv) and full member of the Chartered Institute of Ecology and Environmental Management (MCIEEM). Cormac has worked professionally as a Consultant Ecologist for over 17 years. He holds an MSc (Distinction) in Environmental Management from the University of Ulster and has extensive experience in a broad range of flora & fauna surveys. He has undertaken and/or coordinated a wide range of ecological surveys and associated impact assessments for over 30 renewable energy projects. Cormac is also an experienced field naturalist and prior to his consultancy work, he worked as a ranger on a number of important nature reserves. As a result, he also has considerable habitat management experience across a broad range of habitats in including broadleaved woodland, wetland, grassland and wet & dry heathland.

6.7 This report has been reviewed Dr Brian Sutton, who was awarded a PhD in Environmental Science by the University of Ulster. Prior to working at Blackstaff Ecology, he worked as a member of the Habitat Survey Team of the Environment and Heritage Service (now NIEA) for 2 years. During this time, he carried out habitat surveys of, principally, designated sites or candidate designated sites across Northern Ireland. In so doing he gained experience of most of the habitat types that are present in the Province. Following this, he worked as a consultant ecologist for AECOM Ltd for 15 years, carrying out habitat and faunal surveys for a wide range of governmental and private clients. Projects undertaken were at a range of scales, from small private developments to major infrastructure projects.

6.8 Karl Hamilton acquired an honours degree in Environmental Biology from the Queen's University of Belfast in 2001 and has since worked on a number of ecological projects including a PhD at the Queen's University of Belfast studying the Feeding Ecology of the Kestrel (2001 – 2003, to be completed); senior reserve warden / biodiversity officer for the Wildfowl & Wetlands Trust (2003 – 2010) where he was tasked with monitoring site flora and fauna (birds, mammals, aquatic and terrestrial invertebrates, botany) as well as managing a wide range of habitats including mesotrophic and calcareous grasslands, freshwater lagoons, fen, saline lagoons, saltmarsh, intertidal mudflats with seagrass beds and woodland. This included sourcing and establishing native plants of local provenance as well as managing and monitoring invasive non-native species.

6.9 Florentine was awarded a PhD in Ecology by Queen's University, Belfast. Prior to working at Blackstaff Ecology, she worked as a Plant Health Inspector in Forest Service for 3 years. During this time, she planned and carried out surveillance of quarantine organisms harmful to plants across Northern Ireland. In so doing she gained experience of conducting vegetation surveys in varied habitats. She also worked as a research assistant at Queen's University, Belfast and has been responsible for fieldwork and sampling for various ecological projects. She has experience doing multiple PEAs and Bat Roost Potential Assessments for a wide range of habitats including both buildings and trees. She has conducted bat activity, emergence and re-entry surveys and assisted with endoscopic surveys for bats at various locations across Northern Ireland.

6.10 Dr Erfan Fadaei has a BSc (Hons) in Zoology from the University of Manchester and a PhD in deer ecology and management from Queen's University Belfast. Erfan has several years' experience conducting a range of faunal surveys and habitat surveys using Phase 1 and NVC methodologies. He currently works as an ecologist with Blackstaff Ecology Ltd and is a qualifying member of CIEEM.

6.11 Traci Adams has a BSc (Hons) in Zoology (1st class) from the University of Manchester and an MSc in Ecological Management and Conservation Biology from Queen's University, Belfast. She has gained experience within the ecology and nature conservation sector over the past 2 years through volunteering both abroad and in the UK with organisations such as WildlifeSense, The National Trust, Belfast Hills and Lagan Valley Regional Park. Her experience within the Ecological Consultancy sector began in May 2019 when she commenced work with Blackstaff Ecology. Traci has conducted numerous bat transects on single turbine and windfarm developments, as well as working on several bat reports for Blackstaff Ecology.

6.12 Jazmin has a BSc in Zoology and has undertaken further courses including Animal Conservation, GIS and Environmental Management. She has a range of experience in conducting field surveys both locally with organisations including BTO, The National Trust and TetraTech, and abroad through her time monitoring elephant behaviour and habitat damage in South Africa. Since joining Blackstaff Ecology in July 2021, Jazmin has gained significant experience in conducting bat emergence and re-entry surveys, utilising bat detectors and thermal imaging equipment. She has also assisted with bat transects and static detector surveys for a large Leisler maternity roost supporting >100 individuals during her time with TetraTech. Jazmin is a qualifying membership of CIEEM.

6.13 Michelle has a BSc (Hons) in Field Biology and wildlife tourism (1st class) from the Institute of Technology Tralee and an MSc in Ecological Management and Conservation Biology from Queen's University, Belfast. She has gained professional and voluntary experience within the ecology and nature conservation sector working with organisations such as, The National Trust, Mourne Heritage Trust, RSPB NI and the Belfast Hills Partnership. Michelle also undertook an environmental internship within Astellas Pharma Co Ltd, Co. Kerry, completing a Preliminary Ecological Appraisal to facilitate future management of a site. Michelle has 6 months experience within the ecological consultancy sector, since joining Blackstaff in May 2021. She has been involved in projects in Northern Ireland and the ROI and has gained experience on both survey techniques and ecological report writing specific to bats. Michelle is also a qualifying member of the Chartered Institute of Ecology and Environmental Management (CIEEM).

6.14 Catriona has an MSc in Animal Behaviour and Welfare (Distinction) from Queen's University, Belfast. She has several years of experience within the nature conservation sector through extensive volunteering including organisations such as UK Overseas Territories Conservation Forum, Ulster Wildlife and the RSPB. Catriona has 8 months experience within the ecological consultancy sector, beginning in April 2021 where she assisted with carcass trials on a windfarm with Allen & Mellon Environmental. Since joining Blackstaff in May 2021 she has been involved in projects in Northern Ireland and the ROI and has gained experience in both survey techniques and ecological report writing specific to bats. Catriona has conducted approximately one dozen bat roost potential (BRP) surveys, thirty emergence / re-entry surveys, two endoscope surveys and seventy-six carcass searches for single wind-turbines (SWTs), plus the associated reports.

6.15 Philip Leathem is a GIS/Ecological Technician who has worked in the environmental sector for the past 7 years. Philip’s role as a technician includes the maintenance, monitoring and deployment of a suite of automated bat detector units (SM2 Bat+, SMZC’s and Anabat Express’) which are used during static (bat) monitoring. In addition to the above role, Philip is also a GIS Technician and has considerable experience in the production of Figures for Environmental Statements. He is also currently working towards a degree in Environmental Science.

Legislation & Planning Policy

International Treaties, Conventions & Directives

Bonn Convention of the Conservation of Migratory Species of Wild Animals (June 1979)

6.16 The Convention requires the protection of the endangered migratory species listed and encourages separate international agreements covering particular species. An agreement covering the conservation of bats in Europe came into force in January 1994. It deals with the need to protect bats and their feeding and roosting areas.

Bern Convention on the Conservation of European Wildlife and Natural Habitats (September 1979)

6.17 The Convention carries obligations to conserve wild plants, birds and other animals, with emphasis on endangered and vulnerable species and their habitats. The provisions of the Convention underlie the EC Habitats Directive as well as the UK's wildlife legislation.

UN Biodiversity Convention (The Rio Convention) (June 1992)

6.18 The Convention provides a framework for international action to protect species and habitats. The UK's overall goal under the Convention is to conserve and enhance biological diversity within the UK and to contribute to the conservation of global biodiversity through all appropriate mechanisms.

Convention on Biological Diversity (93/626/EEC) (CBD)

6.19 The Convention requires contracting parties, in accordance with its conditions and capabilities, to develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programmes. It also requires contracting parties to integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectorial and cross sectorial plans, programmes and policies.

EC Council Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC) (The Habitats Directive)

6.20 Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the EU Habitats Directive) is transposed into law in Northern Ireland by the Conservation (Natural Habitats, etc.) Regulations 1995 (as amended), the Habitats Regulations.

6.21 The Habitats Directive covers habitats and non-avian species of fauna of nature conservation importance and in danger of disappearance, for which the European Commission (EC) has responsibility in view of the proportion of their global range. Habitats are listed and detailed on Annex I of the Directive.

6.22 To conserve these habitats, listed on Annex I of the directive, and species, listed and described on Annex II, a European network of Special Areas of Conservation (SAC) is being established.

6.23 As the Habitats Directive encapsulates a presumption in favour of maintaining Annex I habitats in good conservation status wherever they occur, prior assessment is therefore required to determine whether any areas of habitat within a development site meets the criteria for recognition as Annex I habitat types.

6.24 The Directive also requires appropriate assessment of any plan or project not directly connected with or necessary to the management of a Natura 2000 site, but likely to have significant effects upon a Natura 2000 site, either individually or in combination with other plans or projects.

Annex 1 Habitats

6.25 Blanket Bog (H7130) is listed in Annex 1 of the EU Habitats Directive as a habitat of European interest. Blanket bog occurs as residual, patchy elements of habitat mosaics, or as more extensive areas dominated by *Eriophorum vaginatum* that support little *Sphagnum*. The significant presence of extensive *E. vaginatum*, with patchy and/or localised *Sphagnum* suggests that active peat is at least locally present.

6.26 The main aim of the Habitats Directive is to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats listed in Annex 1 at a favourable conservation status, introducing robust protection for those habitats of European importance.

Domestic Legislation

6.27 The proposed development has been reviewed in relation to local planning policy specific to geology and the water environment. A detailed planning policy and legislation review is included within **Chapter 2: Planning Policy**.

Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended)

6.28 The Regulations give effect to requirements relating to the designation of protected sites under the Birds Directive and Habitats Directive. The Regulations provide for the protection and management of European Sites and place obligations on all competent authorities to have regard to the requirements of the Habitats Directive. The Regulations also provide for the protection of species of European importance.

Environment (Northern Ireland) Order 2002

6.29 The Order provides for the designation, management and protection of Areas of Special Scientific Interest (ASSIs). ASSIs may be designated for important geology and land forms as well as for wildlife and habitats. The legislation repeals Part VI of the Nature Conservation and Amenity (Northern Ireland) Order 1985.

Nature Conservation and Amenity Lands (Northern Ireland) Order 1985 (as amended)

6.30 The Order provides for the establishment of National Nature Reserves (NNRs), Nature Reserves (NRs) and Marine Nature Reserves (MNRs). It also provides for the designation and formulation of proposals for National Parks and Areas of Outstanding Natural Beauty (AONBs).

The Wildlife (Northern Ireland) Order 1985 (as amended)

6.31 The Order prohibits the intentional killing, taking or injuring of certain wild birds or wild animals; or the intentional destruction, uprooting or picking of certain wild plants. It also allows for the establishment of Wildlife Refuges (akin to Nature Reserves) for the special protection of certain species of rare plants or animals.

The Environmental Liability (Prevention and Remediation) Regulations (Northern Ireland) 2009

6.32 The Regulations implement Directive 2004/35/EC and require those carrying out certain activities to prevent, limit and remediate significant environmental damage to protected species, natural habitats, ASSIs, surface water, ground water and land. Operators of activities such as discharges to water sources and water impounding are liable for any significant environmental damage, regardless of whether they intended to cause the damage or were negligent.

Wildlife and Natural Environment Act (Northern Ireland) 2011

6.33 The Act makes provision about biodiversity; amends the Wildlife (Northern Ireland) Order 1985 and Part 4 of the Environment (Northern Ireland) Order 2002; abolishes game licences and game dealers' licences; prohibits hare coursing events and amends the Game Preservation Act (Northern Ireland) 1928.

Planning Policy

Regional Development Strategy (RDS) 2035: Building a Better Future

6.34 The Strategy takes account of European and national policies which would have an influence on the future development of Northern Ireland. The Strategic Planning (Northern Ireland) Order 1999 requires Northern Ireland Departments to have regard to the Regional Development Strategy in exercising any functions in relation to development. There are two types of Strategic Guidance: Regional Guidance (RG) and Spatial Framework Guidance (SFG). RG applies to everywhere in the region and is presented under the three sustainable development themes of Economy, Society and Environment.

6.35 RG 9-RG 12 (Environment) have been adjusted to meet obligations under the Habitats Regulations. Of relevance to the Development is RG 11: Conserve, protect and, where possible, enhance our built heritage and our natural environment. This Strategy Guidance refers to the need to:

'Sustain and enhance biodiversity in line with the objective of the Northern Ireland Biodiversity Strategy to halt the loss of indigenous species and habitats. By protecting existing, or creating new, ecological or wildlife corridors particularly in our cities and towns we can provide valuable help to arrest the decline in biodiversity.'

and

'Identify, establish, protect and manage ecological networks. Ecological networks, including the protection of priority species, are needed to maintain environmental processes and help to conserve and enhance biodiversity. A well-established ecological network, including designated sites, should provide the habitats needed for ecosystems and species populations to survive in an increasingly human dominated landscape. Such networks could also be of amenity value if linked to the green infrastructure provided by walking and cycle routes to heritage and other recreational interest.'

Strategic Planning Policy Statement for Northern Ireland (SPPS)

6.36 In addition to reiterating the statement made in PPS18 (below) the SPPS States:

'Active peatland is of particular importance to Northern Ireland for its biodiversity, water and carbon storage qualities.'

and

'Renewable energy reduces our dependence on imported fossil fuels and brings diversity and security of supply to our energy infrastructure. It also helps Northern Ireland achieve its targets for reducing carbon emissions and reduces environmental damage such as that caused by acid rain.'

Planning Policy Statement 18: Policy RE1

6.37 Policy RE1 States:

'The wider environmental, economic and social benefits of all proposals for renewable energy projects are material considerations that will be given significant weight in determining whether planning permission should be granted'.

'Development that generates energy from renewable resources will be permitted provided the proposal, and any associated buildings and infrastructure, will not result in an unacceptable adverse impact on:

(a) public safety, human health, or residential amenity;

(b) visual amenity and landscape character;

(c) biodiversity, nature conservation or built heritage interests;

(d) local natural resources, such as air quality or water quality; and

(e) public access to the countryside.

Where any project is likely to result in unavoidable damage during its installation, operation or decommissioning, the application will need to *indicate how this will be minimised and mitigated, including details of any proposed compensatory measures, such as a habitat management plan or the creation of a new habitat. This matter will need to be agreed before planning permission is granted.*

Any development on active peatland will not be permitted unless there are imperative reasons of overriding public interest.'

Planning Policy Statement 2 - Policy NH5

6.38 Policy NH 5 - Habitats, Species or Features of Natural Heritage Importance, states:

'Planning permission will only be granted for a development proposal which is not likely to result in the unacceptable adverse impact on, or damage to known:

- priority habitats;
- priority species;
- active peatland;
- ancient and long-established woodland;
- features of earth science conservation importance;
- features of the landscape which are of major importance for wild flora and fauna;
- rare or threatened native species;
- wetlands (includes river corridors); or
- other natural heritage features worthy of protection.

A development proposal which is likely to result in an unacceptable adverse impact on, or damage to, habitats, species or features may only be permitted where the benefits of the proposed development outweigh the value of the habitat, species or feature. In such cases, appropriate mitigation and/or compensatory measures will be required.

PPS 21 Sustainable Development in the Countryside

6.39 PPS 21 aims to:

'Manage development in the countryside in a manner consistent with achieving the strategic objectives of the Regional Development Strategy for Northern Ireland 2025." Objectives include to "Conserve the landscape and natural resources of the rural area and to protect it from excessive, inappropriate or obtrusive development and from the actual or potential effects of pollution," and to "Promote high standards in the design, siting and landscaping of development in the countryside.'

Larne Borough Council, Larne Area Plan 2010

6.40 The proposed development is located within Mid & East Antrim Borough Council (MEABC) boundary. MEABC are currently preparing a new Local Development Plan

(LDP) for the Borough up to 2030. In the interim, the current area plan for MEABC is the Larne Area Plan 2010.

6.41 NV1 contains policy on nature conservation and development. It states;

> *''The Department will not normally permit development which would adversely affect areas of nature conservation importance and will pay due regard to nature conservation issues when considering development proposals which might adversely affect habitats, species or features worthy of conservation.''*

6.42 The Larne Area Plan 2010 highlights the importance of the designation of a hierarchy of sites which are of high nature conservation importance. These include; SAC's, SPA's, Ramsar, ASSI's and NNR's.

Mid & East Antrim Borough Council, Local Development Plan 2030 (Draft)

6.43 The Draft Local Area Plan 2030, although not yet adopted, outlines planning policy pertinent to the natural environment.

6.44 NAT1 sets out policy to protect sites of international importance for nature conservation and biodiversity - European and Ramsar Sites (e'g SAC's and SPA's).

6.45 NAT2 sets out policy to protect both European and National Protected Species (e.g. European protected species are listed under Annex IV of the Habitats Directive (transposed under Schedule 2 of the Habitats Regulations) and must be subject to a system of strict protection. Other national protected species are listed under the Wildlife Order under Schedules (1), (5) & (8)).

6.46 NAT3 sets out policy to protect National Sites of Nature Conservation Importance (e.g ASSI's or National Nature Reserves).

6.47 NAT4 sets out policy to protect Sites of Nature Conservation – Local. These include Local Nature Reserves or Wildlife Refuges. There are currently eight Local Nature Reserves in MEABC

6.48 As the draft Plan is only at consultation stage it holds no material weight in decision making.

Northern Ireland Biodiversity Strategy

6.49 A strategy that has been published by the DoE entitled, Valuing Nature – A Biodiversity Strategy for Northern Ireland to 2020 (01 July 2015) describes 20 targets arising from the 2010 Convention on Biological Diversity (CBD) which was held in Noyoga, Japan during October 2010. A key decision at the Convention was the adoption of a new ten-year strategic plan to guide international and national effort to save biodiversity. The strategic plan, or the Aichi Target, adopted by the meeting is the overarching, internationally agreed, framework on biodiversity. The 20 Aichi Targets form the basis for the Implementation Plan for the NI Biodiversity Strategy. The CBD fully adopted the ecosystem services approach that stresses the need to look at maintaining the functionality of ecosystems as key to protecting biodiversity and delivering benefits for humanity.

Sustainable Development Strategy for Northern Ireland

6.50 The Strategy sets out the Government agenda for ensuring that sustainable practice becomes an integral part of development policy in Northern Ireland. The following six principles of the strategy continue to echo those developed from the previous strategy, and are as follows;

- Living within Environmental Limits;
- Ensuring a Strong, Healthy, Just and Equal Society;
- Achieving a Sustainable Economy;
- Promoting Good Governance;
- Using Sound Science Responsibly;
- Promoting Opportunity and Innovation.

6.51 The strategic objective most relevant to this development is: Ensuring reliable, affordable and sustainable energy provision and reducing our carbon footprint.

UK and Northern Ireland Biodiversity and Habitat Action Plans

6.52 The UK Biodiversity Action Plan (UKBAP) and equivalent Northern Ireland Habitat Action Plan, as well the internal NIEA Guidance Document, have been consulted regarding what constitutes ‘active’ blanket bog.

6.53 The UKBAP indicates that ‘active’ peatlands include the EU Habitats Directive priority habitat 'active' blanket bog, the definition of ‘active’ being given as 'still supporting a significant area of vegetation that is normally peat forming'. The UKBAP indicates that the principal vegetation (NVC) types covered and so defined as Blanket bog are M1, M2, M3, M15, M17, M18, M19, M20 and M25, together with their intermediates.

6.54 The Northern Ireland Habitat Action Plan (NIHAP) provides a similar definition of the habitat type, The NI HAP notes the EC Habitats Directive definition of what constitutes ‘active’ bog, and notes the following in respect of relevant NVC types: -

> *‘Within Northern Ireland, blanket bog encompasses a range of plant communities that are similar to those identified in the National Vegetation Classification (NVC) of Great Britain (Rodwell, 1991). NVC descriptions and codes are given to associations of plants that are characteristic of particular environmental and management conditions. Plant communities that are typical of natural blanket bogs include the bog pool communities M1 to M3, M17 Scirpus cespitosus - Eriophorum vaginatum blanket mire, M18 Erica tetralix - Sphagnum papillosum raised and blanket mire and M19 Calluna vulgaris - Eriophorum vaginatum. A number of additional NVC communities are characteristic of the extensive areas of blanket bog which have been subject to some disturbance such as drainage or peat-cutting. These include M15 Scirpus cespitosus - Erica tetralix wet heath, M20 Eriophorum vaginatum blanket and raised mire, M25 Molinia caerulea - Potentilla erecta mire, together with their intermediates. Other wetland plant communities, such*

as flush M10 Carex dioica - Pinguicula vulgaris mire and poor-fen M6 Carex echinata-Sphagnum recurvum/auriculatum mire, are often closely associated with blanket bog. For the purposes of this plan, these are treated as an integral part of the blanket bog habitat.'

6.55 The UKBAP, NIHAP and European Commission (2007) Interpretation Manual of European Union Habitats has been utilised in the current report to determine whether peatlands are 'active' and hence require consideration in policy and impact assessment terms.

Guidance on Species/Habitats of Conservation Concern

Red Data Book

6.56 Vascular plant species that are rare and/or threatened on an all-Ireland or European scale have been identified as Red Data Book (RDB) species (Curtis & McGough, 1988).

Northern Ireland Species of Conservation Concern

6.57 NIEA has produced a list of Northern Ireland Priority Species (NIPS) and Species of Conservation Concern (SOCC), which includes Biodiversity Action Plan species, not all of which are Red Data Book species. Rarity is also a criterion for inclusion in the list. NIEA is also in the process of identifying vascular plant species that are of conservation concern as the NI response to the adoption by the UK of the Global Strategy for Plant Conservation (Palmer, 1994). The proposed list will be comprehensive and include species that are near-threatened as well as those protected by the Wildlife Order or listed as NIPS and SOCC. This process of evaluation of the current list of species of conservation concern is on-going.

Local Biodiversity Action Plans (LBAPs)

6.58 Local Authorities have been able to employ Biodiversity Officers, with financial aid from NIEA, since 2004. Their duties include raising awareness of biodiversity issues within local areas, and the development of LBAPs as a means of conserving and enhancing biodiversity at a local scale.

NIEA Internal Guidance Note on Active Peatland

6.59 The Northern Ireland Environment Agency (NIEA) provides internal guidance to their personnel indicating the site conditions, and which NVC types, may indicate that blanket bog is 'active'. In terms of NVC communities, the Guidance states: -

'The list below indicates the NVC classifications that could be active. In these habitats, the full details of quadrats surveyed will be needed to aid identification of active peatland. They should be provided within the environmental statement (ES).

NVC classifications which are likely to be found in active peatland:

- M1 *Sphagnum auriculatum* bog pool community

- M2 *Sphagnum cuspidatum/recurvum* bog pool communities
- M3 *Eriophorum angustifolium* bog pool community
- M17 *Scirpus cespitosus - Eriophorum vaginatum* blanket bog
- M18 *Erica tetralix- Sphagnum papillosum* raised and blanket mire
- M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire
- M20 *Eriophorum vaginatum* blanket mire
- M25 *Molinia caerulea-Potentilla erecta* mire'

6.60 Other criteria from the Guidance, including site-specific characteristics which could indicate the presence of 'active' peat include:

- Sphagnum is present
- If the surface is spongy underfoot
- Deep peat is present (>0.5m)
- Intact peat is present or the hydrology is still intact
- *E. vaginatum/angustifolium* is present in significant quantities with some *Sphagnum*
- The typical range of blanket bog and raised bog species is present as indicated within the interpretation manual
- There is a hummock and pool topography

6.61 Consideration of this Guidance is essential in the design and layout of wind energy projects to ensure compliance with Planning Policy.

Scope of Assessment

Ecological Impact Assessment

6.62 The assessment is based mainly on a study area within the scheme Red Line boundary surrounding the proposed Development and associated infrastructure. This study area is considerably smaller than the area enclosed by the LUAC (Blue Line). The entire area within the Red Line was surveyed to establish the main habitat types present, and the results are presented as **Figure 6.2:** JNCC Phase 1 Habitat Map. The reduced survey area described in the present report takes into account the results of this earlier survey and avoids considerable areas of habitats of conservation value identified at that time. Surveys for bats were extended to 200m outside the Planning Application Boundary, as required by NIEA guidance. Sites designated for their nature conservation features within a radius of 10km of the site boundary (**Figure 6.1**) were also considered to assess potential remote effects on valuable ecological site-based receptors.

6.63 The aim of EcIA is therefore to describe and assess potential significant effects upon ecological receptors within the application site and zone of ecological influence within the wider environment, as applicable. This is achieved by informed decision-making in accordance with published methodologies and after collecting a range of primary survey data across the site of the proposed development. Identification and evaluation of likely significance of effects associated with the Development during construction, operation and decommissioning phases permit recommendation of appropriate mitigation measures to avoid and/or reduce the predicted adverse effects of the proposed development on the recorded ecological receptors identified as part of the baseline survey.

6.64 The baseline survey, characterisation of the environment and the likely significance of effects of the Development on ornithology, fisheries (aquatic ecology) and the water environment are reported upon in **Chapter 7: Ornithology**, **Chapter 8: Fisheries** and **Chapter 9: Geology & Water Environment**.

Consultation

6.65 Consultation was undertaken with the statutory and non-statutory organisations listed below regarding the proposed scope of the EcIA; the location of any statutory and non-statutory designated nature conservation sites that have the potential to be impacted by the Development; identification of potential ecological receptors; the existence of any ecological records within 2km of the Preliminary Site Boundary.

- Centre for Environmental Data & Recording (CEDaR);
- DAERA Natural Environment map viewer;
- National Biodiversity Network (NBN);
- NIEA – Natural Environment Division;
- NI Bat Group.

6.66 Biological records were obtained from CEDaR and NBN; while NIEA did not provide a written response.

6.67 NIEA normally requires the identification of the ecological baseline of the area that will be affected by the scheme and the identification of areas which are likely to be of high conservation value or particularly vulnerable to impact from the proposed scheme. NIEA requires that the EIA should cover both habitats and species of flora and fauna, especially protected species, and that it should cover both the site and its surroundings, in all seasons.

6.68 The developer will be required to consider the potential impact of the scheme on designated sites. Where there is a potential for impacts on a European protected site (SPA, SAC) the developer will be responsible for informing a HRA as mandated by Article 6 of EC Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora ("the Habitats Directive").

6.69 The consultation and desk study identified those ecological receptors most likely to be impacted by the proposed wind farm. Ecological receptors identified included; Northern Ireland or European priority habitat and protected species. The ecological surveys and EcIA therefore concentrate on the potential effects of the Development on these ecological receptors.

Assessment Methodology

Baseline Characterisation of the Study Area

6.70 The study methodology includes both desktop and field survey methods in order to assess the potential impact on the local ecological and nature conservation interest. Features of conservation interest and importance were recorded and their locations were one of the key criteria that affect the wind farm layout. The location of the wind farm infrastructure avoids habitats and species of conservation interest where possible, and where this is not possible, mitigation and/or enhancement measures have been incorporated into the design to balance any detrimental impact.

6.71 The habitats within the entire area enclosed by the original Red Line boundary were described in the NVC Phase 2 habitat survey of the site. Habitats were surveyed across the whole Red Line boundary, hereafter referred to as 'the site.' This preliminary assessment enabled the identification of substantial areas of ecologically significant habitat, and the reduction in the area that would be required for the implementation of the scheme. As a consequence of the extensive nature of the Blue Line site (approximately 618ha), the preliminary examination of the site used a largely "broad brush" approach, which identified spatially extensive habitat types as well as many smaller features of ecological significance. However, a more detailed Phase I habitat survey was carried out by Karl Hamilton in June 2021, in order to more clearly define the limits of habitat types within the newly defined development area. In addition to this, 137 (2x2m) botanical quadrats were also recorded when assessing habitat type and condition.

6.72 Signs of mobile species were assessed outside the site to determine their point of origin. The study area was thus extended to take account of the potential for species to use the vicinity of the proposed development as part of wider territories or foraging areas. Watercourses within the site, and some tributaries outside the site, were surveyed for signs of otter. Specific study areas for each species are as follows;

- Bats (450m around proposed turbine locations);
- Otter, badger, (planning application boundary +100m buffer);
- Red squirrel & pine marten (forestry plantations);
- Common lizard & smooth newt (site);
- Marsh fritillary Habitat (site);

6.73 Sites designated at international, national and local level for their conservation value within a potential impact zone were considered. The nearest designated sites to the study area were identified, to assess the potential for remote effects of the scheme on valued habitats and species outside the immediate area.

6.74 The Fauna section of the EIA considers information gathered from the following sources:

- Consultations, with statutory and non-statutory stakeholders

- Desk study, including review of published/unpublished sources/literature
- A walkover survey of the entire study area and any other areas likely to be affected
- Specialist surveys, as detailed in paragraph 6.75 below
- Assessment of the data acquired
- Consideration of ecological interests in the scheme design and identification of mitigation to be incorporated into the design
- Impact assessment
- Proposed additional mitigation measures to address any likely significant adverse impacts

6.75 The data collection methodology adopted involved both a desktop search and field survey. The relevant statutory and non-statutory bodies were contacted to obtain ecological data for the study area. CEDaR was approached for records of species of conservation concern in the study area. Detailed surveys were undertaken to establish the baseline conditions for the various habitats and for the species groups that are likely to occur around the proposed scheme. The purpose of an ecological survey is to identify 'valued ecological receptors', those species and habitats that are especially valued in some way for their ecological function, their contribution to biodiversity or are protected by specific legislation. The following specialist surveys were undertaken:

- JNCC Phase 1 habitat survey
- NVC Phase 2 habitat survey
- Bat (Chiroptera spp) survey
- Otter (*Lutra lutra*) survey
- Badger (*Meles meles*) survey
- Red Squirrel (*Sciurus vulgaris*) survey
- Pine Marten (*Martes martes*) survey
- Common Lizard (*Zootoca vivipara*) survey
- Smooth Newt (*Lissotriton vulgaris*) surveys
- Marsh Fritillary (*Euphydryas aurinia*) habitat survey

Habitat Survey Methodology

Phase 1 Habitat Survey

6.76 The purpose of Phase 1 habitat survey is to identify those habitats of conservation interest that might place a constraint on the placement of the infrastructure of a proposed wind farm. The site was visited by Karl Hamilton on 13.07.21, 04.08.21, 12.08.21 and 16.08.21. Habitats of the proposed development site were allocated to the JNCC Phase 1 Habitat (JNCC 2010) classification. Notes were made of the main plant species, and other species that are indicative of the condition and management of the habitat.

6.77 Phase 1 Habitat survey methodology is intended for the auditing of habitats and is generally accurate and of wide application. It is noted also that habitat types may frequently merge, grade from one to another, or form complex mosaics. Frequently encountered habitat mosaics in Ireland include various mixtures of grassland/pasture types, heathlands and blanket bogs. Mosaics and transitional, modified and degraded habitats can be very difficult to assign to any one Phase 1 Habitat category yet may have very different sensitivities and implications for project planning and assessment.

6.78 The 2021 surveys were carried out along walked transects that attempted to include the variations in habitat types that were present across this extensive site. Features that indicated the potential for active peat formation were noted and, in particular, the extent and type of moss cover were noted, with an emphasis on the prevalence or absence of *Sphagnum* species. The presence of *Succisa pratensis,* the food plant of the marsh fritillary butterfly, which is fully protected under the Wildlife (Northern Ireland) Order, 1985, was noted where encountered.

6.79 The area covered by the Phase 1 Habitat survey is illustrated in **Figure 6.2**.

National Vegetation Classification (NVC) Survey

6.80 The NVC is a system of classifying natural plant communities in Britain according to the species they contain and provides a standardised methodology for detailed environmental assessments. The methodology is repeatable and incorporates the use of quadrat sampling within which the types and relative abundance of plant species is recorded. From these results, plant community types can be classified.

6.81 The survey method employed at Unshinagh was based on the NVC survey methodology described by Rodwell (Volumes 1 to 5, 1991 to 2000), which provides for the detailed classification and map-based survey of a wide range of plant communities found in Britain. The NVC describes communities in Britain, while often relatively depauperate communities in Northern Ireland have developed as a result of isolation from potential colonisers and under a generally more oceanic climate. Consequently, NVC types, while widely applicable to vegetation communities present in Northern Ireland, may vary significantly from those described for Britain in species composition and frequency.

6.82 Plant species were identified and recorded using the keys and nomenclature of Stace (2010) for higher plants and Atherton et al. (2010) for bryophytes (mosses and liverworts).

6.83 NVC survey requires the placement by eye of 2m x 2m squares to include either locally typical vegetation or to record the local variation in community type. All herbaceous and bryophyte species present within the square were recorded and their percentage cover noted. This approach allows subsequent analysis using the MAVIS program. Sward height and evidence of grazing pressure were recorded and, where appropriate, peat depth was measured. Irish Grid References were recorded for all quadrats sampled.

6.84 The NVC survey in the vicinity of proposed turbine locations was undertaken by Karl Hamilton on 13.07.21, 04.08.21, 12.08.21 and 16.08.21. In total, 95 quadrats were described from the 14 proposed turbine locations. The GPS location of each quadrat was recorded and the results mapped using geo-referenced OSNI maps. All quadrat data is provided in **Appendix 6.1: Ecology Annexes.**

6.85 A further 37 NVC quadrats were described by Dr Spaans and Mr Hamilton on three dates in November 2021 along proposed turbine access tracks. Although these quadrats were recorded outside the optimum growing period, most species likely to be found in the recorded habitats retain vegetative evidence of their presence and it is assessed that these quadrats allow identification of the plant communities and their conservation significance. As a consequence of the change in the proposed location of the three turbines noted above, and because parts of the original access route layout encroached on valued habitats, a number of these quadrats no longer describe communities directly affected by the proposed scheme. Conversely, a number of the quadrats describing communities in the wider development site (6.75 above) are now applicable to the habitats along the amended access routes. Where quadrats refer directly to access routes, this is noted in the following account.

6.86 In order to simplify site description, quadrats from the overall site survey, from the abandoned turbine locations and from the survey of access routes have been amalgamated in **Appendix 6.1: Ecology Annexes.** Quadrats for the currently proposed turbine locations are presented separately in the Appendix.

6.87 NVC plant communities were mapped on a 1:10,000 OS map. A hand-held GPS was used to record the location of target notes accurately. A digital camera was used to take representative photographs of each quadrat location for future reference. Analysis of the NVC community and sub-communities that were present were made using the relevant NVC Volumes (Rodwell 1991a to 2000). For the sake of clarity this report uses a combination of common and scientific species names, although the latter are only used by Rodwell (1991a to 2000). The most important references for this work are Rodwell (1991a and 1992).

6.88 NVC survey results were used to identify valuable vegetation communities and provided input into the assessment of active blanket peat within the study area. These were included in a constraints mapping exercise, along with other environmental constraints, to evolve the final layout design and layout of the wind farm. This process is described in **Chapter 3: Design Evolution & Alternatives**.

Blanket Bog Condition Assessments

6.89 Peatland habitats within the site were assessed to determine whether there were any areas of ‘active’ blanket bog present. The criteria used included the following:

- criteria provided in the NIEA Guidance note (2012);
- the presence and condition of NVC communities;

- the eco-hydrological conditions found in each part of the site, particularly the presence and condition of artificial drainage;
- past and present land management practices which have the potential to damage the habitat, including: peat cutting, burning, vegetation topping, sheep grazing, etc.

Bat Surveys

6.90 NIEA recommends different types of guidance for bat surveys, depending on the type of proposal. In the case of the proposed development this includes the SNH guidance (Jan 2019) entitled '*Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation*'. Therefore, this guidance was used when arriving at the appropriate level of survey effort (for both automated and manual surveys) at the windfarm.

6.91 A desk study was undertaken in order to plan survey work and provide context for this assessment. The desk study included a review all the available information on bats relevant to the proposed wind farm and considered the various factors that influence risk to the species at a site. This included:

- The use of bespoke UAV aerial imagery (a ground truthing site visit), topographical maps and habitat survey maps (from a previous Preliminary Ecology Assessment) of the proposed site to identify features of potential value to bats.
- The collation of relevant bat information within 10km of the proposed wind energy site, including species and roost records and the proximity of national and internationally designated sites for bats.
- Particular efforts were made to identify locations with the potential to house significant roosts, such as barns and other buildings.
- The location of other wind energy developments, including the number of turbines and their size, within the surrounding 10km in order to inform an assessment of cumulative pressure.

6.92 Collins (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition) was also considered during survey design and the subsequent survey effort.

6.93 It was noted that:

- Habitat quality is poor for bats on the Application Site. Significant woodland, linear features such as hedgerows are not present;
- The site has an exposed aspect;
- The site is not proximal to sites designated for bats; and,
- No buildings or other structures known to support bats are extant on the site[2].

[2] within 200m plus rotor radius of the boundary of the proposed development.

6.94 Based upon this information, and upon the factors noted in the aforementioned SNH Guidance, the site was deemed to be of 'low quality' for bats and the following survey standard was implemented in accordance with SNH Guidelines.

- Survey Area of up to 200m & Rotor Radius from the proposed turbines;
- Ten consecutive nights of static monitoring per turbine location during each season (spring/summer/autumn) using broadband passive recorders.
- Bat transects, for which the 2019 SNH states '*their applicability is discretionary and site-specific*' were not conducted to identify general use of the land around the turbine location by bats. However, the static monitoring was supplemented with thermal imaging surveys in order to provide more detailed information on bat activity in the vicinity of specific turbines.

6.95 The study area comprises a range of habitats including open sheep grazed pasture (acid/marshy grassland), wet heath and some relict blanket bog/mire habitats. On the lower lying areas of pasture there are few hedgerows, or mature trees; there are also no well-vegetated stream corridors. The wider landscape is similar to the site with extensive areas of open moorland and sheep grazed pasture.

6.96 A detailed survey of potential roosting features within 200m of the application site boundary was carried out during 2021. The habitat survey did not identify any buildings or structures with potential roosting features. There are a few trees present which are in close proximity to the proposed turbines, however no mature trees suitable for use by roosting bats are extant within the application boundary. The majority are isolated hawthorn and were deemed unsuitable for roosting bats.

6.97 Overall the site is identified as being of low risk due to the presence of largely low quality habitat (and limited opportunity for roosting) and the fact that the majority of the site has limited connectivity to the wider landscape; and the presence of largely low quality foraging habitat for bats; with even the areas normally described as moderate quality foraging habitat (i.e. rivers and streams) located in a fairly isolated upland context with no native trees (or sheltered areas) and limited invertebrate prey.

Automated passive Monitoring

6.98 Automated passive monitoring was also undertaken during spring (15 Apr – 15 Jun), summer (15 Jun – 15 Aug) and autumn (15 Aug – 15 Oct) 2021 (**Figures 6.5** and **6.6 - Static (Bat) Detector Locations**). Several (calibrated) broadband ultrasonic bat detectors (SM2BAT+, SM4ZC and Anabat Express) were placed to record for a minimum of ten nights at numerous locations across the site on a seasonal basis, including a majority of the potential turbine locations. The associated Bat Annex (in **Appendix 6.1** (contains photographs of each location along with a brief description)). Each static detector was programmed to automatically operate during set time periods to record bat activity between dusk and dawn each night.

6.99 The SNH 2019 guidance states that;

''Where developments have more than ten turbines, detectors should be placed within the developable area at ten potential turbine locations plus a third of additional potential turbine sites up to a maximum of 40 detectors for the largest developments''.

6.100 For a 14-turbine site this would result in approximately 340 hours of static monitoring across the season for 11.33 turbines (10 plus one third of 4). At Unshinagh, due to alterations to the site layout, slightly different locations were monitored during spring/early summer against late summer/autumn. With 9 of the final turbines monitored during spring/early summer; however, a further 3 locations were subject to monitoring (and these are also representative of activity levels on the upper part of the site). As the layout was finalised, 13 of the final 14 proposed turbines were monitored (during late summer & autumn), which yielded a total of 600 hours of recording time. This was done in order to allow for alterations to the proposed turbine layout (which often occur during the assessment process) and also to allow for equipment failure or damage.

6.101 Detectors were placed with the microphone directed at a 90º angle towards the area to be monitored (e.g. the proposed turbine location). Whenever possible microphones were placed on a fence post or pole. This helps to prevent recording extraneous noises and places the microphone closer to or within the flight path of the bats; this tends to provide higher quality recordings.

6.102 AnalookW and Kaleidoscope Pro UK was used to undertake analysis of data collected during automated passive monitoring. Bat activity was measured using the number of files containing a bat call or bat call sequence irrespective of length, for a complete night of recording. Passive monitoring enables determination of species composition and temporal activity patterns between different times of year and different times of night at a fixed-point location. Bat activity indices (for all survey types) are provided in the survey results, included in **Appendix 6.1: Ecology Annexes**.

6.103 Photographs were taken during each deployment, to check for disturbance, and as a record of work undertaken. Appendix 6.1 also contains photographs of each location along with dates and a description of the proposed turbine location).

Thermal Imaging Surveys

6.104 SNH 2019 states that walked transect and vantage point surveys can be used to complement the information gained from static detectors and other sources, but that their applicability is discretionary and site-specific. While the guidance also states that; *'' Acoustic monitoring can be supplemented with thermal imaging cameras etc. as necessary to provide more detailed information on bat activity in the vicinity of turbines, as necessary*. Similarly, the 2016 BCT guidance states that thermal imaging equipment is very useful as a complementary technique, (when used in conjunction with trained observers).

6.105 After the results of the spring automated passive detector data was analysed, it was deemed worthwhile to see if thermal camera equipment could be used to ascertain the movement (and number) of bats between SD locations 8 – 10 and 14 as shown on **Figure 6.5**.

6.106 A surveyor was positioned on a preselected vantage point on high ground overlooking the areas under investigation. Vantage point watches commenced 15 minutes before sunset and carried on for 1.5-2 hours after sunset. The thermal unit was attached to a trip to prevent fatigue and allow smooth panning across the horizon. Scanning was continuous across the survey session with only pauses for battery swapping (if necessary). The Helion Pulsar XP28 used also has recording capability, which was deployed on a continuous loop in case commuting bats or foraging bats were observed. In addition, the unit selected also has the widest field of view of any unit currently marked for ecological consultancy professionals.

Bat Roost Potential Surveys

6.107 An assessment of the Bat Roosting Potential (BRP) of the trees present on site were conducted during the field surveys following the Bat Conservation Trust (Bat Conservation Trust (BCT)) 'Bat Surveys for Professional Ecologists: Good Practice Guidelines' (2016). The roosting potential of each tree was assessed according to the BCT Bat Surveys for Professional Ecologists Good Practice Guidelines (2016)[3].

Otter Survey

6.108 An otter survey was conducted, extending to 125m outside the Application Site on 15 January and 24 February 2021, with follow-up surveys also conducted on 03 and 04 November 2021 (to take account of changes to the final infrastructure layout). The surveys were undertaken using the methodology described in the NIEA survey requirements (NIEA 2017[4]). The survey area was thoroughly searched for both direct and indirect evidence of otters. Such evidence included: prey remains, spraints, footprints, slides and dens. The locations of any features were noted using a handheld GPS. Where excavations were discovered, the survey detailed; the direction of tunnelling; and the degree of use at the time of the survey. Where trails were found, these were followed to the edge of the recording area.

Badger Survey

6.109 A badger survey was conducted, extending to 25m outside the Application Site on 15 January and 24 February 2021, with follow-up surveys also conducted on 03 and 04 November 2021 (to take account to changes to the final infrastructure layout). The surveys were undertaken using the methodology described in Harris et al (1989[5]) and with reference to the NIEA survey requirements (NIEA 2017[6]). The survey area was

[3] Guidelines for assessing the suitability of a structure for roosting bats [taken from Table 4.1 of the BCT's 'Bat Surveys for Professional Ecologists: Good Practice Guidelines' (2016)].

[4] https://www.daera-ni.gov.uk/sites/default/files/publications/daera/otter-survey-specifications.pdf

[5] Harris, S., Creswell. P., and Jefferies, D.J., 1989. Surveying badgers. Mammal Society, London.

[6] https://www.daera-ni.gov.uk/sites/default/files/publications/daera/bat-survey-specifications.pdf

thoroughly searched for both direct and indirect evidence of badger activity. Such evidence included: badger hairs; mammal pathways of suitable dimension; gaps of suitable dimension in fences or hedgerows; snuffle holes indicating foraging activity; tracks; latrines; and excavations of suitable dimensions to host badgers. The locations of any features were noted using a handheld GPS. Where excavations were discovered, the survey detailed;

- The number of entrances present;
- The shape of tunnel entrances;
- The width of the tunnel entrance at its widest point (visible);
- The direction of tunnelling; and
- The degree of use at the time of the survey, i.e. active or inactive.

6.110 Intact stone walls and (wire) mesh fence-lines, which have the potential to act as territory boundaries, were walked to search for territory markers such as latrines and scratch marks. In more open habitats, such as heath, bracken and grassland, a grid of transects was walked and any badger signs noted. Where badger trails were found, these were followed to the edge of the recording area.

Red Squirrel & Pine Marten Survey

6.111 Dedicated walkover surveys were not conducted along the entire proposed infrastructure locations for red squirrels or pine martens, and work was restricted to areas of suitable habitat. In addition, survey constraints (i.e. impeded access to the forestry areas, due to the density of lower branches, lack of suitable access tracks or forestry rides and wet boggy ground conditions), meant traditional transects were not considered practical. In addition, sheep had access to a number of the plantations, meaning that field signs were almost impossible to discern due to dunging and trampling disturbance. Therefore, baited camera traps (i.e. nuts & seeds placed in a squirrel feeder positioned opposite the camera) were deemed the most appropriate survey method to determine species presence / absence.

6.112 Four number baited camera traps were deployed at various locations within the conifer plantation areas located to the south of the site (see **Figure 6.7: Non-volant Mammal Survey Results**). Cameras were initially deployed on the 21 January 2021 and collected on the 08 April 2021. With a second deployment between June and November 2021. All footage was later extracted and assessed for mammal presence. Further information is provided in **Appendix 6.1: Ecology Annexes.**

Viviparous Lizard Survey

6.113 On assessing the habitats present on the application site it was considered that there is a moderate likelihood of viviparous lizards being present. Therefore, in order to ensure that the proposed development complies with legislation and planning policy, a survey for this species was carried out. The work was carried out during May to September 2021 and aimed to establish whether lizards are present within the construction corridor and surrounding area.

6.114 The methodology includes both visual searches and the use of artificial refugia. Surveys were carried out during the following optimal periods;

- Early spring - middle hours of the day (c.11am-3pm);
- Late spring – mid morning (c.9-11am) and late afternoon (c.4-6pm), and/or;
- Summer – short periods in morning (c.7-9am) and evening (6-8pm); hot weather can produce totally negative results;
- Autumn similar to spring timings.

6.115 During the visual searches a transect was walked slowly, scanning sunny sides of vegetation while keeping the sun behind you or to your side. Particular attention was paid to vegetation interfaces (i.e. habitat edges, where bracken meets heather or grassland) as these are often places where reptiles bask (as they seldom venture far from dense cover for protection).

6.116 The walked transects also made use of natural basking spots, however artificial refugia in the form of 30 number rubber backed carpet tiles (500 x 500mm) were also placed around suitable parts of the site which could be safely accessed (see **Figure 6.8**: **Common Lizard Survey Results**). The transect also took account of suitable habitat within or adjacent to the construction corridor. The following was applied to the emplacement of refugia;

- Choose sunny locations away from public view and livestock;
- Press refugia down close to the ground;
- Use deep cover or edge of dense vegetation;
- Do not deploy on bare ground/sparse cover;
- Lift and replace refugia carefully taking care not to squash retreating animals.

6.117 Surveys were carried out during suitable weather conditions (as above), and focussed during May & September. The surveys were 2-3 hours in duration and three visits were made (with the first visit at least a week after the refugia were laid).

Smooth Newt Survey

6.118 The habitats on site were considered for the presence of smooth newt *Lissotriton vulgaris* breeding habitat. Aerial photography was reviewed for the presence of ponds or other water bodies within 200m of all proposed infrastructure. In addition to this, the area (within 200m of all infrastructure) was surveyed during the habitat survey.

6.119 An assessment of the potential for smooth newt to be present on the site was undertaken. Any suitable waterbodies/drainage channels which were identified during the initial habitat surveys of the Site were subject to a newt HIS (Habitat Suitability Index) assessment. OSNI aerial photographs were also reviewed, as were bespoke images of the site which were taken from a height of 120m above the ground and which have 5 cm resolution per pixel.

6.120 The presence of numerous small and ephemeral ponds and a small lochan (on vector mapping and aerial photographs) was noted, therefore a smooth newt survey was undertaken. The methodology was in accordance with the NIEA survey specification (in force at the time of survey).

6.121 Due to the absence of natural refugia (other than tussocks of *Juncus effusus)* several artificial refugia were placed around the ponds (but within 100m). This was completed to fulfil the NIEA requirement that;

> *"The survey must establish whether newts are present, and if applicable, their status in the water-body and surrounding potential terrestrial refugia sites. The survey must include any suitable terrestrial habitat within 200m of the water body."*

6.122 The techniques employed during the survey were:

- Refuge Search - all suitable and accessible terrestrial refugia (logs, rocks, moss hummocks, and artificial refugia) within 200m of the pond were searched;
- Egg Search - any submerged and emergent vegetation was searched for the presence of newt eggs.
- Netting - a long-handled pond net was used to search within the pond for newts; this was undertaken at an approximate rate of 15 minutes searching per 50m of pond to ensure thorough coverage.
- Torchlight Survey - this element of the survey was undertaken after dusk to search for newts within the pond using a high-powered hand-held torch.

6.123 All work was carried out under licence from NIEA and all surveys took place during May/June 2021.

Marsh Fritillary Survey

6.124 On assessing the habitats present on the site it was considered that there is reasonable likelihood of devils-bit scabious *Succisa pratensis* being present on the site. This is the food plant or LHP (Larval Host Plant) of the marsh fritillary butterfly *Euphydryas aurinia*. This is a protected species listed on Schedules 5 and 7 of the Wildlife (NI) Order 1985 (as amended) and included on Annex 2 of the EU Habitats Directive (92/43/EEC).

6.125 Therefore, in order to ensure that the proposed development complies with legislation and planning policy, an appropriate survey for devils-bit scabious was carried out during September 2021, the aim of which was to establish the frequency and abundance of this species across the site.

Ecological Impact Assessment

6.126 The assessment of the impact of a scheme on a species or habitat must consider the conservation value of the species or habitat. This assessment of the potential impact of the Development on the conservation interest of the construction area and associated access routes adopts the Guidelines for Ecological Impact Assessment in the UK (CIEEM 2018[7]).

6.127 The objective of the EIA process, in relation to the natural environment, is to undertake sufficient assessment to identify and quantify any significant impacts on the natural environment likely to arise from turbine construction, operation and eventual decommissioning. Following identification of the final infrastructure layout, the baseline ecological (or biodiversity) conditions in the Site are described, based on information provided by consultees, background sources of information and the results of dedicated surveys carried out for the scheme.

6.128 As a means of achieving this objective, ecological constraints on development of the scheme at international, national, regional and local levels are identified and assessed. This includes the main ecological features that should be avoided or that could affect the design of the scheme or delay progress.

Sensitivity Criteria

6.129 Potential significant impacts are assessed according to the ecological value of a site, which is derived from the criteria outlined below. The sensitivity (importance) of a receiving habitat is defined by its position in a hierarchy of site importance and conservation value. This hierarchy extends, highest to lowest, from International, National, Regional, Local, to negligible importance. This range of values is expressed in the protection afforded a site by international and national legislation, and in planning policy at a more local level (**Table 6.1**).

6.130 The biodiversity value of a site, is measured by such factors as:

- animal or plant species, subspecies or varieties that are rare or uncommon, either internationally, nationally or more locally;
- endemic species or locally distinct sub-populations of a species;
- ecosystems and their component parts, which provide the habitats required by the above species, populations and/or assemblages;
- habitat diversity, connectivity and/or synergistic associations (e.g. networks of hedges and areas of species-poor pasture that might provide important feeding habitat for rare species);
- notably large populations of animals or concentrations of animals considered uncommon or threatened in a wider context;
- plant communities (and their associated animals) that are typical of valued natural/semi-natural vegetation types, including examples of naturally species-poor communities;
- species on the edge of their range, particularly where their distribution is changing because of global trends and climate change;

[7] CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.1. Chartered Institute of Ecology and Environmental Management, Winchester.

- species-rich assemblages of plants or animals; and
- typical faunal assemblages that are characteristic of homogeneous habitats.

6.131 The secondary value of a site can be as part of a corridor or a series of stepping stones that facilitate the migration, dispersal and genetic exchange of wild species, or as a buffer zone that protects a valued site from adverse or beneficial environmental impacts.

Magnitude of Effect

6.132 This relates to the magnitude of the impacts on the features during the construction, operation and decommissioning phases. The magnitude of ecological impacts is assessed by considering the change in the ecology of a site that will arise because of the direct and indirect effects of a development on that ecology. Factors to be considered when considering the magnitude of an impact are outlined in **Table 6.2**. The criteria for determining the magnitude of impact are listed in **Table 6.3**. Both direct and indirect impacts, and the duration of these impacts are examined.

Significance Criteria

6.133 This relates to the significance of impacts on species and habitats of conservation importance, based on their presence as determined by survey. Factors to be considered when assessing the ecological significance of impacts are outlined in **Table 6.4**. Taking the factors in **Table 6.4** into account the significance of an impact may be broadly categorised according to **Table 6.5**.

Table 6.1: Criteria for assessing ecological sensitivity/importance at a geographic scale

Value/Importance	Criteria
Internationally important sites (very high conservation value)	World Heritage Sites identified under the Convention for the Protection of World Cultural & Natural Heritage, 1972. Biosphere Reserves identified under the UNESCO Man & Biosphere Programme. Wetlands of International Importance designated as Ramsar Sites under the terms of the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (the Ramsar Convention) formulated at Ramsar, Iran, in 1971. Special Protection Areas (SPAs) designated in accordance with the 1979 European Communities Directive on the Conservation of Wild Birds (79/409/EEC): The Birds Directive. This Directive requires member states to take measures to protect birds, particularly rare or endangered species as listed in Annex I of the Directive, and regularly occurring migratory birds. Special Areas of Conservation (SACs and cSACs) designated in accordance with the 1992 European Commission Habitats Directive 92/43/EEC (1992): The Habitats Directive. This Directive requires member states to establish a network of sites that will make a significant contribution to conserving habitat types and species identified in Annexes I and II. Other sites maintaining habitats and/or species listed under the Birds and/or Habitats Directives (see above). Sites hosting significant populations of species annexed under the Bonn Convention. Sites hosting significant populations annexed under the Bern Convention.

Value/Importance	Criteria
	Biogenetic Reserves (UNESCO Man and the Biosphere Programme).
Nationally important sites (high conservation value)	Areas of Special Scientific Interest are the principal national designation for sites of nature conservation interest. They are notified under Section 28 of the Environment (NI) Order 2002 and are chosen by virtue of any of their flora, fauna, geological, or physiographic features to represent the best national and regional example of natural habitat, physical landscape features or sites of importance for rare or protected species. National Nature Reserves (NNRs) and Marine Nature Reserves (MNRs) are designated under the Environment Order. Sites maintaining UK Red Data Book species that are listed as being either of unfavourable conservation status in Europe, of uncertain conservation status or of global conservation concern. Sites maintaining species listed in Schedules 1, 5 and 8 of The Wildlife (NI) Order 1985, as amended.
Regionally important sites (medium conservation value)	Sites that reach criteria for Local Nature Reserve but do not meet ASSI selection criteria. Sites of Local Importance for Nature Conservation (SLNCIs) are recognised by Planning Service and are intended to complement the network of nationally and regionally important sites. SLNCIs receive special consideration in relation to local planning issues. Sites supporting viable areas or populations of priority habitats/species identified in the UK Biodiversity Action Plan or smaller areas of such habitat that contribute to the maintenance of such habitat networks and /or species populations. Sites maintaining habitats or species identified in Regional Biodiversity Action Plans based on national rarity or local distribution. Other sites of significant biodiversity importance (e.g. sites relevant to Local Biodiversity Action Plans).
Local (lower conservation value)	Sites not in the above categories but with some biodiversity interest. Examples of lands of lower ecological value include; intensive agricultural lands and coniferous forestry.
Negligible conservation value	Sites with little or no local biodiversity interest.

Table 6.2: Factors to be considered when assessing magnitude of ecological impacts

Parameter	Description
Extent	The area over which an impact occurs.
Duration	The period required for a feature to recover or be replaced following an impact. Duration of an activity may have a shorter duration than the impact of the activity.
Reversibility	A permanent impact is one from which recovery is unlikely within a reasonable timescale. A temporary impact is reversible either through natural recovery or because of mitigation.
Timing and frequency	In some cases, an impact may only occur if it occurs during a critical season or part of a species' life-cycle, and may be avoided by careful scheduling of work activities. Frequency of an activity may also affect the magnitude of its impact by reinforcement of the impact.

Table 6.3: Criteria for assessing magnitude of ecological impact

Significance	Description
Severe adverse	The development fails to satisfy the subject environmental objective and results in major fundamental deterioration of the environment at national and international levels of importance.

Significance	Description
	Proposed development activities will result in a major alteration to the baseline ecological conditions, resulting in fundamental change and major environmental deterioration. Large adverse impacts are attributed to any significant adverse impact on habitat and species (or other valued ecological receptors) identified as being of international significance. Highly significant impact, warrants refusal of planning permission.
Major adverse	The proposal (either on its own or in-combination with other proposals) may adversely affect the site, in terms of coherence of its ecological structure and function, that enables it to sustain the habitat, complex of habitats and/or the population levels of species of interest.
Moderate adverse	The site's integrity will not be adversely affected, but the effect on the site is likely to be significant in terms of its ecological objectives. If it cannot be clearly illustrated that the proposal will not have an adverse effect on integrity, then the impact should be assessed as a major adverse.
Minor adverse	Neither of the above applies, but some minor adverse impact is evident. (In the case of Natura 2000 sites a further appropriate assessment may be necessary if detailed plans are not yet available).
Negligible	Very minor alteration to one or more characteristics, features or elements.
Neutral	No observable impact in either direction.

Table 6.4: Factors to be considered when assessing ecological significance of impacts

Factor	Defining criteria
Site integrity	Extent to which site/ecosystem processes will be removed or changed. Effect on the nature, extent, structure and function of component habitats. Effect on the average population size and viability of component species, size and viability of component species.
Conservation status	Habitats: conservation status is determined by the sum of the influences acting on the habitat and its typical species that may affect its long-term distribution, structure and functions as well as the long-term survival of its typical species within a given geographical area. Species conservation status is determined by the sum of influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within a given geographical area. Conservation status may be evaluated for any defined study area at any defined level of ecological value. The extent of the area used in the assessment will relate to the geographical level at which the feature is considered important.
Probability of expected outcome	Known or likely trends and variations in population size/habitat extent. Likely level of ecological resilience.

Table 6.5: Significance of impacts

Significance	Description
Severe adverse	The proposal (either on its own or with other proposals) is likely to adversely affect the integrity of a European or nationally designated site, in terms of coherence of its ecological structure and function, across its whole area, that enables it to sustain the population levels of species of interest, or is likely to adversely affect the numbers, distribution or viability of a species or population of conservation concern. A major change in a site or feature of local importance may also enter this category.

Significance	Description
Major adverse	The integrity of a European or nationally designated site will not be adversely affected, but the effect on the site is likely to be significant in terms of its ecological objectives. If, in the light of full information, it cannot be clearly illustrated that the proposal will not have an adverse effect on integrity, then the impact should be assessed as very large adverse.
Moderate adverse	The proposal may adversely affect the integrity of a locally important conservation site, or may have some adverse effect on the numbers, distribution or viability of a species or population of conservation concern.
Minor adverse	None of the above applies, but some minor negative impact is evident. (In the case of Natura 2000 sites a further appropriate assessment may be necessary if detailed plans are not yet available).
Neutral	No observable impact in either direction.
Minor beneficial	The development partly satisfies the subject environmental objective and partly contributes to the environmental context. Proposed development activities will result in minor improvements to baseline ecological conditions and should result in minor environmental gains. Slight beneficial impacts can be attributed to benefits to any valued ecological receptors. Environmental gains which can easily be achieved through standard practices.
Moderate beneficial	The development satisfies the subject environmental objective and contributes to the environmental context. Proposed development activities will result in recognisable improvements to baseline ecological conditions and will result in notable environmental gains. Moderate beneficial impacts can be attributed to benefits to any valued ecological receptors where improvements are expected to be significant. Environmental gains which require detailed design consideration – potentially employed to offset slight/moderate adverse impacts elsewhere.
Major beneficial	The development satisfies the subject environmental objective and results in a major contribution to the environmental context. Proposed development activities will result in quantifiable improvements to baseline ecological conditions and will result in significant environmental gains. Large beneficial impacts are only attributed to substantial benefits to valued ecological receptors identified as being of National or International importance and where such benefits will result in the consolidation and/or expansion of areas of habitats or ensure the security and/or expansion of viable populations of species. Environmental gains which require very detailed design consideration – potentially employed to eliminate and offset potential significant adverse impacts elsewhere.

6.134 Cumulative impacts may also arise. Other projects that have been included in the cumulative impact assessment are:

- Wind farm projects which have received planning consent; and
- Other development projects with valid planning permissions, and for which formal EIA is a requirement or for which non-statutory EIA has been undertaken. Other projects should be included as appropriate, subject to consultation with DOE Planning and other statutory bodies. The cumulative impacts of different projects are assessed against the significance criteria outlined in **Table 6.6**.

Table 6.6: Criteria for assessing the significance of cumulative effects

Significance	Effects

Severe	Effects that the decision-maker must consider as the receptor/resource is irretrievably compromised.
Major	Effects that may become key decision-making issue.
Moderate	Effects that are unlikely to become issues on whether the project design should be selected, but where future work may be needed to improve on current performance.
Minor	Effects that are locally significant.
Not Significant	Effects that are beyond the current forecasting ability or are within the ability of the resource to absorb such change.

Baseline Conditions

Consultation and Desk Study Results

6.135 The results of the desk study detail designated nature conservation sites and/or ecological records of protected species or species of natural heritage importance within 2km of the Planning Application Boundary.

Plants of additional conservation interest

6.136 The food plant (devil's-bit scabious *Succisa pratensis)* of the marsh fritillary butterfly *Euphydryas aurinia* is present locally at a low density as an occasional component of the rush pasture on site. The insect is fully protected in Great Britain and Northern Ireland under the Bern Convention (Annexe II) and EC Habitats and Species Directive (Annexe II). The Wildlife (Northern Ireland) Order 1985 Schedule 5 protects the species at all times and Schedule 7 makes it an offence to sell live or dead specimens.

6.137 No examples of bog myrtle *Myrica gale* (food plant for the larvae of the argent and sable moth *Rheumaptera hastata*, a UK priority species) were found on the site.

Site Overview

6.138 The site is situated on the extensive southern slopes of the Garron Plateau. The northern-most part of the site consists of a gently undulating upland plateau which descends into improved agricultural fields to the east in close proximity to the A42 Carnlough/Ballymena Road, and to swathes of semi-improved wet grasslands and coniferous forestry blocks to the south. The central part of the site lies on the fringes of an upland lake which supports a wide fringe of sedge fen, wet heath and mire habitats.

6.139 Although the majority of the site is located in an upland situation, it is sub-divided into a series of large 'fields' by barbed wire fencing, and some degree of agricultural improvement is evident even in the northern-most, higher elevation parts of the site. Such improved areas can coincide with the localised presence of smaller field systems and their associated boundaries. Field units do not always represent separate management units at Unshinagh, and as such the site has been sub-divided instead according to broad compartments in the overview of NVC Phase 2 plant communities, each compartment consisting of one of five 'legs' which comprise the application area.

6.140 The higher elevation areas in the northern-most part of the site are dominated by a complex mosaic of wet heath, mire, rush-pasture and acid grassland habitats which vary according to variations in peat depth, slope, aspect, local topography and a combination of both past and current grazing pressure. Grazing is mostly by sheep, although cattle were also observed on lower ground in the southern part of the site as well as smaller numbers in some of the northern-most, upland fields. Grazing pressure differs markedly across the site according to vegetation type and elevation, with higher ground in the north and west of the site being subjected to relatively low intensity grazing whereas lower-lying areas consisting of *Holcus lanatus*-dominated rush-pasture and acid grassland which are often heavily grazed with a tight sward and associated poor species diversity.

6.141 Grazing pressure is one of the main factors impacting negatively on the favourable condition of areas of NI Priority Habitat within the site, with a reversion from more typical upland heath and mire communities to grass-dominated communities in those areas subjected to the most sustained high levels of grazing pressure.

6.142 Sloping ground across the site, but particularly at mid-elevation and lower elevation parts of the site, often supports large expanses of marshy grassland consisting of species-poor rush-pastures where *Juncus effusus, Molinia caerulea* and/or *Holcus lanatus* can be present with occasionally more species-rich swards where *Juncus acutiflorus* is often the most dominant species. Wetland forbs present within such species-rich swards can include *Jacobaea aquatica, Cirsium palustre, Ranunculus flammula, Galium palustre* and *Epilobium palustre*. Such species-rich habitat falls within the description of the NI Priority Habitat Purple Moor-grass and Rush Pasture.

6.143 A series of four coniferous forestry blocks is present near the southern limit of the application area, each consisting of a monoculture of Sitka Spruce *Picea sitchensis*.

6.144 The following account will provide brief descriptions of the occurrence and distribution of Phase I habitat types, followed by a more detailed differentiation of habitats, based on NVC Phase II quadrat data, across the site as a whole. A further section describes the Phase II NVC survey of, specifically, proposed turbine locations.

Phase I Habitat Types

6.145 The broad habitat types differentiated by Phase I methodology are described below.

A1 Broad-leaved woodland

6.146 A small band of broad-leaved woodland dominated by *Fraxinus excelsior* and *Corylus avellana* is present at the point where the site access track meets the A42 Carnlough/Ballymena Road.

A1 Coniferous woodland

6.147 Four blocks of coniferous forestry are present near the southern limit of the application area, each consisting of planted rows of *Picea sitchensis*. In addition, a smaller stand of conifer forestry is situated within a swathe of acid grassland a short distance to the north of the proposed location for T8.

A2 Scrub

6.148 Scattered patches of scrub dominated primarily by *Ulex europaeus* with a lesser quantity of *Crategus monogyna* are present within improved fields adjacent to the site access point along the A42 Carnlough/Ballymena Road. In addition, Gorse scrub is also scattered across much of the remainder of the site, primarily in areas inaccessible to livestock such as the steep banks of streams, and drier slopes enclosed by marshy ground such as rush-pasture. Scrub cover generally decreases with increasing elevation, although it persists along some steep stream banks in upland areas where adjacent ground has been subjected to some agricultural improvement.

A3 Scattered trees

6.149 Scattered trees are located mainly in lowland parts of the site i.e., those areas with improved or semi-improved agricultural fields where scattered trees indicate the line of a former hedgerow which has since been removed, or where they may remain as remnants of former areas of scrub or woodland. Occasional trees are also present within Gorse scrub across the site, which affords sapling trees some protection from livestock. Occasional scattered trees are also associated with localised areas of agricultural improvement in more upland parts of the site, notably to the north-north-west of T14.

B1 Acid grassland

6.150 Three main types of acid grassland are present within the application area. The first and most widespread type is dominated by *Deschampsia flexuosa* and is found in a mosaic with other habitat types such as dry heath, mesotrophic grassland, wet heath, rush pasture and, to a lesser extent, blanket mire. Most of this type of acid grassland are found in the north-eastern part of the site.

6.151 The second type is dominated by *Festuca ovina* which is restricted to a small area to the south of the proposed location of the Control Building and Substation Compound.

6.152 The third type, dominated by *Nardus stricta*, is found in an extensive swathe to the north of the proposed location of T8 as well as a small area to the south of T4.

B2 Neutral grassland

6.153 Neutral grassland within the application area is dominated by *Holcus lanatus* and is rather species-poor, with the sward generally supporting either few forbs, bryophytes and/or graminoids other than *Holcus*, or having forbs, bryophytes and graminoids other than a few grass species entirely absent. Such areas are often heavily grazed, with the resultant sward becoming a dense lawn of a few hardy, fast-growing grass species.

6.154 Neutral grassland dominates the central part of the site where most livestock grazing seems to be concentrated, but also covers a significant part of the southern leg of the application area which extends south to the proposed locations for T10 and T11.

6.155 An extensive swathe of neutral grassland is present in the vicinity of T1 which is an upland location; in addition, smaller pockets of neutral grassland are present within similarly upland locations close to the proposed locations for T4, T7, T12 and T13.

6.156 Neutral grassland also exists in a mosaic with many other habitat types which attests to the moderate to heavy grazing pressure experienced across much of the site. Such mosaics include marshy grassland (including rush-pasture) in the vicinity of T3, T5 and T14; and acid grassland in the vicinity of T6.

B4 Improved grassland

6.157 Within the application area, improved fields are restricted to the eastern boundary where the proposed main site access from the A42 Carnlough/Ballymena Road is located. This area consists of a series of closely-grazed fields which have been re-seeded and fertiliser applied to yield a rich green sward where *Lolium perenne* is dominant.

B5 Marshy grassland

6.158 Three main types of marshy grassland are present within the application area – those dominated by *Juncus acutiflorus* which are often species-rich; those dominated by *Juncus effusus*; and those dominated by *Molinia caerulea*. The latter two types are often species-poor.

6.159 The species-rich form dominated by *Juncus acutiflorus* is found along the southern flank of a series of improved fields near the proposed site entrance from the A42 Carnlough/Ballymena Road, this area supported 18 species. Smaller pockets are located in close proximity to T1, T7 and T13 near the northern site margins where they correspond to sloping ground where sufficient lateral flow of groundwater is present.

6.160 This species-rich form of marshy grassland more often occurs in a mosaic with neutral grassland and/or *Molinia*-dominated marshy grassland in the vicinity of T3, T5 and T14; also in a mosaic with acid grassland across much of the south-eastern leg of the application area as well as in the vicinity of T6. A small area of mosaic with wet modified bog also exists close to the proposed location for T7.

6.161 Species-poor marshy grassland dominated by *Juncus effusus* is present primarily in a mosaic with neutral grassland around the margins of the coniferous forestry blocks at the southern end of the application area, as well as occurring in a small wedge to the east of T12.

6.162 Species-poor marshy grassland dominated by *Molinia caerulea* exists primarily around the proposed location of T13 and as small swathes to the south-east of T5; more often this form of marshy grassland exists in a mosaic with a range of other habitat types including with wet modified bog along the south-eastern leg of the application area, where the proposed site of the Temporary Construction Compound is located; a small area to the immediate east of the one of the forestry blocks in the southern part of the site; and to the immediate south-east of T6.

6.163 *Molinia*-dominated marshy grassland also exists in a mosaic with wet heath and wet modified bog in a narrow band between T8 and T9, in a band to the east of T5, and also in a band to the south-east of T12; in a mosaic with wet heath in the vicinity of T13, T7 and T14; with dry heath and wet heath to the south-east of T5; in a mosaic with acid grassland and wet heath to the immediate east of T4; and in a mosaic with neutral grassland and *Juncus acutiflorus*-dominated marshy grassland in the vicinity of T3, T5 and T14.

D1 Dry dwarf shrub heath

6.164 Small, scattered pockets of dry dwarf shrub heath are present in a mosaic with acid grassland to the east and north-east of the proposed location of T5, and also in a mosaic with wet heath and *Molinia*-dominated marshy grassland to the south-east of T5 and at T14. The distribution of this localised habitat corresponds to well-drained, south-facing slopes supporting shallow peat which is relatively inaccessible to livestock and./or has been subjected to low or moderate levels of grazing pressure.

D2 Wet dwarf shrub heath

6.165 This habitat, dominated by *Trichophorum germanicum* within the application area, is present primarily to the immediate east of the proposed location of T8. Elsewhere on site it occurs in a mosaic with a wide range of other habitat types including wet modified bog at T7, T12, T4, T14 and to the south of T9; with wet modified bog and *Molinia*-dominated marshy grassland to the south of T3, the south-east of T12 and between T8 and T9; with wet modified bog and acid grassland in the area between T1 and T2; with *Molinia*-dominated marshy grassland in the vicinity of T14, T7 and between T7 and T13; with acid grassland between T4 and T6; with dry dwarf shrub heath and *Molinia*-dominated marshy grassland to the south-east of T5 and at T14; and in a mosaic with acid grassland and neutral grassland in the area between T14 and T6.

E1.7 Wet modified bog

6.166 A band of this habitat is present to the immediate south and east of T6 with *Trichophorum germanicum* dominating the bog element of the mosaic although *Molinia caerulea* is also well-represented. Sphagna are sparse in this area owing to the presence of drainage ditches nearby.

6.167 An extensive area of wet modified bog exists in the north-eastern corner of the application area, centred around the proposed location of T2, in a mosaic with dry modified bog, wet heath and acid grassland; and to the east of T5. The wet modified bog element is dominated largely by *Trichophorum germanicum* in both locations.

6.168 Several areas support a mosaic of wet modified bog and wet heath dominated by *Trichophorum germanicum*, the habitat mosaic being a result of variations in the depth of the underlying peat. These occur in a narrow wedge between T9 and T11 near the southern limit of the site; at and in the wider area of T12; to the immediate north of T7; to the north-east of T14; at and to the west of T4; and on low-lying ground to the north of the upland lake, the mosaic just entering into the nearby application site boundary.

E1.8 Dry modified bog

6.169 Most blanket bog habitat within the application area is of this type owing to the excavation of drainage ditches and moderate to high grazing pressure in many parts of the site.

6.170 An area of this habitat is present to the immediate east of one of the forestry blocks at the southern end of the site which occurs in a mosaic with rush-pasture around the margins of a small upland lake.

6.171 A small area of wet modified bog exists in a mosaic with wet heath to the immediate south-east of T4, the mosaic resulting from variations in the depth of underlying peat. The bog element of the mosaic is dominated by tussocks of *Eriophorum vaginatum*.

6.172 A narrow wedge of this habitat is present at T7 where it exists in a mosaic with *Juncus acutiflorus*-dominated rush-pasture. The bog element of the mosaic is dominated by tussocks of *Eriophorum vaginatum* and as a result of the effects of drainage, Sphagna are lacking in this area.

6.173 An area of blanket mire is present along the south-eastern leg of the application area where *Calluna* cover reaches 55%, there are scattered tussocks of *Eriophorum vaginatum* and a good carpet (40% cover) of peat-forming *Sphagnum papillosum*. Although scattered carpets of this *Sphagnum* are present there are drainage ditches present nearby, the area is over-grazed, and the bog vegetation is mixed with tussocks of Molinia. As such, it has been classified as dry modified bog.

6.174 Tracts of dry modified bog in a mosaic with wet heath and *Molinia*-dominated marshy grassland are present between T8 and T9, and also to the south-east of T12. In both areas *Calluna vulgaris* and *Eriophorum vaginatum* are co-dominant within the bog element of the mosaic.

G2 Running water

6.175 Several small, upland streams traverse the site including a stream which drains blanket mire habitat in the northern part of the site, traversing to the east of T7 and T12 in a south-south-easterly direction, terminating in the upland lake to the south of the application area; a small stream also exits the same lake and flows to the east, traversing the south-eastern leg of the application area. A third stream also traverses the southern leg of the application area between T8 and T9, in a southerly direction, flowing towards and then to the immediate west of two of the coniferous forestry blocks present at the southern limit of the site.

6.176 The larger streams each have a relatively shallow channel overall, with localised deep pools situated beneath where the channel is intersected by a rock outcrop. The channel base is typically shallow and rocky in the upper reaches but mud-based and deeper, to 1.5m depth, in lower-lying areas. The upper reaches occasionally support small carpets of aquatic bryophytes such as *Fontinalis antipyretica* but these are not abundant. The lower reaches and margins of the streams can also support linear beds of large *Carex* sedges, particularly *Carex rostrata* and occasionally also *C. diandra*.

6.177 Numerous other, more minor streams and drainage ditches are present across the site, often flowing into one of the above-mentioned larger streams.

Phase II NVC Habitat Surveys

6.178 The NVC communities identified during the survey are listed below:

- H10a *Calluna vulgaris-Erica cinerea* heath;
- M3 *Eriophorum angustifolium* bog pool community;
- M15 *Scirpus cespitosus-Erica tetralix* wet heath;
- M17 *Scirpus cespitosus-Eriophorum vaginatum* blanket mire;
- M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire;
- M20a *Eriophorum vaginatum* blanket and raised mire;
- M23a *Juncus effusus/acutiflorus*-Galium palustre rush-pasture, *Juncus acutiflorus* sub-community;
- M23b Juncus effusus/acutiflorus-Galium palustre rush-pasture, Juncus effusus sub-community;
- M25 *Molinia caerulea-Potentilla erecta* mire;
- MG7 *Lolium perenne* leys and related grasslands;
- MG10 *Holcus lanatus-Juncus effusus* rush-pasture;
- U2 *Deschampsia flexuosa* grassland;
- U4 *Festuca ovina-Agrostis capillaris-Galium* saxatile grassland;
- U5 *Nardus stricta-Galium saxatile* grassland;
- W9 *Fraxinus excelsior-Sorbus aucuparia-Mercurialis perennis* woodland.

6.179 More detailed descriptions of the habitats can be found in **Appendix 6.1: Ecology Annexes**. Descriptions are provided for each compartment (as outlined in **Figure 6.4**) as well as for each proposed turbine location. Quadrat data is also provided for both the NVC survey of the wider study area and a more focused assessment along the infrastructure layout.

Designated Nature Conservation Sites

Internationally Designated Nature Conservation Sites

6.180 The site is immediately adjacent to (and 4 turbines are located within) the northern section of Antrim Hills Special Protection Area (SPA). The SPA has been designated for its breeding populations of hen harrier *Circus cyaneus* and merlin *Falco columbarius*. Any potential impacts of the scheme on the designation features or conservation objectives of the designated site will be considered in Chapter 7:; Ornithology of this EIA.

6.181 The northern boundary of the site abuts to the Garron Plateau Special Area of Conservation (SAC). The SAC has been declared for its blanket bog, which is the largest intact bog in Northern Ireland. Nutrient poor lakes on the site conform to EU Habitats Directive Annex I types. Locally, mineral enriched flushing provides the alkaline fens priority habitat, and in hollows on the wetter more level parts of the blanket bog, the influence of mineral rich water provides the transition mires and quaking bog systems. The site supports a number of rare plant species, including Marsh saxifrage *Saxifraga hirculus*.

6.182 Annex I habitats that are a primary reason for selection of this site are:

- Active blanket bog; and
- Alkaline fens.

Annex I habitats that are present as a qualifying feature but are not a primary reason for selection of this site are:

- Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*;
- Natural dystrophic lakes and ponds
- Northern Atlantic wet heaths with *Erica tetralix*; and
- Transition mires and quaking bogs

An Annex II species that is a primary reason for selection of this site is

- Marsh saxifrage *Saxifraga hirculus*

Nationally Designated Nature Conservation Sites

6.183 The Garron Plateau is also designated as an Area of Special Scientific Interest (ASSI). There are also 13 ASSI's within 7.5km of the centre of the development site:

ASSI26: Cleggan Valley

6.184 The site is 1.7km from the proposed nearest turbine location. Cleggan Valley is known for its diversity of habitats and plant communities present. The site contains several specimens of the locally rare Bird Cherry (*Prunus padus*) and other scarce species include Northern Bedstraw (*Galium boreale*).

ASSI162: Straidkilly Wood

6.185 The site is approximately 4.5km to the north of the proposed development red line. Straidkilly Wood is one of the largest and least disturbed base-rich woodlands in north-east Antrim. It is of high quality with a well-developed structure and a good range of woodland floral communities.

ASSI408: Cranny Falls

6.186 The site is approximately 1.9km to the north of the proposed development red line. Cranny Falls is an ASSI for the presence of a rare plant Wood Barley *Hordelymus europaeus*. Cranny Falls is composed of a narrow, steep-sided wooded ravine, through which the Carnlough River flows, headed by a waterfall.

ASSI023 Glenarm Woods

6.187 The site is approximately 3.1km to the southeast of the proposed development. The bulk of the site is made up of semi-natural woodland, which joined together make up the largest stand of semi-natural woodland left within the Antrim region. The woodland types present range from base-rich and flushed to strongly acidic, which accounts for the high number of associated woodland plant communities. These incorporate one of the richest woodland plant assemblages in Northern Ireland, including a large number of rare and notable woodland species.

ASSI369: Glenarm Woods Part 2

6.188 The site is approximately 3.8km to the southeast of the proposed development. The site has been declared an ASSI because of its wood pasture habitat and associated species, characterised by old, open-grown trees and shrubs which have significant amounts of standing and fallen dead wood. These old open-grown trees provide a specialist habitat for rare and uncommon species of invertebrates, lichens and fungi.

Local Wildlife Sites

6.189 No Sites of Local Nature Conservation Importance (SLNCIs) are recognised in the Larne Area Plan 2010, the extant Local Development Plan. The Plan rather lists Nature Conservation Sites notified by RSPB and Ulster Wildlife Trust.

6.190 Therefore, the NIEA Natural Environment Map Viewer (which maps Local Wildlife Sites, which are equivalent in conservation interest to SLNCIs) was reviewed. Sites within 500m of the scheme red line are:

- Craigfad Loughs, notable for its grassland plant assemblage;
- Ticloy Water, important for its ancient woodland and parkland, and partly within the Glenarm Woods ASSI;
- Glencloy River, adjacent to the Feystown ASSI and supporting similar species-rich grassland;
- Doonan Leap & Doonan Water.

Biodiversity Action Plan (BAP) Habitat Action Plan habitats

6.191 NIEA requires reference to be made to any potential impacts of the scheme on habitats that are the subject of Northern Ireland Habitat Action Plans (HAPs). There are significant areas of blanket bog and heath habitats within the site Red Line, but these are mostly outside that part of the site that will be affected by construction or operation of the proposed wind farm.

Blanket bog

6.192 Blanket bog habitats typically occur in a mosaic with other habitats at Unshinagh and as such, most parcels are very unlikely to support active peat as indicator species such as *Sphagnum capillifolium, S. papillosum, Eriophorum angustifolium* and *E. vaginatum* are rather scattered and patchy in their occurrence across the site. No turbines are located on active blanket bog habitat. Only a single turbine, T12, is located within a parcel of M17 blanket bog/M15 wet heath mosaic, with localised areas of blanket bog within this mosaic not being active at the turbine location or to its east through which its access road traverses, this area instead supporting only scattered, small stands of one or more of the above-mentioned active peatland indicator species or wet heath on shallow peat; the same parcel of blanket bog/wet heath mosaic does support small, localised pockets of active peat to the west of T12, however as such areas (at Q46, Q48 and Q49) are present in a mosaic with inactive peat and also with wet heath, the parcel does not form a single hydrological unit of either active peat or blanket bog.

Purple moor-grass and rush pastures

6.193 *Molinia* is a frequent constituent of bog, heath and marshy grassland communities, and *Juncus* species are important in defining the extent of much of the marshy grassland on the site. The only type of this habitat present on site which aligns with the Priority Habitat as defined by NIEA are species-rich versions of M23a at nine quadrat locations – Q5, Q6 and Q8 within Compartment 2; Q56 and Q60 within Compartment 5; Q64, Q65 and Q71 within Compartment 4; and Q87 within Compartment 3.

Rivers

6.194 Minor streams that drain parts of the site are examples of the priority habitat, since they are headwater streams that contribute to the waters of the local major stream, the Glencloy River. The streams on the site have a natural aspect but, because of their youthful stage do not support significant vegetation communities. Further information on the rivers and streams on the site can be found in **Chapter 9: Geology and Water Environment**.

Hedgerows

6.195 Three sections of hedgerow occur along the northern and southern field boundaries where the site is accessed from the A42 Carnlough/Ballymena Road.

Upland Heathland

6.196 Three areas of upland heathland supporting M15 are present within the proposed development corridor – the first a small parcel situated a short distance to the south of T8 and a second to the immediate east of T8, both lying within Compartment 1; and a small parcel situated along the western boundary of the proposed application corridor leading to T12, within Compartment 5.

Species Action Plan species

6.197 Several non-avian species for which NIEA has published Species Action Plans (SAPs) occur or may occur in the study area. SAP species that are known to occur or may occur at the site include; Irish hare, all bat species (the subject of an all-Ireland SAP) and otter. Occurrence of and significance of impact on these species are discussed below.

Existing Ecological Records (NIPS)

6.198 The desk study found historical records of a number of Northern Ireland Priority Species (NIPS), BAP, and/or Red-or Amber-listed species of conservation concern (as defined by CEDaR).

Plants

6.199 There are dozens of records of Bluebell *Hyacinthoides non-scripta* and Primrose *Primula vulgaris* from many localities within 10km of Unshinagh. In addition, a large number of NI Priority Plant Species are known from the area including Parsley Fern *Cryptogramma crispa* from several localities on the Garron Plateau; Marsh Saxifrage *Saxifraga hirculus* from Collin Top, Loughgarve and Crockravar Mountain; Serrated Wintergreen *Orthilia secunda* from Glenarm Glen and the Cranny Water; Oblong-leaved and Great Sundews *Drosera intermedia* and *D. anglica* from the Garron Plateau; Small Cow-wheat *Melampyrum sylvaticum* from Glenarm Glen; Bog Orchid *Hammarbya paludosa* from several localities on the Garron Plateau; Tall Bog-sedge and Few-flowered Sedge *Carex magellanica* and *C. pauciflora* from several localities on the Garron Plateau; Betony *Stachys officinalis* from the Inver River; Moonwort *Botrychium lunaria* from Glenarm Glen; Alpine Clubmoss *Diphasiastrum alpinum* from the Inver River; Great Burnet *Sanguisorba officinalis* from Lemnalary ASSI; Limestone Bedstraw *Galium sterneri* from several localities on the Garron Plateau; and Irish Lady's-tresses *Spiranthes romanzzoffiana* from Gortnagory ASSI, the Cranny Water and Loughnatrosk.

6.200 The bog-mosses *Sphagnum fuscum* and *S. imbricatum* are also recorded from the Glenariff area; Dark-leaved Willow *Salix myrsinifolia* from the Glenballyemon area; Meadow Cranesbill *Geranium pratense* from Glenarm Estate (of horticultural origin as its native range within Northern Ireland is restricted to a few localities along the northern coastline); Al[pine Meadow-rue *Thalictrum alpinum* from the Pollan Burn; Victorian records of Shepherd's-needle *Scandix pecten-veneris* from the Carnlough area and Slender Thistle *Carduus tenuiflorus* from the Inver River; Frog Orchid *Dactylorhiza viridis* from Glenarm Park; Wood Cranesbill *Geranium sylvaticum* from Glenarm Forest; Green-flowered Helleborine *Epipactis phyllanthes* from Glenarm Park; Juniper *Juniperus communis* from several localities on and around the Garron Plateau; Opposite-leaved Pondweed *Groenlandia densa* from Loughnatrosk on the Garron Plateau; and Field Gentian *Gentianella campestris* from the Glenariff area.

6.201 Birds-nest Orchid *Neottia nidus-avis* is known from Glenarm Forest and Straidkilly Wood; the Whitebeams *Sorbus hibernica* and *S. rupicola* from the areas of Glenariff and Garron Point; Lesser and Greater Butterfly-orchids *Platanthera bifolia* and *P. chlorantha* from several localities including Upper Glencloy and Glenarm Glen; Small an old record of White-orchid *Pseudorchis albida* from Glenarm Glen; Intermediate Wintergreen *Pyrola media* from Upper Glencloy and Straidkilly; Yellow Birds-nest *Monotropa hypopitys* from Straidkilly Wood; Lesser Twayblade *Listera cordata* from Cranny Lough; late Victorian records of Stag's-horn Clubmoss *Lycopodium clavatum* from the River Inver; Wood Barley *Hordelymus europaeus* from the Cranny Water; old records of Oak Fern *Gymnocarpium dryopteris* from the Pollan Burn (now likely extinct in the area); the Marsh-orchids *Dactylorhiza traunsteineri* and *D. lapponica* (now lumped as *D. traunsteinerioides*) from the Garron Plateau; Bee Orchid *Ophrys apifera* from the Carnlough area; and Cowslip *Primula veris* from Cranny Falls.

Mammals

6.202 There are CEDaR records of otter *Lutra lutra,* badger *Meles meles,* Irish hare *Lepus timidus hibernicus,* pine marten *Martes martes,* Irish stoat *Mustela erminea subsp. hibernicus,* red squirrel *Sciurus vulgaris* and hedgehog *Erinaceus europaeus* from the surrounding area. Irish hare and Irish stoat are likely to be at least occasional visitors to the site, if not resident. While pine marten and red squirrel are more likely to be present in wooded areas around the periphery of the proposed Development area, as well as a few blocks of coniferous forestry within the Red Line boundary.

Herpetofauna

6.203 There are records for common lizard *Zootoca vivipara,* smooth newt *Triturus vulgaris* and common frog *Rana temporaria* from the Garron Plateau.

Species Baseline

Bats

6.204 A site visit was undertaken during April 2021 to consider the potential value of habitats and landscape features within 200m of the site (i.e. the study area). The presence of any features that could support maternity roosts and significant hibernation and/or swarming sites (both of which may attract bats from numerous colonies from a large catchment) within 200m plus rotor radius of the boundary was also considered.

6.205 The landscape surrounding the site consists of several features that have potential to provide habitat for bats, notably open moorland, acid grassland; ponds as well as several watercourses. However, overall habitat quality is poor due to a combination of the exposed nature of the site and the high grazing pressure from livestock which have resulted the site having very limited shelter and vegetation in order to provide suitable foraging conditions.

6.206 Thence, the overall foraging potential of the study area is considered 'poor' as it comprises mostly heavily grazed degraded blanket bog, heath and marshy grassland. However, the site is connected to the wider landscape by linear features (i.e. minor watercourses) that could be used by commuting bats. Habitats and landscape features (i.e. moderate) that may be used by bats are illustrated on **Figure 6.2**.

6.207 The overall potential of the site was of 'low' value taking into consideration the landscape of the general area, the habitats and landscape features identified on the site, the distance from the proposed (14) turbines and the potential use of the site by bats for roosting, foraging and/or commuting. However, given the large size of the site there wis also features of 'moderate' interest to bats (i.e. watercourses and sheltered area near the coniferous forestry plantations.

Automated Passive Monitoring

6.208 Automated passive monitoring was undertaken at the site across spring, early summer, late summer and autumn during 2021. Monitoring took place at a wide range of potential turbine locations (see **Figures 6.5** and **6.6: Static (Bat) Detector Locations**).

6.209 Across the 2021 monitoring season (spring, summer & autumn), automated monitoring was carried out for 391 nights (estimated total hours = 3128 hours (based on an average of eight hours recording per night (although night length varies across the survey season)). Bat species recorded during automated passive monitoring included; common pipistrelle, soprano pipistrelle, pipistrelle spp., Nathusius pipistrelle, Leisler's bat, *Myotis* species. *Myotis daubentonii, M. nattereri* and *M. mystacinus* are the most difficult species to identify and are therefore collectively referred to as *Myotis* bats (Russ 1999[8] & Russ 2012[9])), as well as a few records for brown long-eared bat.

6.210 During spring (across the 10 potential turbine locations which were monitored) there were a total of 101 nights of combined monitoring. Of these, 78 nights recorded 'negligible' or 'no activity'; 8-nights recorded was 'low' activity; 6-nights recorded 'moderate' activity; 7-nights recorded 'high' activity and 2 nights recorded 'near constant' activity.

6.211 During the early summer round of monitoring there were 50-nights of monitoring at 5 potential turbine locations. Of this there were 14-nights with negligible or no activity; 14-nights with low activity; 8-nights with moderate activity; 12-nights with high and 2-nights with 'constant' activity.

[8] Russ, J. (1999) *The Bats of Britain and Ireland, Echolocation Calls, Sound Analysis and Species Identification*, Alana Ecology Ltd, Shropshire.
[9] Russ, J. (2012) *British Bat Calls, A Guide to Species Identification*, Pelagic Publishing, Exeter.

6.212 During the late summer monitoring there were 110 nights of monitoring at 11 potential turbine locations. Of these, 40-nights showed ‘no’ or ‘negligible’ activity; 63-nights had ‘low’ activity; while 7-nights had moderate activity.

6.213 During the autumn monitoring round there were 130-nights of monitoring at 13 potential turbine locations. Of these 122-nights recorded ‘no’ or ‘negligible’ activity levels, with the remaining 8-nights of showing ‘low’ activity levels.

Table 6.7: Description of levels of bat activity (adopted from Mathews et al., 2016)

Description	Bat Activity Index	Interval between passes
Negligible	<1	>60 minutes
Low	1 - 5	12 - 60 minutes
Moderate	5 - 12	5 - 12 minutes
High	12 - 60	1 - 5 minutes
Near-constant	>60	<1 minute

6.214 **Appendix 6.1: Ecology Annexes** contains Bat Activity Indices (BAI) for the static surveys, broken down by location (see **Figures 6.5** and **6.6: Static (Bat) Detector Locations**). These indices are based on the total number of files (containing a recording) of each species, divided by the total number of survey hours for that location.

6.215 Overall, during 391 nights of monitoring; there were 347-nights with either negligible or low levels of bat activity. While moderate levels were experienced during 21-nights; 19-nights were high and 4-nights with near constant activity. Therefore, a detailed BMMP (Bat Monitoring Mitigation Plan) is required (post-consent).

Thermal Imaging Surveys

6.216 The thermal imaging surveys aimed to supplement the data collected during the automated passive monitoring by attempting to determine the number and location (including direction of travel) of bats visible from the vantage point (see **Figure 6.5**).

Table 6.8: Dates, times and weather conditions thermal imaging surveys (vantage point)

Date	Sunset	Sunrise	Start / Finish	Weather Conditions		
				Temp	Wind (mph)	Cloud
03 June 2021	2154		2139 - 0009	12ºC	1-2	60%
09 July 2021	2159		2144 - 0014	14ºC	1-2	50%
23 Aug 2021	2038		2023 - 2253	11ºC	0-1	35%

6.217 A total of 7.5 hours of recording time was noted across the three thermal imaging (bat activity) surveys. However, very few bats were observed during the vantage point surveys. This would indicate that either, small numbers of bat are being recorded repeatedly by the same detectors across individual nights; or bats are present in moderate to significant numbers (but only during specific meteorological conditions which favour insect abundance). The surveys did not happen to coincide with the latter conditions.

6.218 Temporal patterns of bat activity most likely reflect changing weather conditions across the survey season.

6.219 The results of bat activity surveys confirmed commuting and foraging activity within the site. The results yielded significant periods of bat activity across parts of the site and would require that the initial assessment of Unshinagh as a 'low' value site for bats be upgraded to moderate/high (at least sporadically when weather conditions permit).

Bat Roost Potential Surveys

6.220 During the final stages of infrastructure design the site entrance was moved to meet the main A42 Ballymena/Carnlough Road. This will have an impact on an small semi-natural woodland copse (ash/hazel) growing on an embankment overlooking the road. All mature trees within the potential zone of impact were assessed for their Bat Roost Potential during a site visit undertaken during September 2021. However, as the surveys were undertaken outwith the core period for bat activity surveys (May-Aug) an endoscopic survey (under licence) was undertaken on the four trees which were identified as having 'moderate' BRP during ground level surveys. A professional tree climber was engaged in order to undertake a closer inspection of the PRFs (Potential Roost Features).

6.221 During a second site visit a thorough aerial inspection of the PRFs on the four trees was conducted by the tree climber under supervision from an ecologist at ground level (also using a wireless endoscope). On closer inspection, the PRFs were able to be reclassified to 'low', due to limited space and unsuitable conditions for roosting bats. In addition, no bats or field signs which could be attributed to bats were found during the endoscopic inspection survey. Photographs and the licence issued by NIEA can be reviewed in **Appendix 6.1: Ecology Annexes**.

Other Mammals

Otter

6.222 The presence of this species within the site was not confirmed during otter surveys. There were no otter holts, foraging areas or field signs recorded. The watercourses within the site are small upland streams, which are devoid of any significant riparian vegetation. However, these small rivers flow downstream into the Glencloy River or the River Braid, both of which are home to otters. Therefore, there is the potential for otters to come upstream during dispersal of young animals or when travelling between the numerous minor catchments within the wider catchment.

Badger

6.223 The presence of this species within the site was not confirmed during badger surveys. There were no setts recorded, and field signs such as foraging/trails were no definitive evidence of badger. However, badgers were recorded during the camera trapping sessions for red squirrel & pine marten. Therefore, badgers do forage over the area and there is the potential for setts to be encountered.

Herpetofauna

Viviparous Lizard

6.224 Lizard *Lacerta vivipara* surveys commenced when the first thirty (500x500mm artificial refugia) were placed across the site on during May 2021. These were left in-situ for at least a week to allow the lizards to become acclimatised to their presence. This coincides with the NIEA Specific Requirements (in force at the time of survey) for this species, which states that "surveys should be carried out between March and October. With the best time for surveys to be undertaken is generally April-May and in September."

Table 6.9: Results of the common/viviparous lizard surveys carried out during 2021

Date/Time	Weather	Results
21/05/21	14ºC sunny and calm	4 (all 4 recorded from refugia)
31/05/21	13ºC Some cloud but mostly clear, intermittent light showers and sunny spells	5 (4 recorded from refugia; 1 recorded along the walked transect)
22/09/21	14ºC Some cloud but mostly clear and sunny spells	4 (all 4 recorded from refugia)

6.225 A maximum total of 5 adult lizards were recorded using a total of seven refugia (see **Figure 6.8**). The results of the common lizard surveys reveal a population score of 1 (low population[10]) (with 7 individuals recorded). It is likely that the habitats surrounding T7 as well as adjacent to T12 and T13 are also potentially good habitat for this species. Albeit, optimal habitat that is degraded via overgrazing. Whereas the habitats surrounding T1, T2 & T4 and possibly T6 may also be suitable habitat for this species. sub-optimal (due to heavy sheep grazing) but that lizards are likely to be present (at low population densities).

Smooth Newt

6.226 The site is pockmarked with small permanent and ephemeral ponds. Initial walkover surveys identified 27 water bodies within the site boundary; 25 of these were assessed

[10] Froglife Advice Sheet 10 Reptile Survey, an introduction to planning, conducting and interpreting surveys for snake and lizard conservation

to have HSI values above 0.5 (see **Figure 6.9**). The latter were therefore subject to torchlight surveys.

Table 6.10: Results of the 2021 (nocturnal) surveys for smooth newt

Survey visit	Date	Sunset	Temperature (˚C)	Rain	Wind (mph)
1	23/03/2021	18:44	6 - 9	No	10 - 11
2	31/03/2021	19:59	8	No	11 - 12
3	21/04/2021	20:39	6 - 8	No	6
4	25/05/2021	21:42	9	No	10
5	09/06/2021	22:00	14 - 16	No	9 - 10

6.227 **Appendix 6.1: Ecology Annexes** contains summarises for the newt survey results for the 25 ponds that were subject to torchlight surveys. Additional visits were not conducted at ponds which were found to be dry during the first or second. Ponds 12 and 19 were not included in the torchlight surveys, as they had HSI values below 0.5.

6.228 Newts were recorded at ponds: 5, 10, 11, 18, 20 and 26. Ponds 5, 10, 20 and 26 had maximum counts of below 10 individuals and therefore are considered to support small smooth newt populations. Ponds 11 and 18 had maximum counts of 22 and 35 respectively and are therefore considered to support medium sized populations of smooth newt.

Lepidoptera

Marsh Fritillary Survey

6.229 The presence of *S. pratensis* (the LHP of *Euphydryas aurinia*) was confirmed within the site.

6.230 Over the whole site *S. pratensis* was thinly recorded within areas of rush pasture, each field was estimated to contain between 15 and 25 plants. In view of the limited extent of suitable habitat and the distance from any known breeding colonies, the site is considered to have negligible potential for breeding marsh fritillaries. The size and extent of these patches were too small to map at any meaningful scale.

6.231 The presence of marsh fritillary larval webs was not confirmed on any of these plants. This butterfly exists in a series of linked meta-populations, forming numerous temporary sub-populations, which frequently die out and recolonise. Where unable to do this, populations do not seem to be able to persist in habitat fragments.

6.232 In addition to this marsh fritillary is typically found in either dry calcicolous grassland or damp neutral or acidophilous grassland and mires. A common factor in many occupied sites is the presence of low-intensity cattle grazing which creates the preferred sward for the butterfly. The intensive sheep grazing across much of the site has created poor sward conditions and the absence of suitable habitat which is highly unlikely to favour marsh fritillary; therefore, this species has been removed from any further assessment.

Assessment of Impacts

General

6.233 Having defined the ecological baseline characteristics of the study area, it is necessary to describe the potential resultant scheme-related changes to the baseline and to assess the impact on valued ecological resources (CIEEM 2018)[11]. The process of identifying impacts refers to aspects of ecological structure and function on which a resource feature depends. Examples of aspects of ecological structure and function to consider when predicting impacts include (CIEEM 2018):

- Available resources (Territory: hunting/foraging grounds; shelter and roost sites; breeding sites; corridors for migration and dispersal; stop-over sites);
- Stochastic processes (Flooding, drought, wind blow and storm damage, disease, eutrophication, erosion, deposition and other geomorphological processes, fire and climate change);
- Ecological processes (Population dynamics: population cycles; survival rates and strategies; reproduction rates and strategies; competition; predation; seasonal behaviour; dispersal and genetic exchange; elimination of wastes. Vegetation dynamics: colonisation; succession; competition; and nutrient-cycling);
- Human influences (Animal husbandry, cutting, burning, mowing, draining, irrigation, culling, hunting, excavations, maintenance dredging, earth shaping, ploughing, seeding, planting, cropping, fertilising, pollution and contamination, use of pesticides and herbicides, introduction of exotics, weeds and genetically modified organisms and disturbance from public access and recreation, pets and transport);
- Ecological relationships (Food webs, predator-prey relationships, herbivore-plant relationships, herbivore-carnivore relationships, adaptation and dynamism);
- Ecosystem properties (Fragility and stability, carrying capacity and limiting factors, productivity, community dynamics; connectivity; source/sink; numbers in a population or meta-population, minimum viable populations; sex and age ratios; patchiness and degree of fragmentation);
- Ecological role or function (decomposer, primary producer, herbivore, parasite, predator, keystone species).

6.234 Impacts on ecosystem structure and function are assessed by reference to the following parameters:

[11] Chartered Institute of Ecology & Environmental Management (CIEEM) (2018) *Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine (September 2018).*

- Positive or negative impacts, with international, national and local policies increasingly pressing for projects to deliver positive biodiversity outcomes
- Magnitude, or size of an impact, which in the case of habitat may be coincident with extent
- Extent over which an impact is felt
- Duration of time over which the impact is expected to last prior to recovery or replacement of the resource or feature
- Reversibility, or whether an impact is permanent or temporary
- Timing and frequency of an activity, which may have different impacts depending on, for example, the season during which it is carried out.

6.235 EIA legislation requires the enumeration of significant negative or positive impacts of an activity on ecological features. An ecologically significant impact is here defined as an impact on the integrity of a defined site or ecosystem and/or the conservation status of habitats or species within a given geographical area (CIEEM 2018). The significance of an impact depends on the importance of a receptor as defined in **Table 6.1** and on the magnitude of the impact on that receptor as defined in **Table 6.2**. Receptor impacts may be averaged against each other to assess the significance of the impact of the scheme on the site's natural environment, but in some cases a single receptor, for example an internationally important species or habitat, may be of sufficiently critical importance that the magnitude of impact on that single receptor defines the significance of the impact on the site. The following narrative assesses the significance of the impact of the Development.

Construction Phase

6.236 Activities that may be associated with construction of the Development and that may generate impacts on the natural environment near the proposed scheme include:

- Disturbance of designation features/designated sites;
- Disturbance to protected species;
- Construction of hard surfaces for access roads, turbine bases and construction platforms;
- Construction on new ground, leading to habitat and population constriction and/or fragmentation;
- Storage of materials and plant, and construction of site compounds;
- Environmental incidents and accidents (e.g. spillages, noise and emissions;
- Excavation works;
- Removal and redistribution of topsoil and subsoil;
- Provision of temporary access routes;
- Disruption or modification of drainage;
- Vegetation clearance; and
- Implementation of landscape design and habitat management.

6.237 The significance of the potential effects of the proposed scheme on valued ecological receptors during the construction phase has been assessed and outlined in the following sections.

Permanent loss of habitats due to land-take

6.238 The footprint of wind farm infrastructure (including the BESS) will involve permanent land-take, due to the construction of around 18.3 ha (183540m^2) consisting of new access track (including turning heads), and the construction of substation and control building, 14 crane pads and turbine bases (see **Chapter 1: Proposed Development**).

6.239 The design of the wind farm layout has evolved in part by taking into account the location of NI Priority Habitats and the NIEA, Natural Heritage, Development Management Team Advice Note – Active Peatland and PPS18.

6.240 The location of all 14 turbines, the BESS and the route of the access tracks have been chosen, as far as is possible, to minimise impacts to habitats of conservation significance.

6.241 There is likely to be a limited effect on active blanket bog. T8 is located on the margin of an extensive area of the habitat. T6 is located in a mosaic of habitats of generally low conservation interest, of which a poorly-developed M18 bog community is a part. The other proposed turbine locations are separated via an adequate buffer from areas identified as blanket bog by habitats, mainly species-poor acid grassland, of lower conservation interest.

6.242 **Table 6.11** lists the NVC communities and habitat condition at each turbine location.

Table 6.11: NVC community and habitat condition at each turbine location

Turbine	NVC	Habitat condition
T1	M23a	South-oriented fan of rush-pasture, quite species-poor.
	MG10	Extensive area of species-poor rush-pasture dominated by *Holcus lanatus* and *Juncus effusus*, indicating some agricultural improvement.
T2	M15	Wet heath present in complex mosaic with mire and acid grassland owing to past heavy grazing pressure and varying peat depths in local area.
	M17	Blanket mire dominated by *Trichophorum germanicum*, in mosaic with wet heath and acid grassland on account of varying peat depths and past heavy grazing pressure. Peat not active.
	M20	Mire dominated by *Eriophorum vaginatum* present in mosaic with wet heath and acid grassland on account of varying peat depths and former heavy grazing pressure. Peat very unlikely to form an active hydrological unit.
	U2	Acid grassland in complex mosaic with mire and wet heath habitats on account of varying peat depths and former heavy grazing pressure.
T3	MG10	Extensive area of species-poor rush-pasture dominated by *Holcus lanatus* and *Juncus effusus*, indicating some agricultural improvement.
	M23a	The dominant habitat type at the location of T3, present in a mosaic with MG10 and M25 owing to varied topography and former heavy grazing pressure.
	M25	Present on sloping ground in mosaic with MG10 and M23a; species-poor.
	M15	Wet heath grading into M17 mire owing to varying peat depths; also in mosaic with M25 owing to grazing pressure.

T4	M17	In mosaic with wet heath owing to varying peat depths; also M25 due to grazing pressure. Peat not active.
	M25	In mosaic with M15 and M17 owing to varying peat depths and grazing pressure.
T5	MG10	In large-scale mosaic with M23a rush-pasture.
	M23a	In large-scale mosaic with MG10 rush-pasture.
	M25	Small area on sloping ground within wider mosaic of M23a and MG10 rush-pastures.
T6	M23a	In complex mosaic with MG 10 rush-pasture, U2 acid grassland, M17 mire and M25 mire.
	MG10	In complex mosaic with M23a rush-pasture, acid grassland and mire habitats.
	U2	In complex mosaic with rush-pasture and mire habitats.
	M17	In complex mosaic with rush-pasture, acid grassland and M25 mire. Active peat not present.
	M25	In complex mosaic with rush-pasture, acid grassland and M17 mire.
T7	M23a	In complex mosaic with MG10 rush-pasture, mire and wet heath habitats.
	M20	In complex mosaic with rush-pasture, wet heath, and M17 and M25 mire habitats. Peat very unlikely to form an active hydrological unit.
	M15	In complex mosaic of rush-pasture and mire habitats.
	M17	In complex mosaic of rush-pasture, wet heath and M20 and M25 mire habitats. Active peat absent.
	MG10	In complex mosaic with M23a rush-pasture, wet heath and mire habitats.
	M25	In complex mosaic with rush-pasture, wet heath, and M17 and M20 mire habitats.
T8	MG10	Extensive area of species-poor rush-pasture dominated by *Holcus lanatus* and *Juncus effusus*, indicating some agricultural improvement. Grades into M15 to east.
	M15	Extensive area of M15 wet heath with extends westwards into application area where it grades into MG10 to the west.
T9	MG10	Extensive area of species-poor rush-pasture dominated by *Holcus lanatus* and *Juncus effusus*, indicating some agricultural improvement.
T10	MG10	In mosaic with M23b rush-pasture, indicating some agricultural improvement.
	M23b	In mosaic with MG10 rush-pasture, in area subjected to some agricultural improvement.
T11	MG10	Species-poor rush-pasture indicating some degree of agricultural improvement.
T12	M15	In mosaic with M17 mire owing to varying peat depths.
	M17	In mosaic with M15 wet heath owing to varying peat depths. Active peat absent.
T13	M25a	Predominance in area likely due to previous disturbance event such as fire of heavy grazing pressure.
T14	H10a	In complex mosaic with wet heath, rush-pasture and mire habitats.
	M15	In complex mosaic with dry heath, mire and rush-pasture habitats.
	M25	In complex mosaic with dry heath, wet heath, mire and M23a rush-pasture habitats.
	M17	In complex mosaic with dry heath, wet heath and rush-pasture habitats; no active peat present.
	MG10	In complex mosaic with dry heath, wet heath, mire and M23a rush-pasture habitats.
	M23a	In complex mosaic with dry heath, wet heath, mire and MG10 rush-pasture habitats.

6.243 In summary, **Figure 6.2** shows that much of the access track, as well as the BESS, substation (and both temporary construction compounds) are in areas of neutral, acid/marshy or improved grassland. The significance of the effect of this impact on a low value habitat is assessed as being negligible to minor and hence is acceptable without further mitigation.

6.244 The site at Unshinagh is a complicated mosaic of habitats due to topography, drainage and grazing. Most parts are not a single uniform habitat over any substantial distance. But rather the habitats can grade and change over even a few metres. Therefore, estimating the exact loss of habitat types and hence the overall loss of NI Priority Habitat has been estimated in the table below. These mosaics either represent an NI Priority Habitat or contain substantial areas of said habitats. They have been included as a precautionary basis even when in a mosaic with species poor habitats of lower conservation value.

Table 6.12: Habitat loss calculations by habitat type (M^2)[12]

Habitat	Loss
M19 M25 Mosaic	2787
M25a	2421
M15 17 Mosaic	13930
M15 M25 Mosaic	9161
M15 M17 M19 M25 Mosaic	2455
U2 M10 Mosaic	1375
M15 M19 M25 Mosaic	2473
W9	729
H10a M15 M25 mosaic	1710
M15 M17 M20a U2 Mosaic	9658
M15 M20a Mosaic	2683
M15 U2 Mosaic	775
M17 M25 Mosaic	1700
M15	385
M25a Acid Grassland Mosaic	5134
U2 H10a Mosaic	2485
U2 MG10 M15 Mosaic	1457
M20 M23a Mosaic	463
H10a M23 Mosaic	720
Total	62501 m^2

6.245 The loss of approximately 7.33[13] ha of degraded blanket bog, wet heath/heathy acid grassland and PMGRP habitats is a permanent and direct effect of medium to high magnitude on receptors of high value and sensitivity. The loss of these NI priority habitats is assessed to be an adverse effect of **moderate magnitude** on receptors of high value. Since land take (and hence habitat loss) will be long term, this means

[12] Calculated using a continuous 1.5m buffer around all construction structures and a 8m wide track (5m for running surface and 1.5m either side for shoulders/drainage.
[13] Includes an additional 10800m2 of loss for permanent spoil storage

that the effect is of **moderate adverse significance** and further mitigation is required.

6.246 In addition, there will be a temporary loss of 2.86 ha due to the need for spoil storage during construction. However, these areas will be restored to their original levels post-construction and impacts should be only minor adverse, of limited duration and reversibility.

6.247 However, under the "*Biodiversity Net Gain Good practice principles for development*" and to achieve net gain locally to the Development while also contributing towards nature conservation priorities at local, regional and national levels. There will be management implemented to both enhance existing and also create new/enhance habitat over 63.2ha of suitable lands. An outline HMP (Habitat Management Plan) is presented in **Appendix 6.1: Ecology Annexes**.

Bats

6.248 Construction activities have the potential to remove foraging habitat or reduce its value, and to disrupt flight-lines. Studies in Britain indicate that most bat activity is near habitat features. Activity declines with distance from features such as treelines and woodland edge and is generally not significant at distances greater than 50 m (Natural England 2014[14]). This decline occurs both when bats are commuting and when foraging, although the decline is greater when animals are commuting. The potential impact of loss of feeding habitats may vary seasonally, with greater impact during the summer, and lower impact during migration.

6.249 The four blocks of coniferous plantation forestry will be felled prior to construction taking place. These will not be replanted. Therefore, the shelter provided for foraging will be removed, potentially changing foraging patterns at the local level. However, there is significant alternative plantation edge habitats within close proximity to the site, notably at Cleggan Forest to the northwest.

6.250 A few river crossings will also be required during construction, and therefore this may cause some limited disruption to foraging areas. However, most bat activity will likely continue as the main areas of better foraging along the stream corridors will remain untouched during construction activities and key commuting routes will therefore be unaffected.

6.251 The other main potential impact on bat populations that may arise due to construction is the loss of roost sites. However, no roosts were identified on the site during survey, and the nearest potential roosting location is 450 m away from the nearest turbine. Therefore, this impact will not arise at the Development. The magnitude of construction activities on bats is likely to be **neutral**, and the significance of the impacts will be **neutral**.

[14] Natural England Technical Information Note TIN051 Third edition February 2014, Bats and onshore wind turbines Interim guidance.

Otter

6.252 Impacts of construction works on otters includes damage to holts, disturbance at holts, disruption of dispersion and foraging routes and displacement of foraging or breeding animals. Disturbance of otters is possible during the construction phase, but the shy species is likely to avoid areas of intense human activity, particularly when this involves significant noise. Potential indirect impacts include adverse effects on fish prey species. The species is largely crepuscular in its habits, and it is likely that much of its activity will take place outside normal working hours. However, the reaction of individual otters to disturbance is unpredictable, with some inquisitive animals drawn to investigate work sites, whilst others avoid them. The likely sporadic nature of any use by otters of the site, indicates that there is highly unlikely to be any significant impact on the species as a result of construction activities. Magnitude of impacts is likely to be **negligible to neutral** and of **neutral** significance.

Badger

6.253 Potential conflicts with badgers (arising from construction) include damage to setts, disturbance at setts, and removal of foraging areas and displacement of foraging or breeding animals. Construction works may present additional hazards to badgers, with a potential for entrapment within excavations, accidental injuries on construction plant or materials, diversion from traditional trails by plant and site compounds and exposure to oils and other toxic materials.

6.254 There are no known badger setts located within the Development and thus there is low potential for such disturbance to occur. Badgers have crepuscular and nocturnal foraging habits, and it is unlikely that daytime construction activities will disturb or reduce the foraging range of the local social group. However, construction of access tracks, crane bases, foundations and erection of turbines will reduce the area available for foraging.

6.255 There is also the potential risk of displacement of sensitive animals unaccustomed to high levels of anthropogenic activities. The potential magnitude of impact (without mitigation) on badgers during the construction phase is moderate adverse magnitude and significance.

6.256 However, despite intensive surveys of the site, no known badger setts has been identified and as such that there are no sett entrances are within 25m of any infrastructure. As a result of this, the potential impacts of the Development on the local badger population are assessed to be **neutral** during construction.

Common Lizard

6.257 Construction of infrastructure will remove habitat for this species and cause disturbance leading to displacement of animals over a limited area of the site. It also has the potential to impact the habitat feature/requirements that lizards need within suitable habitat; this includes areas for basking, foraging, diurnal shelter and hibernation. The recorded use of the site by this species indicates that these impacts have the potential to be of **moderate adverse magnitude** and of **moderate adverse significance**. Therefore, mitigation is required (see paragraphs 6.325 – 6.334).

Smooth Newt

6.258 Construction of infrastructure will potentially remove terrestrial habitat for this species and cause disturbance leading to displacement of animals over a limited area of the site. It also has the potential to impact the habitat feature/requirements that smooth newts require within suitable habitat; this includes areas for foraging, diurnal shelter (particularly for sub-adults) and hibernation. The recorded use of the site by this species indicates that these impacts have the potential to be of **moderate adverse magnitude** and of **moderate adverse significance**. Therefore, mitigation is required (see paragraphs 6.335 – 6.340).

Operational Phase

6.259 Characteristics of wind farms that may generate impacts on the natural environment in the vicinity of the proposed scheme include:

- Replacement of former semi-natural habitats by turbines and associated infrastructure;
- Use of a swept volume of air space by turbine rotors;
- Vehicular use of access routes; and
- Improved access to remote sites.

6.260 Many of the impacts on biological receptors noted for the construction phase are also relevant during the operational phase. However, effective land take is reduced following the construction phase, as temporary site compounds and vehicle and plant running surfaces are returned to their former vegetation cover, and disturbance pressures arising from human presence along the route are significantly reduced.

6.261 Impacts on valued ecological receptors are outlined below.

Habitats

6.262 No adverse effects on vegetation communities and habitats are anticipated during the operation of the Development. Significant positive effects, through habitat restoration and enhancement, i.e., the reinstatement of heathland and blanket bog are anticipated through implementation of the outline HMP (Habitat Management Plan) in **Appendix 6.1: Ecology Annexes**.

Bats

6.263 The main potential impacts on bats during the operational phase arise from collision with rotors and from ‘barotrauma’, the often-fatal injuries that occur as a result of bats flying through air of rapidly changing atmospheric pressure in the immediate vicinity of a moving blade. The turbines have been located away from the habitat features that many species of bat use as flightlines or as a focus for foraging.

6.264 There is potential for loss of foraging area because bats may avoid a turbine site. Alternatively, there is some evidence that bats may be attracted to turbines (Kunz et al 2007[15]), possibly because insects may congregate in these locations as a response to the heat radiating from the structures (Ahlén 2003[16]). This effect is most likely to occur in calm conditions, or at low wind speeds, when collision risk for bats is likely to be at its highest.

6.265 A further possible operational impact is that ultrasound emissions from turbines may interfere with bats' echolocation capabilities. The literature addressing this effect is sparse and it is likely that impacts on Irish bat species is limited (European Commission 2010[17)]. **Table 6.13** outlines the bats likely to be at risk from wind turbines.

6.266 Seasonal variation in impacts of operational turbines on bats in Ireland is at present not fully understood. Movement of bats over long distances within a limited time period may produce a concentration of animals that are available for collision. Studies have shown that there is a peak in mortality in late summer and autumn during dispersal and migration, and that migrating species are most susceptible (Rodrigues et al 2008[18]). However, it is not known to what extent Irish bats migrate, which species, if any, are involved, whether migration is on a broad or narrow front, and whether there are discernible migration routes. It has been suggested that collisions during migration may be exacerbated because echolocation is not used in order to save energy (Keeley et al 2001[19]).

6.267 Late summer and autumn are also the period during which there may be increased activity associated with finding mates, and differentiating between migration and mating-related causality of mortality at turbines is problematic (Cryan and Barclay 2009[20]). Recent research into Leisler's bat in Ireland (Boston, 2008[21]) showed that this species does not migrate long distances between summer ranges and hibernation sites. Leisler's have been shown to hibernate within Ireland and do not appear to migrate in numbers on a broad front. This is likely to significantly reduce the collision risk for this species in the Irish context. However, in the absence of definitive data for all species, it is not possible to assess the likelihood, and hence the significance, of collision risk during putative migration periods. **Table 6.13** outlines the risk of collision fatalities affecting bat populations identified from the site.

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[15] Kunz, T.K., Arnett, E.B., Erickson, W.P., Alexander, A.R.H., Johnson, G.D., Larkin, R.P., Strickland, M.D., Thresher, R.W. & Tuttle, M.D. (2007) Ecological impacts of wind energy development on bats: questions, research, needs and hypotheses. – Frontiers in Ecology and the Environment 5: 315-324.R.

[16] Ahlén, I. (2003) Wind turbines and bats – a pilot study. – Report to the Swedish National Energy Administration, Dnr 5210P-2002-00473, P-nr P20272-1.R.

[17] European Commission (2010) Guidance on wind energy development in accordance with the EU nature legislation. European Commission, Brussels.

[18] Rodrigues, L., Bach, L., Duborg-Savage, M-J., Goodwin, J. & Harbusch, C. (2008) Guidelines for consideration of bats in wind farm projects. – EUROBATS Conservation Series No. 3, UNEP/EUROBATS Secretariat, Bonn.

[19] Keeley, B., Uogretz, S. & Strickland, D. (2001) Bat ecology and wind turbine considerations. –pp135-141 in Schwartz, S.S. (2001, ed) Proceeding of the National Avian-Wind Power Planning Meeting IV, Carmel, CA, May 16-17, 2000.

[20] Cryan, P.M. and Barclay, R.M.R. (2009) Causes of bat fatalities at wind turbines: hypotheses and predictions. Journal of Mammalogy, 90(6):1330–1340.

[21] Boston (2008) Molecular ecology and conservation genetics of the Leisler's bat (*Nyctalus leisleri*) in Ireland. Unpublished Ph.D Thesis.

Table 6.13: Level of potential vulnerability of populations of N. Irish bat species[22]

Relative abundance		Low collision risk	Medium collision risk	High collision risk
	Common species			Common pipistrelle Soprano pipistrelle
	Rarer species	Brown long-eared bat Daubenton's bat		Nathusius' pipistrelle Leisler's Bat
	Rarest species	Whiskered bat Natterer's bat		

6.268 In the absence of mitigation, bats flying along the site would be potentially in close proximity to the rotor swept areas during foraging and commuting activity. This could potentially result in bat fatalities. Therefore, under the precautionary principle (and without mitigation) this project has the potential to have a **major adverse** impact magnitude, of **major adverse** significance during the operational phase. As a result, detailed mitigation by design has been developed and implemented. In addition to the layout design, a detailed BMMP has been recommended.

6.269 With mitigation, and based on currently available data on all species of (Irish) bat species, the impact magnitude can be reduced to **neutral** significance during the operational phase of the Development.

Otter & Badger

6.270 The level of potential disturbance to these species is less during wind farm operation as compared with the construction phase, as the site reverts to minimal human presence. The use of access tracks will be mainly limited to single-vehicle journeys for maintenance and there will be minimal collision risk. There will be no additional impacts as a result of the operation of the Development. There is likely to be **neutral** impact on magnitude and significance during the operational phase.

Common Lizard & Smooth Newt

6.271 The use of access tracks will be mainly limited to single-vehicle journeys for maintenance, and there will be minimal traffic risk to these two species. The additional likely impacts on this species as a result of the operation of the Development will include species specific habitat management and enhancement measures. Overall, the successful implementation of these measures during the operational lifetime of the wind farm is likely to be of **minor positive** magnitude and of **beneficial** significance.

Decommissioning Phase

6.272 Impacts associated with decommissioning a wind farm bear many similarities to those arising during construction. Many of the work processes are similar and plant and

[22] There is no Ireland specific section with the SNH guidance, therefore the Table 2 ('Scotland') has been adapted for use here (with Brandt's and Noctule bats removed) as this is the closest match to the bat species assemblage found locally to the Site.

vehicle movements are likely to be at a similar scale. It is assumed that decommissioning will require the removal of all above ground structures; the removal of all underground structures to one metre below ground level; and reinstatement of disturbed areas.

Habitats

6.273 Two types of activities have the potential to disrupt and damage vegetation communities and peatland habitats during decommissioning. These are:

- Removal of above-ground infrastructure; and
- Laydown of waste demolition materials or spillages or leaks of fuels from decommissioning plant.

6.274 The types of decommissioning effects are as follows:

- Disruption/damage to peatland vegetation, compaction/rutting of the peat surface and disruption of peat hydrology that supports peatland (especially blanket bog) vegetation
- Contamination of the peat surface and peatland vegetation with demolition waste materials or spilled/leaked fuels.

Species of Conservation Concern

6.275 Impacts on protected mammals and herpetofauna during decommissioning are likely to be of a similar scale and nature to those that occurred during construction and are unlikely to be significant.

6.276 Each of these impacts is described and assessed below and the unmitigated impacts, mitigation measures and residual impacts are summarised in tabular form (**Tables 6.14** and **6.16**).

Table 6.14: Significant Effects upon Valued Ecological Receptors (Prior to Mitigation)

Impact	Nature of Effect	Magnitude	Significance
Construction			
Designated Sites	Statutory sites: Garron Plateau SAC; Straidkilly Wood ASSI Glenarm Woods ASSI, Glenarm Woods ASSI Part2. There is low potential for works to have effects on designated sites because of the distance of the scheme from sites. The scheme is downslope from Garron Plateau SAC/ASSI, the nearest designated site, and no effects are therefore likely on this site.	Neutral	Neutral
Watercourses	Access tracks will cross a number of unnamed minor streams; there is a potential for ingress of silt and construction materials into streams at crossing points. Flows in these headwater streams is likely to be low and culverting/bridging works are unlikely to release significant amounts of material into the watercourses.	Negligible	Minor adverse

Impact	Nature of Effect	Magnitude	Significance
Loss of NI Priority Habitats	Degraded blanket bog/Wet heath/PMGRP/Hedgerow & Woodland Land take associated with construction of access tracks and turbines and associated infrastructure.	Moderate	Moderate
Bats	There should be limited disturbance of these European Protected Species during construction activities as there are no identified roosts within the study.	Neutral	Neutral
Pine marten	Temporary disturbance from construction works probable	Minor	Minor Adverse
Common lizard	Temporary disturbance from construction works and loss of habitat	Moderate	Moderate Adverse
Smooth newt	Temporary disturbance from construction works and loss of habitat	Moderate	Moderate Adverse
Operational			
Designated Sites / Watercourses	Statutory sites: Water pollution or increased sediment loading are extremely unlikely during the operational phase	Neutral	Neutral
NI Priority Habitats	Habitat restoration and enhancement to be conducted in accordance with methods defined in the outline HMP	Neutral	Neutral
Bats	Potential collision of European Protected Species with turbine blades (or barotrauma) during the operational phase	Moderate adverse	Major Adverse
Pine marten	Operational Effects unlikely	Negligible to Neutral	Neutral
Common lizard	Loss of habitat for the operational lifetime of the wind farm	Negligible to Neutral	Neutral
Smooth newt	Loss of habitat for the operational lifetime of the wind farm	Negligible to Neutral	Neutral
Decommissioning			
Designated Sites / Watercourses	Statutory sites: Garron Plateau SAC; Straidkilly Wood ASSI Glenarm Woods ASSI, Glenarm Woods ASSI Part2. There is potential for waterborne pollution and increased sediment loading during the decommissioning phase in the absence of mitigation	Minor	Minor Adverse
NI Priority Habitats	Removal of turbines and associated infrastructure will permit reinstatement of impacted areas of this habitat types.	Moderate	Moderate Adverse
Bats	Disturbance of European Protected Species during decommissioning activities unlikely	Neutral	Neutral
Pine marten	Temporary disturbance from decommissioning works possible	Minor	Minor Adverse
Common lizard	Temporary disturbance from decommissioning works probable	Moderate	Moderate Adverse
Smooth newt	Temporary disturbance from decommissioning works probable	Moderate	Moderate Adverse

Design Evolution & Mitigation

6.277 The purpose of what is broadly classed as mitigation is to maintain the conservation value of a development site as far as is possible, and to exploit opportunities to enhance the site's conservation value wherever possible. This can be achieved by (CIEEM 2018):

- avoiding negative ecological impacts - especially those that could be significant;
- reducing negative impacts that cannot be avoided; and
- compensating for any remaining significant negative ecological impacts.

6.278 The aims of mitigation can be best achieved by choosing locations that allow sites or features of conservation value to be avoided; **Chapter 3: Design Evolution & Alternatives** provides a full description of the design evolution process which includes details on avoidance measures.

6.279 The Red Line boundary of lands available to the developer encloses an area of approximately 206.65 ha. The development site comprises numerous enclosed 'fields', while the access road to the public road network crosses a small wooded embankment. A number of fields support pockets of both 'species-poor' and 'species-rich' variants of rush pasture. Lands within the Red Line, but outside the development site, support extensive areas of wet/dry heath and blanket bog, as well as a number of smaller features of conservation interest such as streams and flushes. The present scheme therefore avoids using those areas that support the most extensive and most intact areas of habitat of conservation value.

6.280 Avoidance and impact reduction techniques relate to reducing the footprint of the development and any ancillary works as far as is practicable. Measures required to address ecological concerns described in this ES during the construction phase will be implemented by an Ecological Clerk of Works (ECoW) as detailed in the outline Construction Environmental Management Plan (oCEMP) in **Technical Appendix 6.11** and will be incorporated within a Construction & Method Statement (CDMS), which will be submitted to and agreed with the Department at the pre-construction stage. Avoidance and impact reduction measures include:

- No turbine rotors are within 50m from the edge flight-lines such as streams and shelterbelts), which is the minimum stand-off distance from blade tip to the nearest habitat feature likely to be used by bats, (Natural England 2014).
- Consideration will be given to the provenance of fill materials for roads, in terms of the similarity of their physicochemical properties (particularly pH) to the present substrate.
- The contractor will prepare a CMS prior to construction activities to provide a method statement for working practices that will include measures, among others, to prevent adverse impacts on rivers and other watercourses. Please also refer to the SUDS design Statement in Appendix 9.1 Surface Water Management Plan.

- A “no access” buffer will be implemented along sensitive watercourses to prevent damage to banks and to prevent disturbance of riparian habitats, apart from the narrow corridor required during construction.
- Access of all machinery and personnel will be limited to the working area corridor.
- Site compounds and stores will be sited away from any features of conservation interest, including watercourses. Any of these features in close proximity to the works or to compounds will be fenced to prevent damage by plant or stored materials.
- Dust suppression filters and appropriate wetting of running and work surfaces will be used to prevent masking of vegetation outside construction corridors, where appropriate.
- Appropriate speed limits will be imposed to reduce the potential for dust production.
- Excavations left unattended overnight should be ramped in at least one location to allow mammals to avoid becoming trapped.
- It is also recommended that, to minimise the risk of suspended sediment entrainment in surface water run-off, the site drainage system should only be carried out during periods of low rainfall and therefore minimum run-off rates.

6.281 Of particular importance for the maintenance of habitats and associated fauna is the institution of good management practices that prevent the discharge of silt and pollutants into the local drainage system. Containment measures will include:

- Where works near or in watercourses are unavoidable, working practices will include standard methods designed to minimise sedimentation and pollution, and measures will be put in place before the works begin to ensure containment of any released sediments. These may include silt containment booms or sediment barriers, as appropriate. Land stripping will be done in stages to minimise the potential for concentrated, long-lasting pulses of silt to discharge into watercourses. All filtration systems will be monitored frequently, and they will be replaced before they become ineffective.
- Material storage compounds will be located remote from any watercourse. Surface water run-off high in suspended solids should be contained and treated prior to discharge to any watercourse. All storage tanks should be bunded and should be sited remotely from any watercourse. Works should incorporate the relevant Pollution Prevention Guidelines. Additionally, a Pollution Incident Response Plan should be put in place as part of the Construction Management Plan.
- Water should be pumped from turbine bases during construction either to areas of ground capable of absorbing the water or to settlement ponds prior to discharge. Any discharged water must be free of cementitious products.

- All tracks and drains will be maintained and monitored to ensure that surface water flow is directed as designed, and that ponding and blockages are prevented.

6.282 Avoiding or mitigating impacts arising from construction-initiated alterations of drainage patterns and infiltration regimes is of importance for preventing damage to both aquatic and terrestrial habitats. It must be appreciated that hydrological characteristics of peatland and the habitats that they support are inextricably linked, and that changes in hydrological regime will lead to changes in these habitats. The areas of blanket bog have been avoided by sensitive siting during the design process. The site hydrological regime is considered in detail in **Chapter 9: Geology & the Water Environment** and measures outlined there will be carried out in order to maintain the limited areas of conservation interest on the Site.

6.283 Sympathetic management of the wind farm habitats during the operational phase will provide the greatest opportunity for enhancing the conservation value of the Site and should be regarded as compensatory mitigation for the permanent land take required for the new turbines and infrastructure.

6.284 The landowner will incorporate compensation and enhancement for lizard into the habitat management plan for the site. This will include the removal of grazing the habitat management area (shown in **Figure 6.10**) for the lifetime of the Development

Habitat Specific Mitigation

6.285 Mitigation measures are required during both the construction and decommissioning phases of the Development. These consist of both generic, standard, good construction working practices and controls described in the CMS, together with site specific and activity specific measures. Only the latter, the specific mitigation measures, are described here.

6.286 Adverse effects during the construction phase that were assessed to be potentially significant and require mitigation are:

- Land take (7.33ha), resulting in loss of degraded blanket bog/wet heath/PMGRP/ash woodland (the former, despite being degraded are still considered to be an NI priority habitats).
- Excavation of turbine bases and cable trenches, potentially severing hydrological routing and causing dewatering of areas of soils.

6.287 The prime mitigation to reduce to an absolute minimum any disturbance or damage to vegetation, over and above the strict controls provided in the CMS, is habitat restoration and enhancement and vigorous supervision by the ECoW of all activities and at all stages of the Development.

6.288 Habitat restoration and enhancement is described in the Outline Habitat Management Plan (OHMP) in **Appendix 6.1** to provide compensation for the loss of areas of PMGRP/wet heath/degraded blanket bog.

6.289 Quantification of anticipated areas enhanced via habitat management measures indicate that approximately 63.2ha of habitat management areas will be restored or managed for the benefit of biodiversity. The overall area enhanced is a combination of 63.2ha (for restoration of grassland/heath/bog (including the remediation of two blocks of coniferous forestry plantation back to blanket bog/heath) (i.e., NI Priority Habitats)) including 49.8ha given over to management for curlew and other breeding waders. This is approximately 8-times greater than the areas of NI priority habitat (wet heath/PMGRP/degraded blanket bog) which will be lost to the Development through land take for the footprint of 7.33ha.

6.290 This is considered to be a not insignificant level of compensation (considering that the majority of infrastructure is situated on habitats of lower conservation value. In addition, the restored and enhanced habitats will also be protected from drainage, flailing and burning, and reduced grazing throughout the 30-year lifetime of the Development.

6.291 As detailed in the outline HMP, the landowners have agreed to fully implement the land management prescriptions to restore and enhance the habitats on siteshould the Development be constructed.

General principles for reinstatement of habitats

6.292 Turves of heathland vegetation and associated topsoil from construction activity represent a valuable resource that can be used in the restoration of bare areas. Turves must be cut so that they capture the root systems of mineral soil as this will ensure any viable seeds are present. Turves can be laid in blocks or in a patchwork and over time heathland will develop within gaps and will provide a mosaic of structure.

6.293 During construction the areas of bog/heath/heathy acid grassland will be lifted and stored for reuse using large-scale turfing equipment, using a technique known as "macro-turfing", moving large, thick turves. This method has many advantages over traditional turfing, virtually eliminating problems of frost and drought damage, and because the turves are thick, most burrowing invertebrates and deep-rooted plants survive. At both locations the vegetated turves will be lifted to a depth of approximately 25-40cm, (i.e., total depth of topsoil at each location).

6.294 Under the supervision of an Ecological Clerk of Works the original soil layering will be maintains and the mixing of topsoil and subsoil layers will not be permitted to occur. For peat soils, the acrotelm and catotelm will be handled and stored separately and reinstated with the acrotelmic layer on top. For peat and mineral soils, it is especially important to keep the layer of surface soil and stripped turves of vegetation on the top of the reinstatement, the right way up.

6.295 Turves will not be stacked but placed beside each other. As described above turves will be cut to an appropriate depth to maintain plant root systems and provisions for keeping soil moist must be considered in the event of dry spells of weather where vegetation may succumb to drought or the soil may be susceptible to wind erosion. Maintaining the seed bank and existing vegetation on the surface provides the best possible start for effective restoration.

6.296 Turves will be watered during times of drought or more frequently if deemed necessary by the ECoW in order to protect the health and integrity of newly translocated turves.

Compensation of the loss of NI Priority Habitats

6.297 63.2ha of existing habitats (likely derived from former heath/bog) will be managed in order to restore these habitats to the more species-rich habitats from which they are ultimately derived.

6.298 The main management techniques that will be employed is the removal of all grazing and the blocking of all drains within the proposed habitat management areas. After 5 years the sward will be assessed and compared with the preconstruction baseline for the area. At this point, contingency measures such as the introduction of light cattle grazing will be considered in order to maintain the momentum towards a more species-rich sward, while slowing down successional forces towards scrub/woodland (should this occur).

6.299 The current land-use within the three proposed Habitat Management Areas consist primarily of mixed sheep & cattle grazing on the larger Block (A) and two smaller Blocks (B & C) currently under forestry. Given the historical land-uses, the complete moratorium on livestock grazing is proposed for the first 12-24 months (from the commencement of construction (Block A)). While in Blocks B & C there will be no grazing for the lifetime of the Development (unless monitoring after year 5 concludes that light grazing would be beneficial). All three Habitat Management Areas will continue therefore, to be fenced off to allow close control of all management prescriptions.

Species specific mitigation

Mitigation for bats

6.300 Under the precautionary principle, and due to the presence of several species of bat known for open-air foraging, i.e. considered at risk from turbine associated mortality (Leisler's bat; common and soprano pipistrelle), a BMMP will be implemented as follows.

6.301 The BMMP will include the use of "feathering". This shall involve pitching the blades to 90 degrees and/or rotating the blades parallel to the wind direction to reduce the blade rotation speeds below two revolutions per minute while idling. This will substantially reduce the risk of bats being struck by idling blades and will reduce the spatial extent of low-pressure vortices in the wake of the blades (i.e. will substantially reduce the potential for barotrauma to occur).

6.302 This BMMP will consist of post-construction monitoring in the form of casualty searches, undertaken during years 1-3 post construction. These will be extended for a further two seasons in the event that activity levels (as recorded during the static monitoring) are moderate/high (>50 bat passes at the turbine during a single night) or if a bat carcass is found.

6.303 Carcass searches will be conducted during the spring (15 Apr – 15 June), summer (15 Jun – 15 Aug) and autumn (15 Aug – 15 Oct) seasons, as bat activity levels have been identified as moderate-high during each period. This monitoring will entail the systematic search for bat casualties within a 175m x 175m grid centred on the turbine. Searches will commence in April and be carried out as shown in Table 6.15 (adjusted accordingly depending on weather conditions; see below). They will begin no later than 1-hour post-sunrise to minimise the potential for carcass removal by predators. Three turbines will be searched during each visit, and these will be selected at random across the year.

Frequency of searches and number of turbines to be searched

6.304 Searches will be conducted at 2 to 4-day intervals (SNH 2019). Data must be obtained from the turbine operators on whether or not the target turbine was operational on the night preceding the search, with the surveying protocol being adjusted as necessary if the turbines were either non-operational or were not rotating because of a lack of wind.

6.305 To maximise the duration of monitoring during each season, whilst maintaining low carcass removal rates, it is recommended that surveying should be split into blocks as illustrated below. This is the spring schedule, which will be repeated during summer and autumn.

Table 6.15: Summary of proposed schedule for carcasses searches (spring).

Days 1-10	Days 11-20	Days 21-30	Days 31-40	Days 41-50	Days 51-60
Initial 'sweep' then survey alternate days (d2, d4, d6, d8, d10)	No Survey	Initial 'sweep' then survey alternate days	No survey	Initial 'sweep' then survey alternate days	No survey

Bat Carcass (Mortality) Searches

6.306 Bat carcass searches will be undertaken using a specialist ECoW; and will only take place the morning after optimal conditions for bats have occurred. These are defined as;

- <5m/s ground wind speed,
- >10ºC of temperature (1 hour after dusk),
- no rain, and
- after a warm day of similar settled conditions (i.e. the dusk should have a peak in bat activity in the area).

6.307 Carcass searches will commence one hour after dawn to minimise the potential for carcass removal by predators.

6.308 This approach has been selected to maximise the likelihood of finding bat carcasses, which is essential in enabling predicted bat mortality to be accurately estimated. Bat carcasses (if found) will be collected to enable accurate species identification using

DNA where required. A post-mortem will also be conducted in order to ascertain the cause of death.

6.309 Also, the recording of a bat activity across the application site will also take place using automated detectors at the turbine base paired with adjacent habitat features. The recording will be undertaken for 10-nights during Spring, Summer & Autumn. This will also allow for comparison with the date collected previously as part of the planning application.

Meteorological Data

6.310 Simultaneous daily collection of meteorological data including wind speed, temperature, and precipitation will be undertaken at the turbine location, alongside bat carcass searches to identify the effect on levels of bat activity at the turbine(s).

Operational curtailment

6.311 In the event that >1 dead bat is found (in any season) during carcass searches, curtailment of the turbine will be immediately implemented on a precautionary basis. This will involve increasing the cut-in speed to 5 m/s, which is recommended by Mathews et al (2016). As bats are nocturnal, the increased cut-in speed will only apply at night, measured from 30 minutes before sunset to 30 minutes after sunrise. The increased cut-in speed will only apply between the 15 Apr and the 15 Oct each year (i.e. the generally accepted bat activity season in NI). For the remainder of the year (i.e. 15 Oct to 15 Apr), the turbine manufacturer's cut-in speed will be used.

Search efficiency trials

6.312 In addition to the proposed operational curtailment, the efficiency of the search dogs will be assessed based on integrated efficiency trials (Mathews et al., 2016). Use of this method will allow a correction factor for search efficiency to be factored into statistical modelling of numbers of bats which may be found dead beneath the turbine.

6.313 Carcasses will be dropped from waist height at randomly selected points within the search area under the turbine, on days when the dog teams are conducting searches and prior to searches taking place. The person placing the bats will not be involved in the search and will not reveal the exact number and location of bats that have been deployed to the dog teams until the trial is concluded.

6.314 When conducting observer efficiency trials for dog search teams, care will be taken to avoid transferring human scent to the specimen, for example by using tongs or disposable gloves. To allow human scent from footprints to dissipate, an interval of at least an hour will be left between placing the bats and conducting the searcher efficiency trial.

Scavenger removal rates

6.315 In order to determine the rate at which carcasses are removed (and therefore not be available for dogs to find), scavenger removal trials will be completed.

6.316 A carcass (of similar size and colour to a bat) will be left under the turbine each season. The carcasses will be placed out around dusk, and transference of human smell will be avoided. Carcasses will not be left under the turbine if and when searches are being carried out.

6.317 The carcasses will be monitored through the use of a motion-activated remotely operated camera for up to 10 days (battery life is affected by weather and the number of times the camera is triggered and is not entirely predictable). A second visit will be made to the site to check the cameras and change the batteries to ensure we can assess the scavenging rates over a three-week period. Assessing rates over a shorter timeframe would not enable a true test of scavenging removal rates to be made (Mathews et al., 2016). Different habitat types will be selected for the trials to ensure a robust evaluation of scavenging rates can be made.

6.318 The methods used in the Matthews (2016) study involved daily visits, rather than camera traps, to check corpses for the first seven days, but the use of camera traps will be more resource efficient and should also indicate the time at which the corpse was taken as well as the species of scavenger in most cases.

6.319 Different locations will be selected for the carcasses during each visit so that scavengers do not become familiar with feeding locations, and the cameras will be repositioned accordingly.

Estimating actual mortality rates

6.320 The number of observed bat carcasses recorded during the study will be corrected taking into account the area searched, scavenger rates and searcher efficiency results. Various researchers have proposed different approaches to data correction including Korner-Nievergelt et al. (2011), Korner-Nievergelt, et al. (2011), Bispo et al. (2012), and Lintott et al. (2016).

6.321 The most up to date formula for estimating the total number of carcasses present per turbine per season will be applied to the data collected at the end of the survey season

Remedial measures

6.322 The trigger threshold for remedial measures will be linked to ‘significance’ in line with the CIEEM guidelines for EcIA. Remedial measures will be triggered by an impact predicted to be of significance to bats at the Local level or greater.

6.323 For geographic context, the local level is considered to represent the site boundary plus a 15km radius. A significant effect would be triggered where the level of bat mortality is considered to reduce the ability of the bat population at the Local scale to sustain a viable and stable population, as informed by monitoring.

6.324 The requirement for and design of remedial measures will depend upon the findings and conclusions of monitoring and specific measures will be developed as appropriate to mitigate and significant impact predicted (those considered significant to bat populations at the Local scale or above). Where significant impacts are predicted, potential remedial options may include, but are not limited to, the feathering of individual turbines.

Mitigation for viviparous lizard

6.325 In the case of common lizard, it has been impossible to totally avoid impacts to this species, given the layout constraints. Therefore, the next course of action is to mitigate for any potential impacts.

6.326 The results of the common lizard surveys for the Development were assessed against the Key Reptile Site Survey Assessment Categories (HGBI 1998). This revealed that parts of the Site had a low population (with five individuals recorded). However, given the location of the records, it is also likely that much of the site is sub-optimal habitat for this species. This is likely a consequence of over-grazing.

6.327 Depending on the commencement of construction on site, the works corridor will be mowed. If possible, this work will be undertaken before the end February (to avoid a conflict with the bird breeding season). If this is not possible, then mowing will take place between August and September, when common lizards are likely to be fully active. Should the latter be required, the corridor will be subjected to an active nest survey by a suitably qualified ornithologist immediately prior to the commencement of mowing operations.

6.328 Clearance of stones, tree stumps, logs, brash, rocks or piles of similar debris will be undertaken carefully and by hand. Although this is only required in a few areas where the proposed site tracks traverse low stone walls. This work will not take place during the hibernation period for common lizard (i.e. mid-October to mid-March).

6.329 Clearance of tall vegetation will be undertaken using a strimmer or brush cutter with all cuttings raked and removed the same day. Cutting will only be undertaken in a phased way which will either include:

- Cutting vegetation to a height of no less than 30mm, clearing no more than one third of the site in anyone day or;
- Cutting vegetation over three consecutive days to a height of no less than 150mm at the first cut, 75mm at the second cut and 30mm at the third cut;

6.330 Following removal of tall vegetation using the methods outlined above, the remaining vegetation will be maintained at a height of 30mm through regular mowing or strimming to discourage common lizards from returning. Ground clearance of any remaining low vegetation (if required) and any ground works will only be undertaken following the works described above.

6.331 As an additional precaution the ECoW will be present from the commencement of clearance/construction with a watching brief to ensure that no common lizards remain within the construction corridor and remain in situ until the area is cleared to ensure no species or habitat conflicts emerge affecting damage to the local lizard population.

6.332 If any common lizards are found during excavation works, all works within the affected area will cease until the ECoW has safely removed them (under licence) from the construction corridor.

6.333 Should it prove necessary during site supervision (i.e. lizards are observed returning to the construction corridor); a protective lizard barrier fence will be installed along both sides of the construction corridor (for 25m either side of the point where the lizard(s) were noted) in order to prevent common lizards from entering the works area.

6.334 In total, there is >500 ha (of blanket bog; dry heath and marshy grassland) adjacent to the proposed construction corridor. These areas together provide more than sufficient suitable habitat.

Mitigation for Smooth Newt

6.335 The current infrastructure layout includes sections of track (illustrated on **Figure 6.9**) within the 200m buffer which surrounds the smooth newt breeding ponds. Therefore, mitigation is required in order to reduce any potential significant effects to this protected species.

6.336 It is proposed that any newts migrating towards the ponds would be captured using a combination of drift fencing (during the construction phase), physical searches, along with pitfall traps in order to prevent access by newts to the works area.

6.337 The drift fencing would consist of UV-resistant plastic stretched between poles with wire to present a barrier 50-60cm high and would be dug into a depth of 10-20cm below ground level to prevent access underneath. This would be positioned for 200m along both sides of the proposed access track (within 200m of each smooth newt breeding pond (as shown on **Figure 6.9**)).

6.338 If the physical searches prove fruitless, up to one hundred plastic 10-litre buckets would be buried with the rim at ground level and placed firmly against the fence (ten either side of the track) in order to catch any newts migrating towards the pond. The traps would contain 10cm depth of water at all times and would be checked daily (between the first erection of the fence (prior to the 15 March) and the completion of construction. This mitigation program would be carried out during both the spring migration (mid-Feb to mid-Apr) towards the pond and the autumn migration (mid-June to mid-August) towards hibernation areas.

6.339 This would be carried out under licence; and once construction is completed the newt fencing would be removed to allow the newt's access to the wider site again. The Project EcoW would also be present on the site immediately prior to and during clearance of site vegetation in order to comply with any likely Wildlife Licence relating to the proposed mitigation. The EcoW would also supervise the erection of the drift fence, the checking of the pitfall traps (and associated removal of any newts to the nearest adjacent breeding pond).

6.340 A newt hibernaculum would also be created (central pond cluster); so as to reduce the need for newts to have to cross the wind farm access track when looking for suitable hibernation locations). An example of a suitable hibernaculum can be found in **Appendix 6.1**).

Residual Impacts

6.341 Residual effects relating to land management that is designed to provide ecological benefits through the establishment of grazing measures which are appropriate within peatland and associated habitats (See **Appendix 6.1: Ecology Annexes** containing the outline Habitat Management Plan) will result in more diverse and ecologically valuable habitat than the present degraded habitats that cover the majority of the site. Continuity of effective, appropriate management should result in the area becoming more biodiverse over time. With improved land management, it is anticipated that in the long term there will be at least a neutral residual impact on fauna of conservation concern. For habitats, a beneficial impact is likely if site management results in more diverse habitats of greater conservation value

6.342 **Table 6.16** provides details of the residual impacts.

Table 6.16: Summary of Residual Impacts after Mitigation and Enhancement

Impact	Ecological Impact Significance without Mitigation	Mitigation & Enhancement	Ecological Impact Significance with Mitigation
Construction			
Designated Sites / Watercourses	Major adverse	Avoidance during infrastructure design and SuDS drainage management (Appendix 9.1). No in-stream works will be required.	Neutral
NI Priority Habitats	Moderate	NI Priority Habitat restoration and enhancement according to the outline HMP.	Neutral
Temporary disturbance to bats	Neutral	No mitigation required	Neutral
Temporary disturbance to common lizard	Moderate	Implementation of species-specific mitigation to off-set potential significant effects including phased mowing of the vegetation within the construction corridor.	Negligible to Neutral
Temporary disturbance to smooth newt	Moderate	Implementation of species-specific mitigation to off-set potential significant effects including erection of newt fencing and construction of an artificial refugia.	Negligible to Neutral
Operational			
Designated Sites / Watercourses	Major Adverse	Application of the SuDS drainage management and CMS as detailed in Appendix 9.1	Neutral
NI Priority Habitats	Moderate	NI Priority Habitat restoration and enhancement according to the outline HMP.	Beneficial
Potential collision of bats with turbine blades	Major adverse	The proposed turbine layout was designed to ensure a minimum stand-off distance of 50 m (Natural England TIN051) to all habitat edges (shelterbelts and natural watercourses) which will be maintained through the	Neutral

Impact	Ecological Impact Significance without Mitigation	Mitigation & Enhancement	Ecological Impact Significance with Mitigation
		lifetime of the Development. A Bat Monitoring & Mitigation Plan (BMMP) will be implemented under the Precautionary Principle.	
Disturbance to common lizard	Minor	Implementation of species-specific enhancement to off-set potential significant effects includes; Management of ~63.2 hectares of habitat which will also benefit this species.	Beneficial
Disturbance to smooth newt	Minor	Implementation of species-specific enhancement to off-set potential significant effects include; Installation of artificial refugia to act as hibernaculum within 100m of the existing dam pond.	Beneficial
Decommissioning			
Designated Sites / Watercourses	Major adverse	SuDS and standard Pollution Prevent Guidelines will be adhered to during decommissioning.	Neutral
NI Priority Habitats	Minor	NI Priority Habitat restoration and enhancement according to the outline HMP.	Beneficial
Temporary disturbance to bats	Neutral	No mitigation required	Neutral
Temporary disturbance to common lizard	Neutral	No mitigation required as no impact during the decommissioning phase is considered likely.	Neutral
Temporary disturbance to smooth newt	Neutral	No mitigation required as no impact during the decommissioning phase is considered likely.	Neutral

Cumulative Impacts

6.343 When considered in the context of the overwhelming dominance of the impact of agricultural land-use change as the primary driver controlling the extent and quality of habitats in Northern Ireland, as well as natural variation (in species populations) over time, it is credible to assume that in only very exceptional circumstances will direct effects in aggregation between wind farm sites have any potential to be cumulatively of concern let alone significant (in EIA terms). It is not unreasonable to assume that any such aggregate effects that may be of significance are likely to be readily apparent to those considering individual applications who can inform consideration of specific detailed measures to avoid unacceptable effects[23].

6.344 The potential for a cumulative impact between proposed and operational wind farms arises principally if species from the same population are using more than one of the sites. The likelihood of this can be assessed through an analysis of the species assemblage and by examining the likely range and territory size of those species.

[23] Review of Guidance on the Assessment of Cumulative Impacts of Onshore Windfarms, Phase 1 Report, ENTEC, September 2008

6.345 The area over which a cumulative impact may be felt should also be considered, and in the present case, wind farms within a radius of 15km have been identified. However, Carnalbanagh, Rathsherry, Elginny Hill, Gruig and Corkey are considered to be the only wind farms likely to have the potential to have a significant cumulative effect.

6.346 The following sections assess the potential cumulative impacts, as a result of the Development with other proposed and operational wind farms, where relevant.

Habitats

6.347 In the uplands there is some concern over the potential effects of the access track network required by wind farm developments on the hydrology of peatlands which are important both because they are generated by and support highly valued specialised vegetation, and as natural carbon stores.

6.348 The Development will result in a loss of low and moderate quality habitats, which are of local conservation value. Restricted areas of habitat of higher conservation value have been avoided and their interest maintained. In the case of Unshinagh, this additional loss of habitats is considered to be not significant because the degraded blanket bog, wet heath/grassland habitats are of local conservation value and is widespread both locally and throughout the region. It is therefore within the ability of the resource to absorb this loss. Those habitats that are of greater value have been avoided and there will be **no significant impact** on them.

Bats

6.349 Outcomes which must be considered are whether the cumulative impact of wind farm developments will adversely affect the distribution of these species of European conservation concern, and whether there will be population-scale effects on any bat species. The most contentious species issue currently is the extent to which bats may be at risk of collision with turbines. There is potential for bats to forage across more than one wind farm and to be subject to at least the potential of an increased risk of collision. As yet there is no agreement on how best to address it, though specific impacts on bats have been addressed through the incorporation of precautionary stand-offs to habitat features (foraging and commuting areas), as well as the use of curtailment and increased cut-in speeds (if required).

6.350 The development therefore has the potential to increase bat mortality resulting from collision and barotrauma, and this impact is likely to be additive to similar impacts arising from the operation of other wind farms, at both local and regional scales. The absence of data relating to bat life cycles and to the intensity and spatial variation of activities during different parts of those life cycles means that there is difficulty in determining the significance of the cumulative impacts on bat species. It is likely that the significance of cumulative impacts will also vary between species, depending on inter alia local and regional abundance of different species, prey preferences, preferred flight height, preferred foraging habitat, degree of attraction to or deflection from turbines, extent of migratory behaviour, swarming characteristics and variability of behaviour in response to varying weather conditions. Bat behaviour and collision risk are likely to be highly site-specific during much of the annual cycle, but more generalised patterns, such as those relating to migration, may be superimposed on these local factors.

6.351 Whilst evidence is beginning to be revealed through a combination of academic research and on-going monitoring at wind farm sites, certainty with regard to cumulative effects is far from clear. This is because the effects of wind farms on bat populations is dependent on a wide variety of factors including; the turbine layout, the species of bats present, existing environmental conditions and the mitigation measures proposed at each wind farm (or individual turbine). Therefore, a clear understanding of the patterns of bat activity at individual wind farms (during the development of EIA's) is essential.

6.352 In the case of the Development a clear understanding of the patterns of bat activity at the site and surrounding area was used to inform the final layout and recommend mitigation, in the form of precautionary stand-off distances to habitat features, and the maintenance of said buffers for the 30-year lifetime of the wind farm).

6.353 The potential cumulative impact of the Development in addition to (the wind farms and single turbines (within 15km) was specifically considered in relation to bats. These included five windfarms. These five have a combined turbine count of 46. These are;

- Carnalbanagh (4.5km to the south)
- Rathsherry (11km to the west);
- Elginny Hill (11km to the southwest);
- Gruig (14.5km to northeast)
- Corkey (15km to the northeast)

6.354 In addition, a further 11 single turbines are located (or potentially located) within 15km of the Development. This gives a total of 50 turbines located within the study area for cumulative effects.

6.355 Overall, during 391 nights of monitoring; over 347-nights bat activity was either negligible or low. Moderate levels were experienced during 21-nights; 19-nights were high and 4-nights with near constant activity. Therefore, a detailed BMMP (Bat Monitoring Mitigation Plan) is required.

6.356 In addition, the stand-off distances of the existing turbines were measured (in addition to the 14 turbines in the Development), in relation to habitat features such as watercourses and plantation edges (areas which are known to have higher levels of bat activity). None of the approved turbines encroached on the Natural England stand-off distance to the edge habitat features. Therefore, if precautionary stand-off distances were applied retrospectively to the windfarms described, the layouts would comply with the guidance (with the implementation of agreed mitigation at the respective sites listed above).

6.357 Therefore, with the implementation of the BMMP (and the stand-off distances described above) the cumulative impact (of the 14 proposed Unshinagh turbines) is not considered to alter the existing predicted impacts, therefore the cumulative impact is **not** considered to be **significant**.

Badger & otter

6.358 It is not anticipated that the Development will have a measurable impact on local social groups and the wind farm will therefore not contribute to any cumulative impacts that may be detectable from the operation of other wind farms in the local area. The cumulative impact on these species is considered to be **not significant**.

Herpetofauna

6.359 The limited distribution of these species across much of the site and the habitat improvements specifically designed to favour them, indicate that the Development will not add to any adverse cumulative effects that may arise from wind farm developments generally. The cumulative impact on the site herpetofauna is therefore considered to be **not significant**.

Trans-boundary effects

6.360 Potential trans-boundary effects of the Development on designated sites and on mobile species (i.e. bats) were assessed. The effects are considered to be the same as those described in the relevant sections (i.e., cumulative effects). Trans-boundary effects are therefore not considered to be significant. Potential trans-boundary effects of the Development on Annex 1 migratory bird species are assessed in **Chapter 7 - Ornithology**.

Conclusions

6.361 There is no regular usage of the area by otter, badger or marsh fritillary butterfly, therefore no impacts to these species is likely. Mitigation for the herpetofauna found on site (i.e. smooth newt & common lizard) is proposed. This involves the provision of habitat management, as well as drift fencing and mowing/hand clearance during the construction phase. All badger setts have been buffered by the required 25m from any infrastructure.

6.362 The proposed outline HMP will ensure compensation for areas of NI Priority Habitat lost under the footprint of the Development and should also result in enhancement of the local site ecology.

6.363 The mitigation measures specified in **Table 6.16** will be adhered to, ensuring that any potential impacts to bats will be negligible. In conclusion and based on current knowledge this would appear to be a site posing little risk to bats or bat populations, with the satisfactory implementation of the recommended BMMP (including curtailment and increased cut-in speeds (as required).

6.364 Therefore, the potential effects of the Development on ecological receptors have been assessed and it is concluded that with the implementation of appropriate mitigation measures the effects would be reduced to a **minor adverse** or **neutral effect** that would not adversely affect the ecological integrity of the site and the wider area.

6.365 An assessment of cumulative impacts on the habitats and fauna of the area was also undertaken, and it was concluded that this is **not significant impact**.

References

6.366 References have been inserted as footnotes within the body of the document.

Abbreviations

AONB	Area of Outstanding Natural Beauty
ARGUK	Amphibian and Reptile Groups of the UK
ASSI	Area of Special Scientific Interest
BESS	Battery Energy Storage Site
BSBI	Botanical Society of the British Isles
CEDaR	Centre for Environmental Data and Recording
CIEEM	Chartered Institute of Ecology and Environmental Management
CNCC	Council for Nature Conservation and the Countryside
EC	European Commission
EcIA	Ecological Impact Assessment
EIA	Environmental Impact Assessment
HRA	Habitat Regulations Assessment
HSI	Habitat Suitability Index
IROPI	Imperative Reasons of Overriding Public Interest
JNCC	Joint Nature Conservation Committee
LHP	Larval Host Plant
LUAC	Land Under Applicant Control
MNR	Marine Nature Reserve
NBN	National Biodiversity Network
NIBG	Northern Ireland Bat Group
NIEA	Northern Ireland Environment Agency

NIPS	Northern Ireland Priority Species
NNR	National Nature Reserve
NR	Nature Reserve
PPS	Planning Policy Statement
SAC	Special Area of Conservation
SLNCI	Sites of Local Nature Conservation Importance
SPA	Special Protected Area
UW	Ulster Wildlife

7

Ornithology

7 Ornithology

Summary

Methodology

7.1 This chapter assesses the potential effects of the Development on bird populations and has been informed by a programme of baseline ornithology surveys commissioned by the Applicant and completed during a two year period from November 2019 to September 2021. The surveys have included breeding bird surveys, winter surveys, vantage point surveys and wider area surveys. All surveys have been completed in line with the relevant current guidance for bird surveys at on-shore wind farms.

Red Grouse

7.2 The baseline surveys have indicated red grouse are not found within the Development boundary or within a 500 m extent of the turbine layout however a small number of birds are present within the surrounding area (1 km extent from the turbine array) and the assessment of effects indicates there are unlikely to be significant adverse effect on the local red grouse population.

Curlew

7.3 The baseline surveys found four pairs of curlew within the survey area of which three pairs were within a 1 km extent from the Development and the assessment of effects indicates the potential displacement of one pair of curlew.

Snipe

7.4 The baseline surveys found five pairs of snipe within the survey area, of which three pairs were within a 500 m extent from the Development and the assessment of effects indicates the potential displacement of one or two pairs of snipe.

Moorland Passerines

7.5 The baseline surveys found seven passerine species breeding within the survey area and an additional ten transient species. All the passerine species were also found in the wider surrounding area and are also widely distributed locally and at a regional level and the assessment of effects indicates there are unlikely to be significant adverse effect on the local populations of breeding moorland passerines.

Winter Birds

7.6 The baseline surveys found a total of 30 bird species during the winter and migration surveys however most of these species are very widespread in distribution locally and regionally and were recorded within the survey area in relatively small numbers. Golden plovers were occasionally recorded within the survey area during the winter and spring periods however numbers were relatively small and the

assessment of effects indicates there are unlikely to be significant adverse effects on the local populations of wintering birds.

Birds at Loughs

7.7 Small loughs are present at two locations within the survey area. The baseline surveys found small numbers of several water bird species (including little grebe, moorhen, water rail and teal) at one of these locations however the assessment of effects indicates there are unlikely to be significant adverse effect on birds at the lough.

Hen harrier

7.8 The baseline surveys found two pairs of hen harriers within a 5 km extent from the Development and both pairs were confirmed to be breeding. Both pairs were located within the local part of the Antrim Hills SPA however neither pair was closer than 4 km from the Development. Hen harriers were observed foraging within the area of the Development however the frequency of observations was low or very low. During baseline year two there were strong indications that the male bird from nest location 1 was foraging within the area of the Development however the frequency of observations was low and there were no particular indications that the male bird from nest location 2 was foraging within the area of the Development. The foraging observations are consistent with guidance on the likely core foraging range of nesting hen harriers and the assessment of effects indicates there are unlikely to be significant adverse effects on the local hen harrier population or on the regional conservation status of the species.

Peregrine

7.9 The baseline surveys found one pair of peregrines (breeding confirmed) within a 2 km extent from the Development. The breeding location was > 1 km from the Development and the frequency of foraging observations within the area of the Development was low. The assessment of effects indicates there are unlikely to be significant adverse effects on the local peregrine population or on the regional conservation status of the species.

Red kite

7.10 During the baseline surveys there were two observations of a red kite (the same wing-tagged bird) within the area of the Development (within a 500 m extent) and two additional observations (in different baseline years) within the wider area (within a 2 km extent). The observations relate to wandering individual birds and during the baseline period there has been no indication of pair formation or of a defined breeding territory being established.

Golden eagle

7.11 During the baseline surveys there were three observations of golden eagles within the area of the Development (within a 500 m extent). The observations were in

January, November and December of the same calendar year and two (November and December) likely related to the same individual bird. There were no observations during the following calendar year and the observations indicate a wandering individual (s) with no indication of a permanent home range or breeding territory.

Buzzard

7.12 During the baseline period buzzards were by far the most frequently observed raptor species within the survey area. At least four pairs of buzzards were found breeding within the survey area (2 km extent) and one of these pairs was within the area of the Development (500 m extent). The estimated collision risk for buzzard is equivalent to one bird every 3.4 years however this needs to be assessed in the context of breeding productivity and also the favourable conservation status and very widespread distribution of this species and the assessment of effects indicates there are unlikely to be significant adverse effects on the local buzzard population and highly unlikely to be significant adverse effects on the regional conservation status of the species.

Kestrel

7.13 During the baseline period kestrels were not found breeding within a 2 km extent from the Development and observations of foraging birds were infrequent and mostly during the period March to September. The estimated collision risk for kestrel is equivalent to one bird every 13.9 years and the assessment of effects indicates there are unlikely to be significant adverse effects on the local kestrel population or on the regional conservation status of the species.

Antrim Hills SPA

7.14 The assessment of effects indicates there are unlikely to be significant adverse effects on the hen harrier population within the local part of the SPA and by extension on the SPA population as a whole.

Garron Plateau ASSI

7.15 The assessment of effects indicates there are unlikely to be significant adverse effects on the red grouse population within the local part of the ASSI and by extension on the ASSI population as a whole.

Mitigation

7.16 Mitigation is proposed for any likely significant adverse effects of the Development on bird populations and includes long term habitat management for breeding waders, an Ornithology Mitigation Strategy for the construction-phase and an Ornithology Management and Monitoring Plan.

Introduction

7.17 This chapter assesses potential effects of the Development on bird communities. The principal objectives of the chapter are:

- To outline the scope of the assessment;
- To describe the methodologies used in completing the assessment;
- To describe the baseline bird communities found within the site and in defined surrounding buffer areas;
- To describe the potential effects on bird communities and assess the significance of these effects;
- To detail any mitigation or compensation measures that may be required and to describe any residual effects remaining after the implementation of these measures.

7.18 The ornithology assessment is supported by:

- ES Volume 2 - Figures 7.1 - 7.12;
- ES Volume 4 - Appendices 7.1 - 7.16.

7.19 The Figures and Appendices are referenced in the text as necessary and listed in full at the end of the chapter.

Statement of Authority of the Author

7.20 The ornithology assessment (including all the surveys) has been carried out by David Steele:

- Professional qualifications - B.Sc. (2i Honours), Zoology, University of Aberdeen (1988);
- Professional experience – 32 years working as a professional ornithologist throughout Britain and Ireland, covering a wide range of bird species and methodologies including those particularly relevant to on-shore wind farm work (raptor monitoring, moorland bird surveys and breeding wader surveys). This work has been for a range of organizations including the Royal Society for the Protection of Birds, British Trust for Ornithology, Birdwatch Ireland and Scottish Natural Heritage (Seabirds Team). For the last 18 years working as a freelance consultant and has completed the fieldwork and ornithology assessments for 18 wind farm proposals in Northern Ireland and has also completed training on collision risk modelling.

Legislation and Policy Guidance

Legislation

7.21 The ornithology assessment has been carried out with reference to the following key pieces of legislation:

7.22 The Wildlife (Northern Ireland) Order 1985 (amended) which describes general protection measures for wild birds and in particular Schedule 1 to the Order which details those species (for example raptors) that have special levels of protection;

7.23 Annex 1 of the EC Birds Directive which details those bird species which are of particular conservation concern in Europe and which should be subject to special measures concerning their habitats in order to ensure they maintain a favorable conservation status.

Policy Guidance

7.24 In line with the current policy of the Northern Ireland Environment Agency (NIEA) the assessment has been carried out with reference to the published guidance of Nature Scot (formerly SNH) on assessing the effects of on-shore wind farms on bird communities outside designated conservation areas[1].

Scope of Assessment

General Effects of Wind Farms on Birds

7.25 On-shore wind farms can potentially effect birds in two main ways – by displacement of birds around the turbine array (leading to indirect habitat loss) or by creating a risk of collisions with the turbines. Direct habitat loss from wind farms is usually relatively small scale compared to other sorts of developments and in most cases is unlikely to be significant for bird communities[2].

7.26 The ornithology assessment therefore focuses on assessing potential displacement effects and (where relevant) collision risk effects of the Development. The assessment considers the potential effects on the bird communities found within the site and in defined surrounding buffer areas. Where relevant, the assessment also considers the potential cumulative effects resulting from other existing, consented or proposed wind farms in the vicinity of the Development.

Bird Species Requiring Assessment

7.27 All wild birds are subject to a general level of protection through the Wildlife and Countryside Act (Wildlife Order in Northern Ireland) and the EU Birds Directive but in line with SNH guidance only some bird species should generally be of concern in relation to wind farms:

- Birds on Annex 1 of the EU Birds Directive;
- Birds on Schedule 1 to the Wildlife and Countryside Act (Wildlife Order in Northern Ireland);
- Regularly occurring migratory species;

[1] SNH (2018): Assessing Significance of Impacts from Onshore Wind Farms Outwith Designated Areas (Guidance, February 2018)

[2] Percival, S. (2005): Birds and wind farms, what are the real issues? (British Birds 98 / 4)

- Species listed on the non-statutory lists of Birds of Conservation Concern (BOCC) for the United Kingdom and the island of Ireland.

7.28 The SNH guidance recommends that assessment of the effects of a wind farm on birds will normally be limited to those species included within the above categories. Additionally, SNH are of the view that passerine species (e.g. small moorland birds such as skylarks and meadow pipits) are not significantly impacted by wind farms[3]. However, all bird species (including passerine species) need to be considered in relation to the general levels of statutory protection afforded by the Wildlife (Northern Ireland) Order[4].

Designated Conservation Sites

Antrim Hills SPA

7.29 Post transition from the European Union the United Kingdom is still required to identify internationally important areas for birds and designate them as Special Protection Areas. The Development is immediately adjacent to (and overlaps partly with) the Antrim Hills Special Protection Area (SPA) and the assessment therefore gives full consideration to possible effects on the SPA, which is designated for its breeding populations of hen harrier and merlin[5].

ASSIs

7.30 The Garron Plateau Area of Special Scientific Interest (ASSI) is immediately adjacent to the northern boundary of the Development and the assessment therefore considers possible effects on the ornithological interests of the ASSI.

Consultation

7.31 Northern Ireland Raptor Study Group (NIRSG) provided confidential information on breeding activity by Annex-1 raptor species occurring in the vicinity of the Development – the information related to specific breeding sites and was therefore given on a personal communication basis rather than within a formal data request.

[3] SNH (2014 and 2017): Recommended bird survey methods to inform impact assessment of onshore wind farms (Guidance Notes, May 2014 and March 2017)

[4] NIEA: The Wildlife Law and You in Northern Ireland (Northern Ireland Environment Agency Biodiversity Series Booklet)

[5] Citation for Antrim Hills Special Protection Area (Northern Ireland Environment Agency)

Assessment Methodology

Survey Methods

7.32 Field surveys were carried out in line with the current SNH guidance for bird surveys at on-shore wind farms[6]. The different methodologies employed during the field surveys are described below.

Breeding Bird Surveys

7.33 Breeding bird surveys have been completed during two consecutive baseline years as summarized in Table 7.1. All surveys have been completed during the period April to early July. In baseline year one the entire area of the Development (area within the applicant's control) and the surrounding buffer area (together the "survey area") was surveyed as a single block. In year two (except for the final survey in July) the survey area was divided into two sections covering (1) the northern array of ten turbines and surrounding buffer area and (2) the southern array of four turbines and surrounding buffer area. In practice there was some overlap of the two survey sections, in particular in relation to the extensive curlew buffer. Further details of the survey visits are provided in Vol. 4 Appendix 7.1.

7.34 All surveys were completed using an adapted Moorland Bird Survey (MBS) method (also known as the "Brown and Shepherd" method)[7]. This method is suitable for surveying breeding wader species (curlew, snipe and lapwing) and also red grouse. SNH do not generally recommend survey of moorland passerines for wind farm developments, however, on sites were breeding waders are present only in small numbers then it is possible to include passerines in the MBS method. The principal target species for the surveys were therefore the breeding wader species and also red grouse however passerine species (in particular the less common species) were included where reasonably possible and particularly during the second survey year.

7.35 The surveys extended to at least a 500 m extent around the turbine locations. All land under the Applicant's control (i.e. within the Development site boundary) was walked through, with additional coverage into adjacent areas (depending on the habitat) by periods of scanning with binoculars.

Curlews

7.36 The survey area for curlew extended to at least a 1 km extent around the turbine locations. This additional survey coverage was achieved by three methods: (1) by scanning the additional area with binoculars during the standard MBS visits (any areas under the Applicant's control were also walked through); (2) during the vantage point surveys by scanning areas of potential curlew habitat with binoculars and telescope and also by listening for calling or singing birds and (3) by looking for

[6] SNH (2014 and 2017): Recommended bird survey methods to inform impact assessment of onshore wind farms (Guidance Notes, May 2014 and March 2017)

[7] Gilbert, G *et al.* (1998): Bird Monitoring Methods – a manual of techniques for key UK bird species (RSPB)

curlews from public roads while moving around within the wider surrounding area of the Development.

Table 7.1 – Summary of Breeding Bird Surveys

Baseline Period	No. of Survey Visits Completed	Remarks
Apr to Jul 2020	5	Five visits covering the survey area as a single unit
Apr to Jul 2021	7	Three visits to each of two sub-sections of the survey area (northern and southern) and one visit covering the survey area as a single unit.

Winter Bird Surveys

7.37 Surveys for wintering and migrating birds have been contemporaneous with the breeding bird surveys and have been completed during two winter periods as summarized in Table 7.2. In baseline year one the entire area of the Development and the surrounding buffer area was surveyed as a single unit. In year two the survey area was divided into the same two sections (northern and southern) as were used for the year two breeding bird surveys. Further details of the survey visits are provided in Vol. 4 Appendix 7.2.

7.38 All the surveys were completed using the same adapted MBS method as employed for the breeding bird surveys. The surveys extended to at least 500 m around the turbine locations. All land under the Applicant's control was walked through, with additional coverage into adjacent areas (depending on the habitat) by periods of scanning with binoculars. In addition to wintering and migrating birds, early breeding bird species (for example curlew and lapwing) were looked for during any survey visits completed during late February and March.

Table 7.2 - Summary of Winter Bird Surveys

Baseline Period	No. of Survey Visits Completed	Remarks
Nov 2019 to Mar 2020	4	Four visits covering the survey area as a single unit
Oct 2020 to Mar 2021	8	Four visits to each of two sub-sections of the survey area (northern and southern).

Vantage Point Surveys

7.39 An assessment of activity by raptors and other relatively large aerial species (e.g. migrating swans and geese) was completed from four vantage points (or view points) in 23 consecutive months during the period November 2019 to September 2021. Two additional vantage points (giving six in total) were added in October 2020. Vantage point survey effort during the baseline period is summarized in Table 7.3 and details of the individual vantage point watches are provided in Vol. 4 Appendix 7.3.

7.40 Vantage points were selected in line with current SNH guidance within any constraints imposed by access restrictions. No turbine location was more than 2 km from a vantage point. The locations of the vantage points and the associated visibility coverage (2 km extents) are shown in Vol. 3 Figure 7.1. In line with SNH guidance, visibility is shown at collision risk height (lower edge of the turbine rotor). For the assessment of collision risk, visibility at rotor height is more important than visibility at or near the ground, however the vantage points were selected so as to also provide an adequate view at or near ground level. Additional location details for each vantage point are given in Vol. 4 Appendix 7.4.

7.41 The vantage point watches were completed in line with the SNH method statement[8]. The surveys therefore extended to at least a 500 m extent around the turbine locations (up to a maximum 2 km extent from each vantage point). The target species were: (1) all raptor species (with priority given to Annex 1 species) and (2) whooper swans and geese (winter and migration periods only). Other relatively large species (e.g. golden plovers and gulls) were recorded as secondary species. At the discretion of the observer, notes were also kept of any significant activity by smaller aerial species (e.g. feeding flocks of swallows).

7.42 Vantage point watches were carried out at different times of day and in a wide range of weather conditions. Showery and moderately windy days were considered acceptable (raptors are often active in these conditions) but not continuous or heavy precipitation or very strong winds. Most watches were of three hours duration but some shorter or longer watches (not shorter than one hour or longer than four hours) were also completed. A number of vantage point watches were targeted at detecting potential roosting activity by raptors. These commenced at least 30 minutes before sunset and continued till dusk (typically 30-40 minutes after sunset). Details of these watches can be found in Appendix 7.3.

Table 7.3 – Summary of Vantage Point Surveys (Hours Completed)

Baseline Period	VP1	VP2	VP3	VP4	VP5	VP6
Nov 2019 to Mar 2020	30	25	30	24	0	0
Apr 2020 to Sep 2020	36	36	36	36	0	0
Oct 2020 to Mar 2021	36	36	36	36	36	36
Apr 2021 to Sep 2021	36	36	36	36	36	36

[8] SNH (2014): Recommended bird survey methods to inform impact assessment of onshore wind farms (Guidance Note, May 2014)

Wider Area Raptor Surveys

7.43 Surveys for breeding activity by raptor species in the wider area around the Development have been contemporaneous with the vantage point surveys and are summarized in Table 7.4. The selection of target species for these surveys depended primarily on indications provided by the vantage point surveys in combination with: (1) an assessment of potential raptor breeding habitat within the wider area; (2) the surveyor's previous knowledge of raptor breeding activity within the wider area[9] and (3) personal communications with NIRSG.

7.44 Following the above criteria the principal target species for the surveys were hen harrier, merlin and peregrine. Current SNH guidance for these species indicates a wider area survey limit of 2 km extent around the turbine locations[10]. Other raptor species that were likely to be breeding (based on indications provided by the vantage point surveys) were also looked for within the same 2 km extent.

7.45 An assessment of habitat suitability in baseline year 1 indicated that for hen harriers there was a low probability of a nesting attempt within the 2 km extent therefore in year two (and following further indications provided by the vantage point surveys and previous knowledge of raptor breeding activity within the wider area) the surveys for hen harrier were expanded to a 5 km extent within the adjacent part of the Antrim Hills SPA.

7.46 The wider area raptor surveys followed appropriate methodologies and protocols for the relevant species[11]. The surveys were carried out from roads and other areas with public access or access permissions. To avoid disturbance, all observations were made using a telescope from a safe distance and no attempt was made to approach nest sites. Further details of the surveys of raptor breeding activity within the wider area are provided in Vol. 4 Appendix 7.15 (confidential).

Table 7.4 – Summary of Wider Area Raptor Surveys

Target Species	Baseline Period / Survey Limit		Remarks
	Year 1 (Apr to Jul 2020)	Year 2 (Apr to Jul 2021)	
Hen harrier	2 km	5 km	an assessment of habitat suitability in year 1 indicated that for hen harriers there was a low probability of a nesting attempt within the 2 km survey limit
Peregrine	2 km	2 km	
Merlin	2 km	2 km	
Other species	2 km	2 km	

[9] Steele, D *et al.* (1997): Antrim Hills Breeding Bird Survey 1997 (Unpublished Report to RSPB, October 1997)
[10] SNH (2016) Assessing Connectivity with Special Protection Areas (Guidance Note June 2016)
[11] Gilbert, G *et al.* (1998): Bird Monitoring Methods – a manual of techniques for key UK bird species (RSPB)

Assessing Significance of Effects

Favourable Conservation Status

7.47 The assessment of the significance of effects on bird communities primarily follows the Favourable Conservation Status (FCS) approach recommended by SNH[12]. This approach considers any potential effects on a species and assesses these in the context of the total national or regional population and distribution. An impact should be judged to be of concern where it would adversely affect the favourable conservation status of a species (or prevent a species from recovering to favourable conservation status) at the regional or national level. The conservation status of the bird species considered by the ornithology assessment follows the current non-statutory list of Birds of Conservation Concern published for the island of Ireland[13].

7.48 For assessing the significance of bird populations (or any expected losses at the national or regional level) the generally accepted 1% threshold level is used, therefore if a population (or loss) exceeds 1% of the national or regional population of the species then it should be considered to be significant.

7.49 In the assessment of effects, the probability of any given effect occurring (and the probability of any likely effects being significant) are described using the scale suggested by the Institute of Ecology and Environmental Management (IEEM)[14] – the scale is given in Vol. 4 Appendix 7.5.

7.50 In line with the IEEM guidance, where relevant the assessment also considers possible local effects on bird communities. The assessment of the significance of local effects generally follows the same approach as for regional and national effects.

Cumulative Effects

7.51 Where relevant the assessment of the significance of effects also considers possible cumulative effects on bird communities from other existing, consented or proposed wind farm developments (including single turbines) in the vicinity. The assessment of cumulative effects on birds has been completed with reference to the current published SNH guidance[15].

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[12] SNH (2018): Assessing Significance of Impacts from Onshore Wind Farms Outwith Designated Areas (Guidance, February 2018)

[13] Gilbert, G *et al.* (2021): Birds of Conservation Concern in Ireland 4: 2020-2026 (Irish Birds 43: 1 - 22)

[14] IEEM (2006): Guidelines for Ecological Impact Assessment in the United Kingdom

[15] SNH (2018): Assessing the cumulative impacts of onshore wind farms on birds (Guidance, August 2018)

Description of Baseline Bird Communities

Breeding Birds

Red Grouse

7.52 The status of red grouse within the survey area during the baseline period is summarized in Table 7.5. Further details of the observation are provided in Vol. 4 Appendix 7.6 and the location is shown in Vol 3. Figure 7.4. An appraisal of the observation indicates that red grouse are not found within the Development boundary or within a 500 m extent of the turbine layout however a small number of birds (of the order of one pair / territory) are present within a 1 km extent. The absence of red grouse within the Development boundary (and within a 500 m extent of the turbine layout) is probably due to unsuitability of the habitat and in particular the absence of significant heather cover within the relevant area.

Table 7.5 – Summary of Baseline Status for Red Grouse

Baseline Period	No. of Observations within 500 m Extent of Turbine Array	No. of Observations within 1 km Extent of Turbine Array
Year 1 (Nov 2019 to Sep 2020)	0	0
Year 2 (Oct 2020 to Sep 2021)	0	1

Curlew

7.53 The status of curlews within the survey area during the baseline period is summarized in Table 7.6 and the locations of the curlew observations are shown in Vol. 3 Figures 7.2 and 7.3. Further details of the curlew observations are provided in Vol. 4 Appendix 7.7. No curlew nests were found during the surveys and the observations relate to locations were curlews were seen on the ground either feeding, resting or engaged in territorial activity.

7.54 The observations indicate that during the baseline period three pairs of curlew were present within a 1 km extent from the Development with one additional pair present within the wider area (>1 km up to a 2 km limit). The birds were very mobile and were frequently observed to fly long distances within the survey area therefore no attempt has been made to define territory boundaries however it is considered that the scatter of mapped observations gives a good indication of the overall area used by the birds. There was certainly some degree of overlap in the areas used by the different pairs especially early in the breeding season when the birds arrived at the survey area and again at the end of the season prior to departure.

7.55 Curlews arrived at the survey area around the middle of March (first observations were on 11th March in baseline year one and on 17th March in baseline year two) and on arrival the birds were typically in small flocks (e.g. five curlews together on 11th March 2020) with discrete pairs soon established thereafter. During the baseline period there was no evidence of successful breeding and departure from the survey area was relatively early in the season (last observations were on 16th June in baseline year one and on 5th July in baseline year two). This early departure from the breeding area is a further indication that the nesting attempts were unsuccessful. Flocking was observed prior to departure from the survey area (e.g. five adult curlews together on 16th June 2020).

Table 7.6 – Summary of Baseline Status for Curlew

Baseline Period	No. of Curlew Pairs within 1 km Extent of Turbine Array	No. of Additional Curlew Pairs within the Wider Area (>1 km up to a 2 km Limit)
Year 1 (2020)	3	1
Year 2 (2021)	3	1

Snipe

7.56 The status of breeding snipe within the survey area during the baseline period is summarized in Table 7.7 and the locations of the snipe observations are shown in Vol. 3 Figure 7.4. Further details of the snipe observations are provided in Vol. 4 Appendix 7.8. All observations were of birds calling from the ground ("chipping") or engaged in brief, low-level display flights with the birds subsequently seen to land on the ground – such observations are likely to give a good indication of territory locations.

7.57 The observations indicate that during the baseline period five pairs of snipe were present within the survey area and that three of those pairs with located within the 500 m extent from the turbine array.

Table 7.7 - Summary of Baseline Status for Snipe

Baseline Period	No. of Snipe Pairs within the Survey Area	No. of Pairs within 500 m Extent of Turbine Array
Year 1 (2020)	5	3
Year 2 (2021)	5	3

Moorland Passerines

7.58 The status of breeding moorland passerines within the survey area (to within a 500 m extent from the turbine array) during the baseline period is summarized in Table 7.8 and the locations of these species are shown in Vol. 3 Figure 7.5.

7.59 A total of seven passerine species were confirmed breeding within the survey area and an additional ten species were recorded as transient visitors. The transient species were not breeding within the survey area but occasionally visited the area to feed (for example flocks of finches, starlings and mistle thrushes in late summer). The transient species are not included within the baseline table but observations of these species are included within Appendix 7.9.

7.60 Meadow pipits and skylarks were the two most abundant passerine species and both were distributed very widely across the survey area. Other species were present in small numbers and were distributed more locally within the survey area.

Table 7.8 – Summary of Baseline Status for Moorland Passerines

Species	No. of Breeding Pairs / Territories	Breeding Status / Remarks
Skylark	34	Breeding confirmed
Meadow pipit	40	Breeding confirmed
Stonechat	4	Breeding confirmed
Wheatear	9	Breeding confirmed
Wren	4	Breeding confirmed
Grey wagtail	3	Breeding confirmed (linear territories along streams)
Reed bunting	2	Breeding confirmed

Breeding Birds at Loughs

7.61 Small freshwater loughs are found at two locations within the survey area and the two locations are shown in Vol. 3 Figure 7.4. Location 1 is at a relatively high elevation within the northeast part of the 500 m turbine buffer extent – the location is very exposed and the two small loughs at this location have stony shorelines with negligible fringing vegetation. Location 2 is at a much lower elevation adjoining the southern boundary of the Development (but outside the 500 m turbine buffer extent) and this lough is surrounded by a small area of fringing wet fen / marsh vegetation.

7.62 During the baseline period no breeding birds were found at Location 1 however small numbers of several water bird species and also several wetland habitat passerine species were found at Location 2 and these observations are summarized in Table 7.9. Further details of the observations of birds at lough Location 2 are provided in Vol. 4 Appendix 7.10.

Table 7.9 - Summary of Baseline Status for Breeding Birds at the Loughs

Species	Lough / No. of Breeding Pairs	
	Lough Location 1	Lough Location 2
Little Grebe	0	1
Water Rail	0	1
Moorhen	0	1
Teal	0	2

Species	Lough / No. of Breeding Pairs	
	Lough Location 1	Lough Location 2
Mallard	0	1
Greylag goose	0	1
Sedge warbler	0	1
Reed bunting	0	1

Winter Birds

7.63 The status of bird species within the survey area (to within a 500 m extent from the turbine array) during the baseline winter and migration periods is summarized in Table 7.10. Further details of the observations are provided in Vol. 4 Appendix 7.9.

7.64 A total of 30 bird species were recorded during the winter and migration surveys however most of these species are very widespread in distribution locally and regionally and were recorded within the survey area in relatively small numbers.

7.65 Golden plovers were occasionally recorded within the survey area during the period November to March however apart from the maximum count of 130 birds (in November) numbers were small (range one to 20 birds) and the flocks were very mobile, with no particularly favoured locations. Flocks were often seen only in flight although it could not be ruled out that the birds subsequently settled somewhere within the survey area.

7.66 A number of additional golden plover observations (seven in total) were made during the vantage point watches – these were during the months December to April and the maximum flock size was 30 birds. The latest observation in spring was of a flock of 12 birds on 30th April 2021 – they were only seen in flight and were certainly on migration and there was no indication that golden plovers were breeding within the survey area.

7.67 Snow buntings were observed on several occasions during the first winter period, mostly in small groups but including a flock of 130 birds in November. The flocks were very wide ranging, flying long distances within the survey area. No snow buntings were observed during the second winter period.

7.68 Other interesting observations during the baseline period include single observations of jack snipe, woodcock, green sandpiper and lapwing. The first two species are likely to occur regularly within the survey area during the winter but in small numbers only. The green sandpiper (observed in August) was obviously a bird on migration that was stopping to rest (at a small temporary pool) and this species is probably not regularly occurring within the survey area. The small flock of lapwings was observed flying over the survey area in late February but didn't settle and were considered to be migrating or dispersing birds.

Table 7.10 – Summary of Baseline Status for Winter and Migration Season Birds

Species	No. of Observations	Maximum Count	Remarks
Golden plover	6	120	Except for the maximum count flock sizes in range 1 – 20 birds
Lapwing	1	12	Small flock flying southeast in February
Snipe	5	10	Mostly flushed as singles or small groups
Jack snipe	1	1	December
Woodcock	1	1	November
Green sandpiper	1	1	At a small temporary pool in August
Great black-backed gull	9	11	One or two usually present, attracted to sheep carcasses
Lesser black-backed gull	1	20	Flock resting on ground
Herring gull	1	1	In flight
Woodpigeon	1	20	
Swift	2	2	
Swallow	1	20	Migrating flock
House martin	1	50	Feeding flock
Skylark	2	21	Pre-breeding flocks
Meadow pipit	6	50	Maximum count in October
Starling	6	600	Except for the maximum count flock sizes in range 40 – 200 birds; flocks ranging widely over survey area
Song thrush	1	4	
Fieldfare	8	100	Roving flocks in grassland areas
Mistle thrush	1	45	Post -breeding flock
Pied wagtail	2	2	
Hooded crow	9	80	Except for the maximum count flock sizes in range 6 – 20 birds
Raven	8	12	
Rook	1	300	
Jackdaw	1	100	
Goldfinch	4	100	Except for the maximum count flock sizes in range 2 – 20 birds
Linnet	1	20	
Redpoll	1	1	Flyover
Siskin	1	1	Flyover
Crossbill	1	1	Flyover
Snow bunting	4	130	Except for the maximum count flock sizes in range 11 – 12 birds

Winter Birds at Loughs

7.69 The two lough locations within the survey area have been described in the baseline for breeding birds. During the baseline winter and migration period no birds were found at Location 1 however small numbers of eight water bird species and three gull species were found at Location 2 although only several species (most notably moorhen, teal and mallard) were present on a regular basis. The observations are summarized in Table 7.11 and further details are provided in Vol. 4 Appendix 7.10. On six occasions (for example during freezing weather) no birds were present at the lough.

Table 7.11 – Summary of Baseline Status for Winter Birds at Lough Location 2

Species	No. of Observations	Maximum Count	Remarks
Little grebe	7	2	
Moorhen	13	2	
Water rail	1	1	
Teal	28	30	Average flock size ten birds
Mallard	16	6	
Greylag goose	5	2	
Cormorant	2	1	
Grey heron	8	2	
Great black-backed gull	8	18	Average flock size eight birds
Lesser black-backed gull	3	5	
Herring gull	1	2	

Vantage Point Surveys

Annex 1 Species

Overview

7.70 Activity by Annex 1 species within the survey area (to within a 500 m extent from the turbine array) during the baseline period is summarized in Table 7.12 and detailed further under the relevant species headings below. The flight-lines for these species are shown in Vol. 3 Figures 7.6 - 7.8. Further details of the observations of Annex 1 species are provided in Vol. 4 Appendix 7.11.

Table 7.12 – Overview of Baseline Activity by Annex 1 Species

Species	Baseline Period / No. of Observations		
	Year 1 (Nov 2019 - Sep 2020)	Year 2 (Oct 2020 - Sep 2021)	Baseline Totals
Hen harrier	8	14	**22**
Merlin	3	7	**10**
Peregrine	8	9	**17**
Red kite	0	2	**2**
Golden eagle	1	2	**3**
White-tailed eagle	0	1	**1**

Hen Harrier

7.71 Activity by hen harriers within the survey area (to within a 500 m extent from the turbine array) during the baseline period is summarized in Table 7.13. Considering the observations relative to the amount of survey effort the frequency of harrier observations was very low in baseline year one. In baseline year two there were significantly more harrier observations however the overall frequency of the observations was still low. In both baseline years observations were evenly distributed between the non-breeding and breeding periods.

7.72 All the observations related to birds engaged in foraging or foraging related behaviour and there was no indication of any breeding or roosting activity within a 500 m extent of the turbine array. Over the baseline period as a whole the number of observations of adult male harriers was similar to that of female or immature birds however during the breeding period of year two almost all the observations were of adult males and these observations were considered to relate to one individual male bird. Furthermore the observations during the breeding period of year two strongly indicated that this male was the bird from hen harrier nest Location 1 within the wider surrounding area.

7.73 Most of the observations of female / immature harriers related to immature (juvenile) birds in their first or second calendar year and there were only two observations of birds considered to be adult females.

Table 7.13 – Summary of Baseline Activity by Hen Harriers

Baseline Period	No. of Observations		
	Adult males	Females / immatures	Total
Non-breeding period year 1	3	1	4
Breeding period year 1	2	2	4
Non-breeding period year 2	1	6	7

Baseline Period	No. of Observations		
	Adult males	Females / immatures	Total
Breeding period year 2	6	1	7
Baseline Totals	**12**	**10**	**22**

Merlin

7.74 Activity by merlins within the survey area (to within a 500 m extent from the turbine array) during the baseline period is summarized in Table 7.14. All the observations were of female or immature merlins and all bar one were during the non-breeding period. The single sighting during the breeding period was on 8th April and so falls within the period when wintering or migrating merlins might still be expected to occur within the survey area. The bird was engaged in fast travelling flight and was not associated with a potential breeding site.

Table 7.14 – Summary of Baseline Activity by Merlins

Baseline Period	No. of Observations		
	Adult males	Females / immatures	Total
Non-breeding period year 1	0	2	2
Breeding period year 1	0	1	1
Non-breeding period year 2	0	7	7
Breeding period year 2	0	0	0
Baseline Totals	**0**	**10**	**10**

Peregrine

7.75 Activity by peregrines within the survey area (to within a 500 m extent from the turbine array) during the baseline period is summarized in Table 7.15. The observations of peregrines were more or less evenly distributed between the non-breeding and breeding periods and relative to the amount of survey effort the frequency of the observations was low.

7.76 Most of the observations related to single birds that were probably engaged in foraging activity however there were three observations of two birds together – these were obviously pairs (the male being significantly smaller) and were observed in high soaring and circling flight. On at least two of these occasions there was a strong indication that the observed pair was that from the peregrine nest site located within the wider surrounding area. Most of the observations were of adult peregrines however there were three observations of immature birds and also several observations were the age of the bird could not be determined.

Table 7.15 - Summary of Baseline Activity by Peregrines

Baseline Period	No. of Observations
Non-breeding period year 1	3
Breeding period year 1	5
Non-breeding period year 2	5
Breeding period year 2	4
Baseline Totals	**17**

Red Kite

7.77 During the baseline period there were two observations of red kites within the survey area (to within a 500 m extent from the turbine array). The sightings were in April and July of year two and the presence of coloured wing-tags confirmed that the same individual was involved in both observations. On both occasions the bird was flying in a leisurely fashion and was probably foraging. During baseline year two the same individual red kite (identified by the wing-tags) was also observed in the wider surrounding area (within a 2 km extent from the turbine array).

Golden Eagle

7.78 During the baseline period there were three observations of golden eagles within the survey area (to within a 500 m extent from the turbine array). The observations were in January of baseline year one and (following a ten-month gap) in November and December of the same calendar year. The November and December observations were just three weeks apart and very probably related to the same individual. There were no further observations during the following calendar year and no additional observations in the wider surrounding area (within a 2 km extent from the turbine array).

7.79 The observations indicate that golden eagles occur very occasionally or rarely within the area of the Development and are consistent with occasional observations of golden eagles elsewhere in the Antrim Hills and these observations are likely to refer to one or two wandering individuals. During the baseline period there have been no indications (for example observations during the summer period or observations of a pair of birds) of a more permanent home range or breeding territory.

White-tailed Eagle

7.80 During the baseline period there was one observation of a white-tailed eagle within the survey area (to within a 500 m extent from the turbine array). The observation was in April of year two and was of an immature bird resting on the ground for a prolonged period. The behaviour of numerous hooded crows and ravens in the vicinity strongly indicated that there was a sheep carcass nearby and the eagle had probably been attracted to that. After about an hour the bird was observed to fly up and departed the survey area high to the southeast, in the direction of the East Antrim coast. What was very probably the same immature white-tailed eagle was reported during subsequent days along the North Down coast[16].

Non-Annex 1 Raptor Species

Overview

7.81 Activity by non-Annex 1 species within the survey area (to within a 500 m extent from the turbine array) during the baseline period (baseline year two only for buzzard and sparrowhawk) is summarized in Table 7.16 and detailed further under the relevant species headings below. The flight-lines for these species are shown in Vol. 3 Figures 7.9 - 7.10. Further details of the observations of non-Annex 1 species are provided in Vol. 4 Appendix 7.12.

Table 7.16 - Overview of Baseline Activity by Non-Annex 1 Species

Species	Baseline Period / No. of Observations	
	Year 1 (Nov 2019 - Sep 2020)	Year 2 (Oct 2020 - Sep 2021)
Kestrel	10	12
Buzzard	-	50
Sparrowhawk	-	12

Kestrels

7.82 Activity by kestrels within the survey area (to within a 500 m extent from the turbine array) during the baseline period is summarized in Table 7.17. Kestrels were observed mostly during the period March to September and barely at all during the period October to February. All of the observations related to foraging activity and there was no indication of breeding activity within a 500 m extent of the turbine array.

7.83 A significant number of the observations during the late summer period of July to September were of juvenile birds and these are likely to have originated from somewhere within the wider surrounding area.

Table 7.17 - Summary of Baseline Activity by Kestrels

Month	Baseline Year / No. of Observations		Baseline Total
	Year 1	Year 2	
January	0	0	0

[16] Nibirds.blogspot.com

Month	Baseline Year / No. of Observations		Baseline Total
	Year 1	Year 2	
February	0	0	0
March	1	2	3
April	1	1	2
May	0	1	1
June	0	1	1
July	1	5	6
August	3	0	3
September	4	1	5
October	0	0	0
November	0	0	0
December	0	1	1
Baseline Totals	**10**	**12**	**22**

Buzzards

7.84 Activity by buzzards within the survey area (to within a 500 m extent from the turbine array) during the baseline period (baseline year two only) is summarized in Table 7.18. During the baseline period buzzards were by far the most frequently observed raptor species within the survey area. They were observed though out the year but observations were least frequent during the mid-winter months and more frequent during the late winter and early spring period through to the spring and summer months.

7.85 Most observations were of single birds but two birds were seen together on a number of occasions. Most of the observations probably related to foraging or associated activity. There was one observation of a pair of buzzards engaged in a display flight and this related to the birds from buzzard breeding Location 1 within the survey area (breeding was confirmed at this location in both baseline years).

Table 7.18 - Summary of Baseline Activity by Buzzards

Baseline Year 2 (Oct 2020 - Sep 2021)	No. of Observations
October	3
November	2
December	0
January	1
February	8
March	9

Baseline Year 2 (Oct 2020 - Sep 2021)	No. of Observations
April	5
May	3
June	7
July	6
August	4
September	2
Baseline Year 2 Total	**50**

Sparrowhawks

7.86 During the baseline period (year two only) there were twelve observations of sparrowhawks within the survey area (to within a 500 m extent from the turbine array). The observations were in February (three), April (two), May (one), July (three), August (one), September (one) and October (one). Most of the observations were of female or immature birds however there were two observations of adult males. All of the observations were of birds engaged in foraging or related behaviour.

Secondary Species

7.87 Activity by secondary species within the survey area (to within a 500 m extent from the turbine array) during the baseline period is summarized in Table 7.19 and further details of the observations are provided in Vol. 4 Appendix 7.13.

7.88 The observations of golden plovers have also been considered in the baseline for winter birds. Flock sizes were small and birds were observed circling (sometimes for moderately prolonged periods) and also flying quickly through the survey area. Great black-backed gulls are predators and scavengers and were occasionally observed during the vantage point watches, typically patrolling the survey area in steady flight, looking for live prey or sheep carcasses.

7.89 Swallows, house martins and swifts were occasionally observed feeding within the survey area during the warmer summer months however not all birds were noted by the observer and the numbers present were typically much smaller than the maximum counts shown in the table.

Table 7.19 – Summary of Observations of Secondary Species

Species	No. of Observations	Maximum Count	Remarks
Golden plover	7	30	Flocks circling or flying over during VP watches
Great black-backed gull	15	4	Flying birds patrolling area
Lesser black-backed gull	1	1	

Species	No. of Observations	Maximum Count	Remarks
Herring gull	1	1	
Greylag goose	1	3	Small flock flying south in November
Swallow	6	100	Feeding and migrating birds
House martin	2	30	Feeding and migrating birds
Swift	4	30	Feeding and migrating birds

Wider Area Raptor Surveys

Overview

7.90 Activity by raptor species in the wider area of the Development (within a 2 km extent from the turbine locations extended to a 5 km extent for hen harriers in baseline year two) is summarized in Table 7.20 and detailed further under the relevant species headings below. The locations of observations of these species within the wider area (including the locations of any confirmed nests) are shown in Figures 7.11 and 7.12 (FIGURES 7.11 AND 7.12 ARE CONFIDENTIAL AND ARE NOT FOR RELEASE INTO THE PUBLIC DOMAIN). Additional details of raptor breeding activity are provided in Appendix 7.16 (APPENDIX 7.16 IS CONFIDENTIAL AND IS NOT FOR RELEASE INTO THE PUBLIC DOMAIN).

Table 7.20 - Summary of Raptor Breeding Activity

Species	No. of Pairs	No. of Confirmed Nests	Survey Extent / Remarks
Hen harrier	2	2	5 km
Peregrine	1	1	2 km
Red kite	0	0	2 km; single birds observed in both baseline years but no pairs present
Kestrel	1	0	2 km; pair observed but breeding location not confirmed within 2 km survey extent
Buzzard	4	2	2 km

Hen harrier

7.91 During the baseline period there were no indications of any breeding activity by hen harriers within a 2 km extent from the turbine array. An assessment of the habitat within the 2 km extent has indicated that this area is currently of very marginal suitability for nesting harriers and the habitat within the area of the Development (including within a 500 m extent from the turbine array) is very marginal or completely unsuitable for nesting.

7.92 During baseline year two the survey area for hen harriers was extended to a 5 km limit into the adjacent part of the Antrim Hills SPA, an area which the surveyor knew (from personal observations and informal discussions with NIRSG) was likely to hold breeding harriers. This resulted in the location of two pairs of hen harriers and nesting was confirmed to take place at both locations. Both nest locations (the locations are shown in Vol. 3 Figure 7.11) are greater than 4 km distant from the Development (turbine array).

7.93 Observations made within the wider area and during the vantage point surveys gave a strong indication that the foraging range of the male harrier from nest Location 1 extended to the area of the Development although the frequency of the observations within this area was low and the male was also observed foraging in other areas extending around the nest location (e.g. to the north, east and southwest of the nest).

7.94 The location of nest 2 is more distant from the Development and during the surveys there were no particular indications that the foraging range of this male extended to the area of the Development. Furthermore, during the surveys there were no indications that the foraging ranges of the female harriers from either nest location extended to the area of the Development.

7.95 These observations are consistent with the known foraging range of hen harriers in Scotland and Northern Ireland which indicates that foraging can extend beyond the core area which current published guidance suggests should be taken to be in the range of 2 – 2.5 km around the nest[17]. During most of the breeding season female hen harriers remain in the relative near vicinity of the nest (and very close to the nest during the incubation and early nestling periods) and are therefore much less likely than males to stray far beyond the core foraging area.

Harrier Roosting

7.96 During the baseline period there was one observation of a hen harrier going to roost within the survey area. The roost location (which is shown in Vol. 3 Figure 7.11) was in dense rushes close to lough Location 1, within the area of the Development boundary but not within the 500 m extent from the turbine array (the location is 600 m distant from the nearest part of the turbine array). The observation was in November of baseline year two and was of a first calendar-year (juvenile) bird. No roosting was observed during several subsequent watches at this location.

7.97 The habitat chosen for roosting is probably atypical as several other hen harrier roost sites in Northern Ireland known to the surveyor have all been in deep heather (a habitat which is not present within the area of the Development). The observations indicate that although individual hen harriers might occasionally roost at this location, regular roosting or communal roosting (involving more than one harrier) is unlikely.

[17] SNH (2016) Assessing Connectivity with Special Protection Areas (Guidance Note June 2016); NIEA guidance given in wind farm consultation responses

Peregrine

7.98 During the baseline period peregrines were confirmed breeding at one location within a 2 km extent from the turbine array. The location (which is shown in Vol. 3 Figure 7.12) is greater than 1 km distant from the Development (turbine array).

Red kite

7.99 During the baseline period there were three observations of red kites within a 2 km extent from the turbine array. The observations (which are shown in Figure 7.12) were of single birds and there was no indication of a pair of birds or anything otherwise indicating breeding activity. The first observation was in April of baseline year one and was of an un-tagged bird flying (probably foraging) over a range of habitats within the southwestern part of the survey area. There were no subsequent observations of this bird therefore it is assumed to have stayed in the survey area for a short time only.

7.100 The other observations were on the same day in April of baseline year two and were of a wing-tagged bird (the same individual) observed at two locations (about 2 km apart) within the eastern part of the survey area. The same wing-tagged bird was also observed on two dates (in April and July) during the vantage point surveys within the 500 m extent from the turbine array.

7.101 The observations indicate that red kites occasionally occur within the survey area however the observations to date have related to wandering individual birds and during the baseline period there has been no indication of pair formation or of a defined breeding territory being established.

Kestrel

7.102 During the baseline period an adult male and female kestrel were observed foraging within the southwestern part of the survey area indicating that a pair might be breeding somewhere in this area however this could not be confirmed and it is possible that these birds nested at a more distant location (but likely not exceeding a 3 - 5 km extent from the turbine array). Observations of juvenile kestrels foraging within the survey area in late summer are a further indication that breeding probably occurred at least within a 3 - 5 km extent from the turbine array.

Buzzard

7.103 During the baseline period at least four pairs of buzzards were found within a 2 km extent from the turbine array (the locations are shown in Figure 7.12) and nesting was confirmed at two of the locations. Buzzard location 1 (nest confirmed in both baseline years) is 250 m distant from the nearest part of the Development (turbine array). The other three buzzard locations are all greater than 1 km from the turbine array.

Assessment of Effects

Breeding Birds

General Remarks

7.104 Results of research for breeding birds[18] have suggested that the main adverse effects of wind farms for these species are probably due to disturbance displacement during construction and that wind farm operation is unlikely to have a significant effect on local breeding bird populations. The research also suggested that there are potential beneficial effects of wind farm construction for some passerine species. The potential effects of the proposed Development on breeding birds are described under the headings below. Potential adverse effects and the significance of any likely effects are summarized in Table 7.21.

Red Grouse

7.105 The baseline surveys have indicated that red grouse are not found within the Development boundary or within a 500 m extent from the turbine array however a small number of birds (of the order of one pair / territory) are present within a 1 km extent. Red grouse is a Red-listed Species of Conservation Concern in Ireland. The potential adverse effects of the Development on red grouse relate principally to displacement due to disturbance during construction however the effect would be temporary with red grouse densities recovering after construction[19]. For red grouse it is considered that any such disturbance effects are unlikely to extend beyond a 500 m extent from the Development therefore the baseline observations indicate it is unlikely that displacement of red grouse would occur.

Curlew

7.106 The baseline surveys have indicated that three pairs of curlew are present within a 1 km extent from the Development with one additional pair present within the wider area (within a 2 km limit). The additional curlew pair is located outside the likely zone of potential adverse effects of the Development and therefore is not considered further. For the remaining three pairs then the potential adverse effects of the Development relate principally to displacement due to avoidance of the turbine array and for curlew the effect can extend up to 800 m resulting in a predicted 30.4 % reduction in breeding density within a 1 km extent of the turbine array[20].

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[18] Pearce-Higgins, J.W. *et al.* (2012): Greater impacts of wind farms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis (Journal of Applied Ecology 49)

[19] Pearce-Higgins, J.W. *et al.* (2012): Greater impacts of wind farms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis (Journal of Applied Ecology 49)

[20] Pearce-Higgins, J.W. *et al.* (2009): The distribution of breeding birds around upland wind farms (Journal of Applied Ecology 46)

7.107 Applying the predicted breeding density reduction factor to the curlew baseline population indicates the potential displacement of one pair of curlew within a 1 km extent from the Development (Vol. 4 Appendix 7.15). Curlew is a Red-listed Species of Conservation Concern in Ireland[21]. The Northern Ireland breeding population has declined c. 90% since the 1980's up to 2013 with further decline since then likely and the remaining population is estimated to be c. 200 breeding pairs[22]. The only notable remaining concentrations of breeding birds in Northern Ireland are 40 – 60 pairs in the Antrim Hills and c. 40 pairs in the Lough Erne Basin, with only small populations persisting in other areas[23]. The local population of four breeding pairs therefore represents a significant part of the Antrim Hills and Northern Ireland curlew populations and the potential displacement of one pair of curlew is likely to be significant for the Antrim Hills population.

Snipe

7.108 The baseline surveys have indicated that five pairs of snipe are present within the survey area and that three of those pairs are located within the 500 m extent from the turbine array. The potential adverse effects of the Development on snipe relate principally to displacement due to avoidance of the turbine array and for snipe the effect can extend up to 400 m resulting in a predicted 47.5 % reduction in breeding density within a 500 m extent of the turbine array[24].

7.109 Applying the predicted breeding density reduction factor to the snipe baseline population indicates the potential displacement of at least one (possibly two) pairs of snipe within a 500 m extent from the Development (Vol. 4 Appendix 7.15). Snipe is a Red-listed Species of Conservation Concern in Ireland[25]. The Northern Ireland breeding population has declined c. 78% since the 1980's up to 2013 when there were estimated to be 1,123 breeding pairs however further decline since then is likely. The displacement of one or two pairs of snipe is therefore likely to be significant for the local snipe breeding population.

Moorland Passerines

7.110 The baseline surveys found seven species of breeding passerines (skylark, meadow pipit, wheatear, stonechat, wren, grey wagtail and reed bunting) within the survey area. Two of these species (meadow pipit and grey wagtail) are Red-listed Birds of Conservation Concern in Ireland and wheatear is Amber-listed (the other species are not of conservation concern in Ireland). The potential adverse effects of the Development on these species relate principally to displacement due to disturbance during construction and avoidance of the turbine array.

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[21] Gilbert, G *et al.* (2021): Birds of Conservation Concern in Ireland 4: 2020-2026 (Irish Birds 43: 1 - 22)

[22] Northern Ireland Curlew Workshop 2018: Notes, outcomes and recommendations (NIEA, RSPB, BTO)

[23] Douglas *et al.* (2021): Recovering the Eurasian Curlew in the UK and Ireland (British Birds 114, 341 – 350)

[24] Pearce-Higgins, J.W. *et al.* (2009): The distribution of breeding birds around upland wind farms (Journal of Applied Ecology 46)

[25] Gilbert, G *et al.* (2021): Birds of Conservation Concern in Ireland 4: 2020-2026 (Irish Birds 43: 1 - 22)

7.111 For two passerine species (meadow pipit and wheatear) breeding densities have been found to be reduced within a 500 m extent from turbine arrays however the reasons for this were unclear and subsequent analysis found little evidence for consistent population declines in wheatear populations at wind farm sites[26]. The same research also suggested potential positive effects of wind farm construction on skylarks, meadow pipits and stonechats and it is suggested that vegetation disturbance during the construction of wind farms results in changes to the vegetation that are known to favour these species.

7.112 Although several of the species found during the baseline surveys are of conservation concern all these species were also found in the wider surrounding area (within a 1 – 2 km extent from the Development) and are also more widely distributed locally and at a regional level. It is also noted that NatureScot (SNH) are of the view that passerine species are generally not adversely affected by wind farms[27].

7.113 Taking all of the above factors into consideration (and including the potential positive effects of wind farm construction that have been identified for several passerine species) it is unlikely that the Development would have a significant adverse effect on the local populations of breeding moorland passerines.

Table 7.21 – Summary of Potential Effects on Breeding Birds

Species / Species Group	Potential Effects	Likelihood / Significance of Effects
Red grouse	Temporary displacement of birds during construction	Unlikely to occur
Curlew	Displacement of birds around the turbine array	Potential displacement of one pair of curlew. Likely to be significant for the Antrim Hills curlew population
Snipe	Displacement of birds around the turbine array	Potential displacement of one or two pairs of snipe. Likely to be significant for the local snipe population
Moorland Passerines	Displacement of birds during construction and around the turbine array	Unlikely to be significant and there are potential positive effects during construction for some species

Winter Birds

7.114 The potential effects of the Development on winter bird species are likely to be similar to those described for breeding birds, therefore displacement due to disturbance during construction and (for some species) potentially also due to avoidance of the turbine array. All of the species found during the winter season

[26] Pearce-Higgins, J.W. *et al.* (2012): Greater impacts of wind farms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis (Journal of Applied Ecology 49)

[27] SNH (2006): Assessing the significance of impacts of on-shore wind farms on birds out-with designated areas (Guidance Note, July 2006)

are very widespread in distribution locally and regionally and were observed within the survey area in relatively small numbers. In general it is therefore unlikely that the Development would cause any significant adverse effects on the local populations of wintering birds. For some species (e.g. snow bunting) that are associated with anthropomorphic habitat features, there may be potential beneficial effects of wind farm construction at the local population level.

Birds at the Loughs

7.115 During the baseline period (breeding season and winter periods) small numbers of several water bird species were found at one of the loughs located within the survey area. The lough is on the boundary of the Development but is not within a 500 m extent from the turbine array and is not particularly close to any of the other infrastructure (e.g. not closer than 300 m from any section of new track). Considering both the location of the lough and the small numbers of birds (both breeding and in winter) then it is unlikely that any significant disturbance effects would occur.

Annex 1 Raptor Species

7.116 The potential effects of the proposed Development on Annex 1 raptor species are described under the headings below. Potential adverse effects and the significance of any likely effects are summarized in Table 7.22.

Hen Harriers

Displacement Effects (Foraging)

7.117 The baseline surveys have indicated hen harriers forage within the area of the Development during both the non-breeding and breeding periods however the frequency of observations has been low. The potential adverse effects of the Development on foraging harriers relate principally to displacement due to avoidance of the turbine array and for harriers the effect can extend up to 250 m resulting in a predicted 52.5 % reduction in flight activity within a 500 m extent of the turbine array[28].

7.118 The low frequency of foraging observations within the area of the Development is consistent with the known locations of the confirmed hen harrier nests in the wider surrounding area - both nests were greater than 4 km distant from the Development (greater than 5 km distant for one nest). An appraisal of the nest locations relative to guidance on the core foraging range for nesting harriers (core range of 2 – 2.5 km) indicates that the Development is located significantly beyond the likely core foraging range for both nest locations.

[28] Pearce-Higgins, J.W. et al. (2009): The distribution of breeding birds around upland wind farms (Journal of Applied Ecology 46)

7.119 In assessing foraging displacement effects the suitability of the habitat within the core foraging range also needs to be considered and in this instance the observations have indicated that there is extensive suitable foraging habitat within the core area around both nest locations. It is well established that the foraging activity of nesting hen harriers (most notably males) can extend to areas significantly beyond the core range (up to at least 5 km in Northern Ireland and even up to 10 km has been recorded in Scotland) however the amount of foraging activity in these peripheral areas would be expected to be significantly less than within the core area.

7.120 Hen harrier is an Amber-listed Species of Conservation Concern in Ireland and the most recent published information for the UK indicates a population of 26 territorial pairs in Northern Ireland[29]. The local population of two breeding pairs therefore represents a significant part of the regional population. However considering the baseline foraging observations, the published guidance in relation to core foraging range and the appraisal of habitat availability within the core range then it is unlikely that the predicted reduction in hen harrier flight activity within a 500 m extent around the turbine array would have any significant adverse effects on the local hen harrier population or on the regional conservation status of the species.

Collision Risk

7.121 From the baseline observations the Collision Risk Model (Vol 4. Appendix 7.14) indicates a collision risk for hen harrier equivalent to one bird every 56.9 years. The collision risk assumes no significant reduction in flight activity due to displacement effects within the 500 m extent around the turbine array and it is highly unlikely that this number of collisions would have any significant adverse effects on the local hen harrier population or on the regional conservation status of the species.

Direct Disturbance (Nest Sites)

7.122 The baseline surveys found two hen harrier nests within the wider surrounding area of the Development however the nest locations are greater than 4 km from the Development. An assessment of the habitat within the 2 km extent has indicated that this area is currently of very marginal suitability for nesting harriers and the habitat within the area of the Development (including within a 500 m extent from the turbine array) is very marginal or completely unsuitable for nesting.

7.123 The limit of disturbance for nesting hen harriers is in the range of 500 - 750 m around the nest site[30]. Considering the habitat assessment then it is highly unlikely that hen harriers would attempt to nest within the area of the Development or within the 2 km extent around the turbine array and known nest locations are more

[29] Eaton, M and Holling, M. (2020): Rare breeding birds in the UK in 2018 (British Birds 113, 737 – 791)

[30] Ruddock, M and Whitfield, D.P. (2007): A Review of Disturbance Distances in Selected Bird Species (Natural Research Ltd Report to Scottish Natural Heritage)

than 4 km away from the Development. It is therefore highly unlikely that any hen harrier nests would be directly disturbed by the Development.

Peregrines

Displacement Effects (Foraging)

7.124 The baseline surveys have indicated peregrines forage within the area of the Development during both the non-breeding and breeding periods however the frequency of observations has been low. Published guidance indicates a core foraging range for peregrines of 2 km however foraging up to a maximum of 18 km from the nest has been recorded in Scotland[31]. It can therefore be assumed that foraging peregrines are likely to travel significantly beyond the indicated core range. Peregrines also forage over a very wide range of habitats including even urban areas and the open sea (anywhere where their principal prey of medium sized birds is available).

7.125 Peregrine has a favourable conservation status in Ireland (it is not currently a species of conservation concern) and the most recent published information for the UK indicates a population of 83 territorial pairs in Northern Ireland[32]. The published research on the effects of wind farms on birds does not indicate any specific turbine avoidance distance for peregrines however it can be assumed that there is likely to be some degree of avoidance. However, considering the foraging behaviour of this species then it is highly unlikely that displacement of foraging birds around the turbine array (assuming a moderate level of avoidance) would have any significant adverse effects on the local peregrine population or on the regional conservation status of the species.

Collision Risk

7.126 From the baseline observations the Collision Risk Model (Vol. 4 Appendix 7.14) indicates a collision risk for peregrine equivalent to one bird every 97.8 years and it is highly unlikely that this number of collisions would have any significant adverse effects on the local peregrine population or on the regional conservation status of the species.

Direct Disturbance (Nest Sites)

7.127 During the baseline period peregrines were confirmed breeding at one location within a 2 km extent from the Development. The location is greater than 1 km distant from the Development. Guidance on the upper limit of disturbance for nesting peregrines indicates a distance in the range of 500 - 750 m[33] therefore, it is

[31] SNH (2016) Assessing Connectivity with Special Protection Areas (Guidance Note June 2016); NIEA guidance given in wind farm consultation responses

[32] Eaton, M and Holling, M. (2020): Rare breeding birds in the UK in 2018 (British Birds 113, 737 – 791)

[33] Ruddock, M and Whitfield, D.P. (2007): A Review of Disturbance Distances in Selected Bird Species (Natural Research Ltd Report to Scottish Natural Heritage)

highly unlikely that the peregrine nest site would be directly disturbed by the Development.

Table 7.22 - Summary of Potential Effects on Annex 1 Raptor Species

Species	Potential Effects	Likelihood / Significance of Effects
Hen harrier	Displacement of foraging birds around the turbine array	Unlikely to be significant
Hen harrier	Collision risk	The CRM indicates a collision risk equivalent to one bird every 56.9 years, and it is highly unlikely that this number of collisions would have any significant adverse effects on the local hen harrier population or on the regional conservation status of the species
Hen harrier	Direct disturbance of nest sites	Highly unlikely to occur
Peregrine	Displacement of foraging birds around the turbine array	Unlikely to be significant
Peregrine	Collision risk	The CRM indicates a collision risk equivalent to one bird every 97.8 years, and it is highly unlikely that this number of collisions would have any significant adverse effects on the local peregrine population or on the regional conservation status of the species
Peregrine	Direct disturbance of nest sites	Highly unlikely to occur

Non-Annex 1 Raptor Species

7.128 The potential effects of the proposed Development on Non-Annex 1 raptor species are described under the headings below. Potential adverse effects and the significance of any likely effects are summarized in Table 7.23.

Buzzards

Displacement Effects (Foraging)

7.129 During the baseline period buzzards were by far the most frequently observed raptor species within the survey area. They were observed though out the year but less frequently during the mid-winter months. The potential adverse effects of the Development on foraging buzzards include displacement due to avoidance of the turbine array and for buzzards the effect can extend up to 500 m resulting in a predicted 41.4% reduction in flight activity within a 500 m extent of the turbine array[34] however, the significance of this effect needs to be assessed in the context of other habitat that is likely to be available to the birds and also the favourable conservation status[35] and very widespread distribution of this species in Northern Ireland and in the island of Ireland as a whole[36].

7.130 Buzzards, forage over a very wide range of habitats including moorland habitats (such as those found within the survey area), upland (less improved) farmland habitats, woodland and commercial forestry habitats and also intensive lowland farmland habitats including highly improved grasslands. During the baseline period buzzards were observed foraging in association with all of the above habitats within the wider area around the Development and availability of foraging habitat is unlikely to be a significant constraint for the birds. Placed in this context then it is unlikely that the predicted foraging displacement would have any significant adverse effects on the local buzzard population or on the regional conservation status of the species.

Collision Risk

7.131 From the baseline observations the Collision Risk Model (Vol. 4 Appendix 7.14) indicates a collision risk for buzzard equivalent to one bird every 3.4 years. The collision risk assumes no significant reduction in flight activity due to displacement effects within the 500 m extent around the turbine array and also needs to be assessed in the context of breeding productivity and also the favourable conservation status and very widespread distribution of this species in Northern Ireland and in the island of Ireland as a whole.

7.132 The all-Ireland buzzard breeding population has been estimated at 3,312 pairs (of which about half are in Northern Ireland) however the population is still expanding in size and range[37]. Breeding productivity in Northern Ireland has been estimated to average 1.95 young fledging per successful pair[38] and a study in the Republic of Ireland recorded an average of 2.61 young fledging per successful pair[39]. The observations of nesting productivity included in the baseline surveys have been consistent with these published figures (Vol. 4 Appendix 7.16).

7.133 Buzzards are also very widely distributed throughout the Antrim Hills and the numbers found within the survey area (within a 2 km extent from the turbine array) are by no means unusual in this context. Taking all these factors into account then it is unlikely that the predicted number of collisions would have a significant adverse effect on the local buzzard population and highly unlikely there would be a significant adverse effect on the regional conservation status of the species.

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[34] Pearce-Higgins, J.W. *et al.* (2009): The distribution of breeding birds around upland wind farms (Journal of Applied Ecology 46)

[35] Gilbert, G *et al.* (2021): Birds of Conservation Concern in Ireland 4: 2020-2026 (Irish Birds 43: 1 - 22)

[36] Balmer, D. *et al.* (2013): Bird Atlas 2007-2011 (BTO Books)

[37] Nagle, T. *et al.* (2014): Habitat and diet of re-colonising common buzzards *Buteo buteo* in County Cork (Irish Birds 10)

[38] Rooney, E and Montgomery, W.I. (2013) Diet diversity of the common buzzard *Buteo buteo* in a vole-less environment (Bird Study 60)

[39] Nagle, T. *et al.* (2014): Habitat and diet of re-colonising common buzzards *Buteo buteo* in County Cork (Irish Birds 10)

Kestrels

Displacement Effects (Foraging)

7.134 The baseline surveys have indicated kestrels forage within the area of the Development however the frequency of observations was low, and most observations were during the period March to September with barely any during the period October to February. The potential adverse effects of the Development on foraging kestrels include displacement due to avoidance of the turbine array however the published research on the effects of wind farms on birds does not indicate any specific turbine avoidance distance for kestrels.

7.135 The relatively low turbine avoidance rate for kestrels (95%) for use in collision risk assessment[40] indicates that kestrels are likely to be less prone to displacement effects than other raptor species. Kestrels also have an extensive foraging range that is likely to extend up to 3 – 5 km from the nest although the core foraging range is likely to be similar to other small raptor species[41]. Considering these factors in combination it is unlikely that the displacement of foraging birds around the turbine array would have a significant adverse effect on the local kestrel population or on the regional conservation status of the species.

Collision Risk

7.136 From the baseline observations the Collision Risk Model (Vol. 4 Appendix 7.14) indicates a collision risk for kestrel equivalent to one bird every 13.9 years. Kestrel is a Red-listed Species of Conservation in Ireland (due to significant population declines)[42] however, it nevertheless remains the most widely distributed raptor species in Ireland[43] and any potential collisions need to be considered in the context of this very widespread distribution. Taking these factors into account then it is unlikely that the predicted number of collisions would have a significant adverse effect on the local kestrel population and highly unlikely that there would be a significant adverse effect on the regional conservation status of the species.

7.23 – Summary of Potential Effects on Non-Annex 1 Raptors

Species	Potential Effects	Likelihood / Significance of Effects
Buzzard	Displacement of foraging birds around the turbine array	Unlikely to be significant

40 SNH (2016): Avoidance rates for the SNH onshore wind farm Collision Risk Model (SNH Guidance Note, October 2016)

41 SNH (2016) Assessing Connectivity with Special Protection Areas (Guidance Note June 2016); NIEA guidance given in wind farm consultation responses

42 Gilbert, G *et al.* (2021): Birds of Conservation Concern in Ireland 4: 2020-2026 (Irish Birds 43: 1 - 22)

43 Balmer, D. *et al.* (2013): Bird Atlas 2007-2011 (BTO Books)

Species	Potential Effects	Likelihood / Significance of Effects
Buzzard	Collision risk	The CRM indicates a collision risk equivalent to one bird every 3.4 years and it is unlikely that this number of collisions would have any significant adverse effects on the local buzzard population and highly unlikely to have any significant adverse effects on the regional conservation status of the species
Kestrel	Displacement of foraging birds around the turbine array	Unlikely to be significant
Kestrel	Collision risk	The CRM indicates a collision risk equivalent to one bird every 13.9 years and it is unlikely that this number of collisions would have any significant adverse effects on the local kestrel population and highly unlikely to have any significant adverse effects on the regional conservation status of the species

Antrim Hills SPA

Overview

7.137 The Development is immediately adjacent to (and overlaps partly with) the Antrim Hills SPA which is designated for its breeding populations of hen harrier and merlin[44]. Four turbine locations (T7, T8, T12 and T13) and their associated infrastructure fall within the boundary of the SPA. The potential effects of the Development on the SPA are described under the headings below. The assessment has been completed with reference to guidance of SNH on assessing connectivity of wind farm developments with Special Protection Areas[45]. Potential adverse effects and the significance of any likely effects are summarized in Table 7.24.

Hen harriers

7.138 The baseline surveys have indicated two pairs of hen harriers are present within the local part of the SPA (within 5 km extent of the Development). The total hen harrier population for the SPA is not currently known but during 1998 – 2004 was in the range of 17 – 25 pairs. The population has almost certainly declined significantly since 2004 and currently may not exceed ten pairs for the entire SPA[46].

Direct Habitat Loss

7.139 Direct habitat loss (which would be relatively minor) to the four turbines and associated infrastructure located within the SPA boundary is highly unlikely to have any significant adverse effects on the hen harrier population within the local part of the SPA and by extension on the SPA population as a whole.

[44] Citation for Antrim Hills Special Protection Area (Northern Ireland Environment Agency)

[45] SNH (2016) Assessing Connectivity with Special Protection Areas (Guidance Note June 2016); NIEA guidance given in wind farm consultation responses

[46] Eaton, M and Holling, M. (2020): Rare breeding birds in the UK in 2018 (British Birds 113, 737 – 791)

Displacement Effects (Foraging)

7.140 Although some hen harrier foraging was observed within the area of the Development this area (including a 500 m extent from the turbine array) falls well beyond the likely core foraging range of the birds nesting within the local part of the SPA (core foraging range guidance of 2 – 2.5 km as compared to distances from the Development of the two known nest sites of > 4 km and > 5 km respectively). An appraisal of the habitat further indicates that any future nests are unlikely to be located significantly closer than 4 km and are highly unlikely to be located within 2 – 2.5 km from the Development. It is therefore unlikely that displacement of foraging birds would have any significant adverse effects on the hen harrier population within the local part of the SPA and by extension on the SPA population as a whole.

Direct Disturbance (Nest Sites)

7.141 The two currently known hen harrier nest locations within the local part of the SPA are both greater than 4 km from the Development. An appraisal of the habitat further indicates that any future nests are unlikely to be located significantly closer than 4 km from the Development. In particular, the habitat within that part of the SPA that is immediately adjacent to the boundary of the Development is either of very marginal suitability for nesting (negligible or poor heather cover) or completely unsuitable (grassland), therefore harriers are highly unlikely to attempt to nest in this. Given that the limit of disturbance for nesting hen harriers is in the range of 500 - 750 m around the nest site[47] then it is highly unlikely that hen harrier nests located within the local part of the SPA would be directly disturbed by the Development.

Collision Risk

7.142 The predicted collision risk for hen harrier is equivalent to one bird every 56.9 years and it is highly unlikely that this number of collisions would have any significant adverse effects on the hen harrier population within the local part of the SPA and by extension on the SPA population as a whole.

Merlins

7.143 Although some suitable habitat exists (edges of thicket and pole-stage conifer plantations) the baseline surveys have indicated that breeding merlins are not currently present within the local part of the SPA (within a 2 km extent of the Development). The total merlin population for the SPA is not currently known but during 2000 – 2005 was estimated to be eight pairs[48] and has probably not changed significantly since then[49].

[47] Ruddock, M and Whitfield, D.P. (2007): A Review of Disturbance Distances in Selected Bird Species (Natural Research Ltd Report to Scottish Natural Heritage)

[48] Citation for Antrim Hills Special Protection Area (Northern Ireland Environment Agency)

7.144 A feature of merlin breeding ecology in Northern Ireland is that the birds change breeding location (typically every 2 – 5 years) with movements of up to several kilometres not unusual. The habitat within the survey area would suggest it is possible than merlins could attempt to nest in the future within the local part of the SPA however any such attempt is unlikely (considering the habitat) to be within a 1 km extent from the Development. Merlin is a small, fast-flying and agile species that forages over very extensive areas and is therefore likely to be significantly less prone to collisions and displacement effects than are other raptor species. It is therefore considered that the Development is unlikely to have any significant adverse effects on the SPA merlin population.

Table 7.24 – Summary of Potential Effects on the Antrim Hills SPA

SPA Species	Potential Effects	Likelihood / Significance of Effects
Hen harrier	Direct habitat loss	Highly unlikely to be significant
Hen harrier	Displacement effects	Unlikely to be significant
Hen harrier	Direct disturbance (nest sites)	Highly unlikely to occur
Hen harrier	Collision risk	Highly unlikely to be significant
Merlin	Collisions risk and displacement effects	Unlikely to be significant

Local ASSIs

7.145 A relatively small part of the extensive Garron Plateau ASSI is immediately adjacent to the northern boundary of the Development. The ASSI is of particular importance for a population of red grouse[50]. The original ASSI Citation also mentions “a few pairs” of golden plover and dunlin. However, in view of recent widespread declines in breeding populations of golden plovers (for example the species is now absent from its former stronghold on Cuilcagh Mountain in Fermanagh and Cavan[51]) then it is probably doubtful whether this species now regularly breeds within the ASSI and the status of dunlin within the ASSI is probably also doubtful. The potential effects of the Development on the red grouse population within the ASSI are described below and the potential adverse effects and the significance of any likely effects are summarized in Table 7.25.

Red grouse

7.146 The potential adverse effects of the Development on red grouse relate principally to displacement due to disturbance during construction however the effect would

[49] Personal observations

[50] Garron Plateau ASSI Citation

[51] Newton, S.F. *et al*. (2016): Rare Breeding Birds in Ireland in 2016 (Irish Birds 10, No. 3)

be temporary with red grouse densities recovering after construction[52] and any such disturbance effects are unlikely to extend beyond a 500 m extent from the Development. It is therefore unlikely that the Development would have any significant adverse effects on the red grouse population within the local part of the ASSI and by extension on the ASSI population as a whole.

Table 7.25 - Summary of Potential Effects on the Garron Plateau ASSI

ASSI Species	Potential Effects	Likelihood / Significance of Effects
Red grouse	Displacement effects	Unlikely to be significant

Cumulative Effects

Methodology

7.147 In line with the current SNH guidance[53] potential cumulative effects are assessed for Species of Conservation Concern that are regularly occurring in significant numbers within the relevant baseline survey extent. The guidance indicates that a cumulative effect should be considered to be of concern when it would adversely affect the favourable conservation status of a species (or prevent a species from recovering to favourable conservation status) at the regional or national level.

7.148 Information on external wind farms and single turbines in the surrounding area has been provided by the Applicant and this information is summarized in Table 7.26 which includes external wind farms within a 10 km extent from the Development and single turbines within a 2.5 km extent.

Table 7.26 - Summary of External Wind Farms and Single Turbines

Wind Farm	Approximate Location	No. Turbines	Status (Remarks)
Elginny Hill	10 km to southwest	11	Operational
Rathsherry	8.5 km to west	9	Operational
Carnalbanagh	10 km to south	7	Consented
Single turbine 1	1.0 km to south	1	Consented
Single turbine 2	1.0 km to south	1	Consented
Single turbine 3	1.7 km to southwest	1	Consented
Single turbine 4a	2.2 km to east	1	Under consideration

[52] Pearce-Higgins, J.W. *et al.* (2012): Greater impacts of wind farms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis (Journal of Applied Ecology 49)

[53] SNH (2018) Assessing the cumulative impacts of onshore wind farms on birds (SNH Guidance Note, August 2018)

Wind Farm	Approximate Location	No. Turbines	Status (Remarks)
Single turbine 4b	2.2 km to east	1	Consented (linked to 4a)
Single turbine 5a	2.2 km to east	1	Consented (linked to 5b)
Single turbine 5b	2.2 km to east	1	Under consideration
Single turbine 6	2.5 km to southeast	1	Consented

Cumulative Assessment

7.149 The potential cumulative effects of the Development are described under the headings below and the potential adverse effects and the significance of any likely effects are summarized in Table 7.26.

Curlew

7.150 Potential cumulative effects on curlew are considered in relation to the six single turbines located within a 2.5 km extent from the Development. Single turbines 1 – 3 form a small cluster located 1 km - 1.7 km south of the Development close to the Slane Road and the Carnlough Road. None of these turbines are closer than 1.5 km from locations were curlew have been observed during the baseline period. Single turbines 4a / 4b and 5a / 5b form another small cluster located 2.2 km east of the Development close to the Ballyvaddy Road. None of these turbines are closer than 1.5 km from the curlew locations and they are also further separated from the curlew locations by the Ballymena Road (A42). Single turbine 6 is located 2.5 km southeast of the Development close to the Ballyvaddy Road and is 1.9 km from the nearest curlew locations.

7.151 Considering the locations of the single turbines relative to the curlew locations it is highly unlikely that the turbines would cause any significant additional displacement effects or other effects in combination with the displacement effects of the Development. Therefore, it is highly unlikely there would be any significant cumulative effects on the local curlew population or on the regional conservation status of the species.

Snipe

7.152 Potential cumulative effects on snipe are also considered in relation to the six single turbines located within a 2.5 km extent from the Development. None of the turbines are closer than 1.6 km from locations were snipe have been observed during the baseline period. Considering the locations of the single turbines relative to the snipe locations it is highly unlikely that the turbines would cause any significant additional displacement effects or other effects in combination with the displacement effects of the Development. Therefore it is highly unlikely there would be any significant cumulative effects on the local snipe population or on the regional conservation status of the species.

Hen harrier

7.153 Potential cumulative effects on hen harriers (and by extension the Antrim Hills SPA) are considered in relation to the two external wind farms (Rathsherry and Elginny Hill) located within a 10 km extent from the Development and also in relative close proximity to the local part of the Antrim Hills SPA. These two wind farms are adjacent to each other and in effect form a single turbine array. The closest part of the array is 8.5 km west of the Development and the approximate centre of the array is 10 km southwest of the Development. Carnalbanagh Wind Farm is located within 10 km of the Development but is on the opposite side of the A42 road in a different geographical area and is not connected with the area of the Development (or with Rathsherry and Elginny Hill) in terms of hen harrier habitat. It is also not close to the local part of the Antrim Hills SPA therefore Carnalbanagh Wind Farm is not considered further in the cumulative assessment.

7.154 The hen harrier nest locations within the local part of the SPA are greater than 3.5 km (nest location 2) and greater than 6 km (nest location 1) from the nearest part of the Rathsherry / Elginny Hill array which therefore should be considered to fall outside the likely core foraging ranges for both nest sites (assuming the 2 – 2.5 km core range indicated by the published guidance). If it is assumed (likely) that some foraging (particularly by males) will take place outside the core range then the male from nest location 2 might reasonably be expected to occasionally reach the area of the Rathsherry / Elginny Hill array however the male from nest location 1 (which is significantly further away) is unlikely to do so.

7.155 During the baseline period there was no particular indication that the male bird from harrier nest location 2 (which might reasonably be expected to occasionally forage within the Rathsherry / Elginny Hill array) was foraging within the area of the Development however there were strong indications the male bird from nest location 1 was doing so (however this bird is unlikely to forage within the Rathsherry / Elginny Hill array). Considering these observations it is unlikely that the Rathsherry / Elginny Hill array would cause any significant additional displacement effects or other effects in combination with the displacement effects of the Development. It is therefore unlikely there would be any significant cumulative effects on the local hen harrier population (and by extension the Antrim Hills SPA) or on the regional conservation status of the species.

Table 7.26 - Summary of Potential Cumulative Effects

Species	Potential Cumulative Effects	Likelihood / Significance of Cumulative Effects
Curlew	Additional displacement effects	Highly unlikely
Snipe	Additional displacement effects	Highly unlikely
Hen harrier	Additional displacement effects	Unlikely

Mitigation

7.156 Proposed mitigation measures are outlined below and summarized in Table 7.27 and would be implemented in full by the Developer. Full details of the Ornithology Mitigation Strategy (OMS) and Ornithology Management and Monitoring Plan (OMMP) would be provided in reports prior to commencement of construction.

Habitat Management

7.157 It is proposed to implement a programme of long-term habitat management (during the life of the Development) for curlew and snipe to compensate for potential displacement of breeding pairs. The habitat management area is to be at least of an adequate size to compensate for the potential displacement and at an appropriate distance from any species-specific turbine buffer zones. The habitat management is to follow the Northern Ireland Environmental Farming Scheme (EFS) species-specific guidance for breeding waders.

7.158 Full details of the habitat management measures for curlew and snipe are provided within the Habitat Management Plan and would also be further detailed within the OMMP. The proposed compensatory habitat for curlew and snipe is substantial in size (totalling 49.80 ha) and is therefore expected to provide *at least* adequate compensation for the potential displacement of birds and is also likely (due to the substantial area secured) to have a significant beneficial effect.

7.159 Furthermore, although no significant adverse effects have been indicated for hen harriers, the proposed habitat measures are likely to be beneficial for this species in terms of improving and maintaining a substantial area of potential foraging habitat. A variety of small moorland bird species such as meadow pipits (which are a principal prey item for hen harriers) are also likely to benefit from the habitat management measures.

Ornithology Mitigation Strategy (OMS)

7.160 It is proposed that no development activity will take place on the Site between 1 March and 31 August in any year until an Ornithology Mitigation Strategy (OMS) has been prepared by a suitably experienced ornithologist and approved by the Planning Authority. The OMS is to include:

- Details of pre-construction bird surveys including the locations of any breeding activity by sensitive species;
- Details of mitigation measures to be implemented prior to construction works commencing including details of disturbance buffers and any associated phasing of works;
- Details of the timing of ground preparation and vegetation clearance to avoid disturbance to breeding birds;
- Details of bird surveys to be conducted during the construction phase;
- Details of appropriate mitigation measures to be implemented during the construction phase (e.g. species-specific buffer zones);

- Provisions for reporting after construction has commenced and at the end of each breeding season during which construction takes place.

Ornithology Management and Monitoring Plan (OMMS)

7.161 It is proposed that no development activity will take place until an Ornithology Management and Monitoring Plan (OMMP) has been prepared by a suitably experienced ornithologist and approved by the Planning Authority. The OMMS is to include:

- Details of a programme of breeding wader habitat management measures for curlew and snipe to be completed prior to the first breeding season after completion of construction;
- Details of a programme of appropriate post-construction bird surveys including surveys of breeding curlew and snipe;
- Details of the provision of bird monitoring reports at the end of each year.

Table 7.27 – Proposed Mitigation Measures

Proposed Mitigation	Implementation	Reason
Habitat Management (49.80ha to be managed under EFS guidance for breeding waders)	Long term during the life of the Development	To compensate for potential displacement of breeding curlew and snipe
Ornithology Mitigation Strategy (OMS)	Prior to and during construction when this takes place during 1 March to 31 August in any year	To protect breeding birds during the construction phase
Ornithology Management and Monitoring Plan (OMMP)	During construction and post-construction	To ensure implementation of the long term breeding wader habitat management and to monitor the long term effects of the Development on these species

Residual Effects

7.162 Any likely significant effects of the Development on birds and any residual effects after the implementation of the proposed mitigation measures are summarized in Table 7.28. Where potential effects have been assessed as unlikely to be significant, they are not included in the table.

Table 7.28 - Summary of Likely Significant Effects and Residual Effects

Species	Effect	Proposed Mitigation	Residual Effects
Curlew	Potential displacement of one pair of curlew - likely to be significant for the Antrim Hills curlew population	Implementation of long term habitat management Implementation of Ornithology Mitigation Strategy	No residual effects

Species	Effect	Proposed Mitigation	Residual Effects
		Implementation of Ornithology Management and Monitoring Plan	
Snipe	Potential displacement of one or two pairs of snipe - likely to be significant for the local snipe population	Same measures as for curlew	No residual effects

Conclusions

7.163 Assuming implementation of the proposed mitigation it is concluded that the Development is unlikely to have any significant adverse effects on local bird populations or on the regional conservation status of any Species of Conservation Concern. The Development is also unlikely to have any significant adverse effects on the Antrim Hills SPA hen harrier and merlin populations or on the Garron Plateau ASSI red grouse population.

7.164 The proposed habitat compensation area for curlew and snipe is substantial in size and therefore is expected to at least adequately compensate for the potential displacement of birds as well as having a likely beneficial effect for these species. The habitat compensation area is also likely to provide a beneficial effect for foraging hen harriers and the small moorland birds such as meadow pipits which are the principal prey of this species. The proposed removal of a substantial area of forestry within the southern part of the Development is also likely to be beneficial for open-landscape species which avoid forestry edge (such as curlew and skylark) as some potential new areas of open habitat are consequently likely to become available for these species.

References

References are given in full in the footnotes to the Chapter.

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Fisheries

8 Fisheries & Aquatic Ecology

Background

8.1 This chapter describes the fisheries interests of the watercourses draining the proposed Unshinagh Wind Farm, hereinafter referred to as 'the Development', and considers the potential effects of the construction, operation and decommissioning of the Development on these interests. The assessment consists of a desk-based assessment using available published and online information in combination with data and observations collected in the field. The specific objectives of the chapter are to:

- describe the fisheries baseline;
- describe the assessment methodology and significance criteria used in completing the impact assessment;
- describe the potential effects, including direct, indirect and cumulative effects;
- describe the mitigation measures proposed to address likely significant effects;
- assess the residual effects remaining following the implementation of mitigation.

8.2 The assessment has been carried out by Paul Johnston Associates Ltd, an independent fisheries consultancy specialising in freshwater fisheries in Ireland. David Kelly holds a BSc (1st Class Hons) degree in Zoology, and a PhD in Freshwater Ecology & Fisheries; he is a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM), a registered member of the Institute of Fisheries Management (MIFM) and a visiting Research Fellow at Queens University Belfast.

8.3 The practice has completed a wide range of assignments in the areas of environmental impact assessment, fisheries development and catchment management. This includes fisheries assessments in connection with a series of onshore wind farm developments in Northern Ireland.

8.4 **Volume 3 - Figures 8.1 to 8.9** are referenced in the text where relevant.

Legislation, Policy & Relevant Guidance

Fisheries Administration

8.5 With regard to fisheries administration and legislation, the footprint of the Development lies within the jurisdiction of Inland Fisheries Division (IFD) of the Department for Agriculture Environmental and Rural Affairs (DAERA). Under the provisions of the Fisheries Act (NI) 1966, DAERA IFD has responsibility for the conservation, protection, development and improvement of salmon and inland fisheries of Northern Ireland.

Legislation

EU Legislation

8.6 EU and local legislation relevant to fisheries and the water environment in the area of the Development includes the following:

- EC Habitats Directive (92/43/EEC);
- EU Water Framework Directive (2000/60/EC) [incorporating standards from the Fish Directive [Consolidated] (2006/44/EC) – this Directive was repealed in 2013];
- European Eel Regulation (EC) 1100/2007.

Domestic Legislation

- Fisheries (Northern Ireland) Act 1966;
- North/South Co-Operation (Implementation Bodies) (Northern Ireland) Order 1999;
- Drainage (Northern Ireland) Order 1973;
- Environment (Northern Ireland) Order 2002;
- Nature Conservation and Amenity Lands (Amendment) (Northern Ireland) Order 1989;
- Water (Northern Ireland) Order 1999;
- Water Environment (Water Framework Directive) (Northern Ireland) Regulations 2003;
- Wildlife (Northern Ireland) Order 1985;
- Wildlife and Natural Environment Act (Northern Ireland) 2011.

Policy

8.7 Policy with regard to Atlantic salmon and European eel in this region is set out in the following:

- Glens and Rathlin Local Management Area Action Plan and Update 2013;
- Atlantic Salmon Management Strategy for Northern Ireland and the Cross-Border Foyle and Carlingford catchments to meet the objectives of NASCO resolutions and agreements, 2008–2012 (DCAL);
- North Eastern River Basin District Eel Management Plan (DEFRA).

Guidance

8.8 Specific guidance relevant to the Development includes the following:

- Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites (DCAL undated);
- Engineering in the water environment: good practice guide River Crossings (SEPA 2nd Edtn 2010);
- Culvert Design and Operation Guide (C689) (Balkham et al, 2010);

- Industry Best Practice as described in the Good Practice Guidance for Pollution Prevention (https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/guidance-for-pollution-prevention-gpps-full-list/), including but not limited to the following;
  - GPP1: Understanding your environmental responsibilities - good environmental practices
  - GPP2: Above ground oil storage tanks;
  - GPP5: Works and maintenance in or near waters;
  - PPG6: Working at construction and demolition sites;
  - GPP8: Safe storage and disposal of used oils;
  - PPG13: Vehicle washing and cleaning;
  - PPG18: Managing fire water and major spillages;
  - GPP21 Pollution incident response planning;
  - GPP22 Dealing with spills;
  - GPP26 Safe storage - drums and intermediate bulk containers

Scope of Assessment

8.9 The fisheries assessment has involved desk study, field work, data processing and analysis and interpretation using professional judgement. The key receptors are the Ticloy Water and its downstream drainage to the Upper River Braid within the River Main catchment. Separate drainage from the site includes several small tributaries, including the main channel of the Upper Glencloy River, that drain the area within the Land Under Applicate Control, hereinafter referred to as ‘the Site’.

8.10 Existing fisheries data and relevant conservation information on the Ticloy Water, Braid (including the upper reaches), Main and Glencloy Rivers was assimilated and supplemented through a bespoke fisheries survey of the Site covering the principal watercourses draining the area.

8.11 The field study consisted of walkover surveys of the principal watercourses, assessments of physical habitat conditions, measurement of basic chemistry parameters, collection of benthic invertebrate samples for assessment of biological quality, and a fish stock survey by electrofishing.

8.12 The sensitivity of each watercourse with regard to fisheries and aquatic ecology has been assessed according to a methodology for environmental sensitivity outlined in the Design Manual for Roads and Bridges, specifically with regard to effects on the water environment (DMRB, 2019). Potential effects of the construction, operation and decommissioning phases of the Development were then assessed. This assessment was based primarily on the potential effects on aquatic ecology, water quality, and resident fish stocks, either directly or upon their habitats.

Consultation

8.13 The principal consultee during the study was DAERA IFD as the statutory body with authority for fisheries matters in the local waters. Consultee responses are summarised in **Table 8.1**.

8.14 Consultations were also conducted with other sub-consultants on the project, notably in relation to hydrology and drainage issues which are contained within **Chapter 9: Geology and Water Environment** of this ES.

Table 8.1: Consultee Responses

Consultee		Summary of Response	Addressed in Assessment
DAERA	Inland Fisheries Division	Personal communication with Peter Irvine, DAERA IFD Senior Fisheries Officer to discuss fisheries interests and data in both catchments	Discussed under “WFD Fish Monitoring” and “Angling”
DFI	DFI Rivers	A formal response was received from DFI Rivers dated December 14th 2021. The response highlighted the numerous potentially affected watercourses within the red line boundary and that flood risk modelling is required for all such watercourses. The response also highlighted that protection of flood defence and drainage infrastructure associated with the numerous watercourses should not be impeded by the development. The response highlighted that a drainage assessment is required for potential impacts on watercourses outside of the development. The response also highlighted that the planning authority would permit modification of a watercourse by culverting only where a short length of watercourse is necessary to provide access to the development site and where no alternative courses of action are available.	All of points are relevant to hydrology and are addressed in Chapter 9. The final point regarding watercourse culverting is addressed in Chapter 9, but also is relevant to fish passage obstruction and loss of habitat; this was discussed in the this Chapter under Mitigation for the Operational Phase with a recommendation for clear span culverts at all major watercourses and where fish passage is required.

Assessment Methodology

Baseline Characterisation

Study Area

8.15 The study area focused on tributary streams of the Ticloy Water (also a tributary of the River Braid) and the Glencloy River, which drain the area within the site to the south-west and east/ north-east, respectively (**Volume 3 - Figure 8.1**).

8.16 The desk assessment includes an evaluation of fisheries in downstream reaches of the Braid, Main and Glencloy Rivers **(Volume 3 - Figure 8.1)**.

Desk Study

8.17 A desk study was carried out to assimilate baseline information relating to salmonid fisheries, ecological and water quality status (under WFD) for the study area. The following sources were consulted/used:

- DAERA Inland Fisheries Division
- Northern Ireland Environment Agency (NIEA) – Water Management Unit (WMU) (Rivers and Lakes Team) https://appsd.daera-ni.gov.uk/RiverBasinViewer/
- NIEA - Protected Areas https://appsd.daera-ni.gov.uk/nedmapviewer/
- NIEA digital datasets https://www.daera-ni.gov.uk/articles/digital-datasets

Field Survey

General Approach

8.18 An initial walkover survey was carried out to assess the significance of the streams directly draining the Site. This was followed by more detailed surveys of the Ticloy Water and tributaries and the Glencloy River and tributary streams in the reaches draining the Site (Vol 3 **Figure 8.2**).

8.19 The surveys at each site comprised assessments of stream quality (water chemistry, physical habitat and aquatic ecology), fisheries habitat and juvenile fish stocks.

Stream Quality

8.20 A series of survey sites was selected on the streams draining the Site. Surveys were conducted in April and between May and July 2021. For each site, baseline water chemistry, physical habitat and aquatic ecology were assessed.

Water Chemistry

8.21 A series of basic water quality parameters were measured at each site using portable meters to provide an outline profile of chemical quality.

8.22 Dissolved oxygen was measured with a Hanna Oxy-Check oxygen meter, conductivity with a Hanna HI86303 conductivity meter, and pH with a Hanna 8424 pH meter; temperature measurements were made with the oxygen meters.

Physical Habitat

8.23 River physical habitat (substratum type, depth, flow velocity) was assessed based on the fully quantitative method developed by DAERA Inland Fisheries Division and the AgriFood and Biosciences Institute (AFBI). In each site, surveys consisted of a 40m stream reach with 25 sampling points across five equidistant cross-sectional transects except on very narrow (<0.3m width) and overgrown streams where it was difficult to observe the riverbed; on these streams, up to 12 transects (1-3 sampling points per transect) were surveyed in each reach.

8.24 At each sampling point, flow velocity was recorded at 60% depth using a Geopacks flow meter, with water depth measured using the meter's impeller stick; substrate was visually assessed using a bathyscope with the dominant substrate type recorded according to a modified Wentworth Scale (Bain et al. 1985; **Table 8.2**).

Table 8.2: Substrate classification and scoring based on the Wentworth system (from Bain *et al*. 1985)

Substrate type	Size Class (mm)	Score
Sand/silt	<2	1
Gravel	2-16	2
Pebble	17-64	3
Cobble	65-256	4
Boulder	>256	5
Irregular Bedrock	-	6

8.25 The following physical characteristics were measured at each site:

- Stream width and depth at each transect (m)
- Substrate composition (visually estimated as per Bain et al., 1985);
- Percentage of deposited fine sediment (<2mm grain) on the river bed as per Clapcott et al. (2011), with the dominant fine sediment type (sand, silt, clays) determined by running the grain through the observer's fingers.

8.26 The classification system of Bain *et al* (1985) was used to summarise the composition of substrate in a reach based on two indices:

- Coarseness index (CI) – calculated as the mean dominant substrate score
- Heterogeneity (SD) – calculated as the standard deviation of the mean CI.

These indices show how coarse or smooth the substrate of a reach is and if it is comprised of a mixture or is dominated by a particular substrate class **(Table 8.3).**

Table 8.3: Substrate description inferred from sample data (from Bain *et al*. 1985)

Mean substrate score (CI)	Heterogeneity (SD)	Inferred substrate description
3.2	1.96	Heterogeneous, smooth and rough
5.0	0.00	Homogeneous, coarse
1.25	0.44	Nearly homogeneous, smooth
3.25	0.85	Heterogeneous, intermediate coarseness
5.05	0.69	Heterogeneous, coarse

Aquatic Ecology

8.27 Stream benthic communities are sensitive to a wide range of environmental stressors including nutrient enrichment and organic pollution, acidification, fine deposited and suspended sediments, and hydrocarbons/ oils. The relatively long lifespans and varying sensitivities of individual taxa mean that invertebrate communities can integrate stressor effects over longer timescales than may be indicated by physico-chemical parameters alone. As such, they are important for assessing both short and longer term effects.

8.28 In May 2021, baseline ecology of watercourses adjacent and downstream of the Development was assessed by sampling the benthic macroinvertebrate community in the riffle/ run habitat using a standard three-minute kick sample (hand held 1mm mesh pole net); the method is recommended by the United Kingdom Technical Advisory Group (UK-TAG) for assessing the condition of the quality element “benthic invertebrates” for WFD reporting (WFD-UKTAG, 2014). The sampling period corresponds to the preferred spring collection season when larger instars of taxa are better retained by the kick-net mesh

8.29 Samples were collected from riffle/run habitats, fixed in 4% formalin for 1 week, followed by preservation in 70% ethanol prior to sorting and identification.

8.30 In the laboratory, macroinvertebrate samples were spread across a 4 x 5, 20-square grid sorting tray to facilitate identification and to estimate relative abundance. Abundant taxa were counted in a subset of five squares and scaled to whole sample estimates as recommended in Murray-Bligh (2002). Less abundant taxa were counted in all grid squares. The ecological quality baseline was summarized as the following observed metrics; total number of taxa (NTAXA), total site WHPT score, and average score per taxon (WHPT-ASPT), using the abundance weighted sensitivity scores developed by Walley and Hawkes as recommended for the WFD (WFD-UKTAG, 2014).

8.31 In order to classify a sites ecological status, expected (predicted) metric values were determined from site-specific physical and chemical data using the RIVPACS IV model implemented by the online River Invertebrate Classification Tool Version 2 (RICT2) a web application (https://www.fba.org.uk/FBA/Public/Discover-and-Learn/Projects/RICT%20Application.aspx/). This tool is maintained by the UK’s environment agencies; Scottish Environment Protection Agency (SEPA), Environment Agency (EA), Natural Resources Wales (NRW) and Northern Ireland Environment Agency (NIEA). Predictions require input of the following test site data: Altitude, distance from source, discharge category, percent substrate composition, and alkalinity (or a surrogate such as electrical conductivity). Input data were obtained from 1:50,000 ordnance surveys maps and from the physical habitat surveys based on the recommended methods outlined in Murray-Bligh (2002). However, discharge category was estimated from width, depth and flow velocity measurements taken during the baseline physical habitat surveys.

8.32 Although samples from at least two seasons are recommended, site classifications can be generated from single season samples. A range of experimental models is available using the online RICT tool with the experiment selected based on relevance. For example, for summer sampled macroinvertebrates in Northern Ireland, the NI single year spring autumn prediction and classification model version 2.0 was selected. The model is hosted on Microsoft Machine Open Learning Studio and is freely available to access with a Microsoft Account. The model calculates observed ecological quality ratios for WHPT-ASPT and NTAXA to determine an unofficial ecological status classification https://www.fba.org.uk/FBA/Public/Discover-and-Learn/Projects/User%20Guides.aspx. Both metrics were then assessed in a "worst of" approach to give an overall invertebrate classification for each reach (see WFD-UKTAG, 2014

8.33 It should be noted that classifications based on single season sampling (as here) are intended only for investigations and are unsuitable for setting environmental objectives or testing compliance against them (RICT2 user guide, https://www.fba.org.uk/FBA/Public/Discover-and-Learn/Projects/User%20Guides.aspx.)

Fisheries Habitat

8.34 An outline assessment of the tributary streams draining the Site was carried out in April 2021 and consisted of walkover surveys recording general characteristics to provide an outline assessment for these watercourses. Additional information of fish habitat classification was recorded during the fish stock survey in July 2021.

8.35 The descriptive terminology used in the survey is based on the Life Cycle Unit method (Kennedy, 1984) currently used by DAERA Inland Fisheries and the Loughs Agency (see also DANI advisory leaflet No 1). In summary, habitat type is recorded as:

- Nursery (shallow rock/cobble riffle areas for juvenile fish - fry/parr);
- Holding (deeper pools/runs for adult fish);
- Spawning (shallow gravel areas for fish spawning);
- Unclassified (unsuitable for fish – shallow bedrock areas or heavily modified sections of channel).

Juvenile Fish Stocks

8.36 Monitoring of fish stocks by the DAERA IFD tends not to include sampling sites in the upper reaches of tributaries in most river systems. Therefore, this part of the fisheries assessment considered the principal streams draining the Development site with the data supplemented by DAERA IFD data for the lower Ticloy Water, Braid and Main.

8.37 A juvenile fish stock survey of the Ticloy Water, Glencloy River, and associated tributaries within and adjacent to the Site was carried out by electrofishing at selected locations in July 2021.

8.38 Electrofishing was carried out according to a semi-quantitative methodology described by Crozier and Kennedy (1994). The procedure involves two operators fishing continuously in an upstream direction for five minutes at each sampling location, using an E-Fish 500W single anode electrofishing backpack (EF-500B-SYS). The system operates on 24V input and delivers a pulsed DC output of 10 to 500W at a variable frequency of 10 to 100Hz. Output voltage and frequency are adjusted according to the electrical conductivity at the survey site.

8.39 All fish were caught using a dip net and retained for general inspection and length measurement before being returned to the water live. Any additional Age 0 salmonids observed but not captured were also recorded. This method is consistent with DAERA IFD and monitoring procedures.

8.40 The semi-quantitative electrofishing method has been calibrated separately for trout and salmon based on extensive studies in river reaches of known juvenile salmonid density. This has resulted in the development of an abundance classification system (Abundance Index) for salmon with five categories: Absent, Poor, Fair, Good, Excellent (**Table 8.4a**). The Abundance Index for trout has six classifications: Absent, Poor, Poor/Fair, Moderate, Good, Excellent (**Table 8.4b**).

Table 8.4: Semi-quantitative abundance categories for age 0 salmon (a) and trout (b), as developed by Crozier and Kennedy (1994); Kennedy (*unpublished data*)

(a) Salmon

Fry (0+) nos.	Density (No/100m2)	Abundance/ quality category
0	0	Absent
1 – 4	0.1 – 41.0	Poor
5 – 14	41.1 – 69.0	Fair
15 – 24	69.1 – 114.6	Good
25+	114.6+	Excellent

(b)Trout

Fry (0+) nos.	Density (No/100m2)	Abundance/ quality category
0	0	Absent
0 - 1	0.1 - 7.0	Poor
2 – 3	7.1 - 16.5	Fair
4 – 8	17 - 31	Moderate
9 – 17	32 - 59.9	Good
18+	60+	Excellent

Assessment of Effects

8.41 The assessment of effects was derived from methodologies outlined by:

- the Design Manual for Roads and Bridges specifically with regard to Road Drainage and the Water Environment, Volume 11, Section 3, Part 10 LA113 (DMRB, 2019);
- Guidelines for Ecological Impact Assessment in the UK and Ireland (2018).

8.42 The significance of the potential effects of the Development has been classified by professional consideration of the sensitivity of the receptor and the magnitude of the potential effect.

Sensitivity Criteria

8.43 Using the information assembled through the baseline assessment, the Fisheries Significance/Sensitivity of each watercourse was graded according to the generic methodology for environmental sensitivity outlined in the Design Manual for Roads and Bridges (2019). **Table 8.5** details the framework applied in determining the sensitivity and this evaluation was used as the basis for the assessment of effects and the specification of any necessary mitigation requirements with regard to fisheries and the aquatic environment.

Table 8.5: Estimating the Sensitivity/Importance of Receptors (adopted from Table 3.70, DMRB, 2019)

Sensitivity	Criteria	Typical Examples
Very High	Attribute has a high quality and rarity on a regional or national scale	WFD Class ‘High’. Site protected/designated under EC or UK habitat legislation (SAC, ASSI, salmonid water)/Species protected by EC legislation. Watercourse containing salmon and supporting a nationally important fishery or river ecosystem.
High	Attribute has a high quality and rarity on a local scale	WFD Class ‘Good’. Species protected under EC or UK habitat legislation. Watercourse containing salmon or trout and supporting a locally important fishery or river ecosystem.
Medium	Attribute has medium quality and rarity on a local scale	WFD Class ‘Moderate’. Watercourse containing trout and upstream of locally important fishery or river ecosystem.
Low	Attribute has low quality and rarity on a local scale	WFD Class ‘Poor’. Watercourse without salmon or trout but upstream of locally important fishery or river ecosystem.
Negligible	Attribute has very low quality and rarity on a local scale	WFD Class ‘Poor’/unspecified.

Magnitude of Effect

8.44 The magnitude of effect was assessed according to the criteria set out in **Table 8.6** and includes a consideration of the timescale of the effect (short, medium or long term).

Table 8.6: Estimating the Magnitude of Impact on Receptors (adopted from Table 3.71, DMRB, 2019).

Magnitude	Criteria	Type and Scale of Effect
Major	Results in loss of attribute and/or quality and integrity of the attribute	Loss or extensive change to a fishery. Loss or extensive change to a designated Nature Conservation Site. Major alteration to fish population levels in catchment as a whole, through fish mortality, habitat destruction or barrier to migration. Duration: long-term (>5 years).
Moderate	Results in effect on integrity of attribute, or loss of part of attribute	Partial loss in productivity of a fishery. Appreciable alteration to fish population levels in specific sub-catchment or zone. Duration: medium-term (1-5 years).
Minor	Results in some measurable change in attribute's quality or vulnerability	Minor loss in productivity of a fishery. Minor alteration to fish population levels in specific sub-catchment or zone. Duration: short-term (up to 1 year).
Negligible / No impact	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity	Unlikely to affect the integrity of the water environment. No measurable alteration to fish population levels.

Significance Criteria

8.45 The correlation of magnitude against the sensitivity of the receptor determines a qualitative expression for the significance of the effect on the basis of a standard matrix shown in Table 8.7. The greater the sensitivity or value of a receptor or resource, and the greater the magnitude of the impact, the more significant the effect.

Table 8.7: Estimating the Significance of Potential Effects (adopted from Table 3.8.1, DMRB, 2019b)

Sensitivity	Magnitude of Effect			
	Major	Moderate	Minor	Negligible
Very High	Very Large	Large/Very Large	Moderate/Large	Neutral
High	Large/Very Large	Moderate/Large	Slight/Moderate	Neutral
Medium	Large	Moderate	Slight	Neutral
Low	Slight/Moderate	Slight	Neutral	Neutral

8.46 The five significance categories with typical effects are shown in **Table 8.8**. Effects evaluated as being Moderate, Large or Very Large are considered to be significant for the purpose of the EIA in line with the EIA Regulations and will require mitigation. Those effects assessed as Slight or Neutral are not considered to be significant in terms of the EIA.

Table 8.8: Descriptors of the Significance of Effect Categories (adopted from Table 3.7, DMRB, 2019b).

Significance category	**Descriptors of effects**
Very large	Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category.
Large	These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process.
Moderate	These beneficial or adverse effects may be important, but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse effect on a particular resource or receptor.
Slight	These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the project.
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

Baseline Conditions

Outline

8.47 This element of the assessment consisted of:

- Desk studies to collate baseline information on fisheries, conservation designations, and ecological status of waterbodies hydrologically connected to the Site; and
- Field surveys focused on the streams draining the Site to assess baseline physical habitat conditions, biological quality, salmonid habitat, and fish distribution. Field survey work was therefore carried out both within the Site Boundary and in the immediate downstream reaches of the drainage streams connecting to the Glenarm River.

Catchment Status

Designated Sites

8.48 There are no designations relating to Fisheries and Aquatic Ecology with respect to SACs or ASSIs within the Site boundary or immediate drainage streams. However, the Garron Plateau SAC/ ASSI is adjacent to the northern boundary of the Site and is considered in Vol 2 Chapter 6; Ecology. The site drainage streams are hydrologically connected to Lough Neagh SPA and ASSI via the Ticloy Water, the Upper River Braid and River Main, although at a distance of over 45km downstream, any potential significant effects on the designations are highly unlikely.

EU Water Framework Directive

Local River Catchments

8.49 The Development is located in two catchments; the Glencloy River and the Ticloy Water sub-catchment of the River Braid, with the latter a key tributary of the River Main. The Upper Glencloy River is formed by a series of tributary streams that rise largely within the central and north-east part of the Site boundary; the main channel is met downstream of the Site boundary by the Doonan Water, before flowing as a single main channel in a north-north-easterly direction to enter Carnlough Bay near Carnlough village (Vol 3 **Figure 8.2**).

8.50 Tributaries of the Upper Glencloy are sourced in the areas of Berry Hill at ca. 320-330m elevation, and Binnagee at ca. 340m elevation. The Glencloy River is assigned to the North Eastern River Basin District (NERBD) under the Water Framework Directive.

8.51 The Upper Ticloy Water is sourced from within the Site boundary at over 260m elevation and flows in a south-south-westerly direction where it meets the River Braid west of the Sheddings. The River Braid flows for over 24km before meeting the main channel River Main, which then runs for further ca. 20km downstream to meet Lough Neagh.

8.52 Land use in the upper reaches of the Site drainage streams is predominantly rough grazing for sheep and extensive Blanket Bog with small conifer forestry plantations, and limited cattle grazing.

Ecological Status & Water quality

8.53 To achieve the ecological objectives of the Water Framework Directive (WFD), River Basin Management Plans (RBMPs) have been implemented through a series of Local Management Areas (LMAs) during the 2010 to 2015 planning cycle, now extended into the subsequent 2016 to 2021 second cycle, and with provision under WFD for a third cycle from 2022 to 2027, with current public consultation taking place (https://consultations.nidirect.gov.uk/daera-environment-marine-fisheries/consultation-on-the-draft-3rd-cycle-river-basin-ma/).

8.54 The Development is bisected by two LMAs consistent with the two different river catchment drainages; the Glens and Rathlin LMA includes the river waterbody defined as the Glencloy River (UKGBNI1NE040403061) whereas the Braid and Main LMA includes the river waterbody defined as the Braid River (Aghacully; UKGBNI1NE030308214), which captures drainage from the Ticloy Water and the Claggan River.

8.55 Ecological and water quality monitoring to inform waterbody status is conducted by the NIEA Water Management Unit to comply with statutory monitoring for WFD compliance. The monitoring station that informs the Glencloy River status is located ca. 4km downstream of the Site boundary in the lower river in Carnlough village at Glencloy Bridge (station 10478). The monitoring station on the Upper River Braid is located ca. 6km downstream of the Site boundary at Aghacully Bridge (station 10189). The latest available ecological assessment for these waterbodies (2018) is summarised in **Table 8.9** which indicates the overall classification and status with regard to each of the principal parameters monitored.

Table 8.9: Classification of individual quality elements contributing to overall WFD status of relevant water bodies in Glenarm and Rathlin and Braid and Main LMAs, 2018 (Source: NIEA data request)

Parameter	Glencloy River (Ref 3061)	Braid River - Aghacully (Ref 8214)
Benthic Invertebrates	Good or better	Good or better
Macrophytes	High	High
Phytobenthos	Good	Good
Fish	-	-
Biochemical Oxygen Demand	-	-
Temperature	-	-
Dissolved oxygen	High	High
pH	High	High
Soluble Reactive Phosphorus	High	High
Ammonia	High	High
Hydrological regime	High	High
Morphological conditions	-	-
Overall Status	**GOOD**	**GOOD**

8.56 For the current planning cycle to 2021, NIEA has developed a series of RMBPs for each River Basin District including the North Eastern and Neagh Bann RBDs. These documents set out the latest assessment of pressures and impacts on the water environment, describe the progress DAERA NIEA made towards achieving objectives for 2015, and explain the significant water management issues that still need to be addressed.

8.57 For both river waterbodies immediately draining the Site, all indicators were classified as having at least Good status, with the overall ecological status indicated also as Good. It should be noted that these classifications are broadly applicable to a waterbody but may fail to reflect the status of individual tributaries that occur distantly upstream of monitoring sites. It is for this reason that additional baseline data is used here to inform on site status (see para 11.102 Aquatic Ecology).

EC Fish Directive

8.58 The EC Freshwater Fish Directive (Consolidated) 2006/44/EC (FWFD) set physical and chemical water quality objectives for salmonid waters and cyprinid waters, specifically with regard to dissolved oxygen, ammonia, pH and total zinc.

8.59 The main stem channel of the Glencloy River to its upper source within and north of the Site, was designated as “salmonid” under the Surface Waters (Fish Life Classification) Regulations (Northern Ireland) 1997, which implements the EC Freshwater Fish Directive.

Although the Ticloy Water was not designated as "salmonid", the main stem Braid into which the former flows was designated as a "salmonid" water.

8.60 The Fish Directive was repealed by the Water Framework Directive at the end of 2013, and the ecological status defined in the WFD sets the same protection to waterbodies designated for fish under the original directive. Areas designated under the Fish Directive have become areas designated for the protection of economically significant aquatic species under WFD and placed on a Register of Protected Areas.

WFD Fish Monitoring

8.61 Water Framework Directive (WFD) compliant fish surveys at surveillance stations are required under national and European law. Annex V of the WFD stipulates that rivers should be included within monitoring programmes and that the composition, abundance and age structure of fish fauna should be examined (Council of the European Communities, 2000). However, there are no WFD fish monitoring stations within the Glencloy catchment or Ticloy Water.

8.62 There is no formal documentation of the fish species recorded within the Glencloy River catchment, although previous DAERA fish surveys (P. Irvine, pers. comm.) have identified the following species:

- Atlantic salmon (*Salmo salar*);
- Brown trout and Sea trout (*Salmon trutta*);
- Eel (*Anguilla anguilla*);

8.63 The same three aforementioned species occur within the River Main catchment, with Atlantic salmon and brown trout the dominant components (Essery and Wilcock, 1990).

Significant Freshwater Species

8.64 This section outlines the current status of Annexe II freshwater species and other species of conservation interest in the Glencloy River and Braid/ Main catchments.

Atlantic salmon

8.65 As an anadromous species, Atlantic salmon use both the freshwater and marine for the completion of the life cycle. The relevant conservation designations for Atlantic salmon give the species national and international significance. Atlantic salmon is listed in Annexes IIa and Va of the EC Habitat and Species Directive (Directive 92/43/EEC), Appendix III of the Bern Convention, and has a IUCN status of threatened in the Irish Red List No 5 (King et al, 2011). The species was added to the UK Biodiversity Action Plan (BAP) list in 2007 as a priority species for conservation action.

8.66 Adult salmon mature at two to four years of age with spawning occurring between November and December usually the upper reaches of suitable tributaries. Juvenile fish remain in freshwater for one or two years to attain sufficient size before becoming smolts, when they migrate to sea during April and May. The marine phase represents a period of rapid growth associated with greater food availability. Many salmon will return to freshwater in the following year as one sea-winter fish (grilse) but a proportion may remain at sea for another year to return as two sea-winter fish.

8.67 The North Atlantic Salmon Conservation Organisation (NASCO) has endorsed a precautionary approach to the conservation, management and exploitation of the salmon resource and the environments in which it lives; Northern Ireland, through the UK and EU, is a Party to NASCO.

8.68 Atlantic salmon stocks in general are in serious decline with some stocks threatened with extinction. As a conservation measure, the Fisheries Regulations (Northern Ireland 2014 saw the introduction of a series of regulations by DCAL (now DAERA) including the closure of commercial salmon fisheries and mandatory catch and release of salmon caught by anglers within the its jurisdiction.

8.69 Conservation measures are subject to annual review by the Standing Scientific Committee on Salmon (SSCS). There is no data or set management advice for salmon stocks on the Glencloy River. However, in 2020, salmon stock data for the nearby Glenarm River indicated a harvestable surplus of 34 fish whereas in the Glendun River the management objective was not met. It is likely that given the relatively small size of the Glencloy River catchment, coupled with significant barriers to migratory fish movement, that salmon stocks are small.

8.70 In the River Main catchment, a harvestable surplus of 32 fish was indicated by the SSCS for 2020 (Kennedy et al, 2020).

Lamprey

8.71 There are three species of lamprey in Northern Ireland:

- Brook lamprey (*Lampetra planeri*)
- River lamprey (Lampetra fluviatilis)
- Sea lamprey (Petromyzon marinus)

8.72 Sea and River lampreys are parasitic and migrate between the freshwater and marine environments, returning to freshwater to breed. In contrast, Brook lamprey are resident freshwater throughout their life cycle and are non-parasitic. Brook lamprey are widely distributed in Northern Ireland but River and Sea lamprey have a more limited distribution (Goodwin *et al*, 2009).

8.73 All three species are designated under Annex II of the EU Habitats Directive (Directive 92/43/EEC).

8.74 Data on the presence and distribution of lamprey species within the Glencloy River catchment is lacking. It is unlikely that lamprey juveniles would be present within the tributaries draining the immediate Site because of the significant downstream barriers to fish movement and their requirement for fine silts in which the ammocoete larval stages live for up to four years.

8.75 For the River Braid sub-catchment, sea lamprey do not occur in the River Main catchment or any of the Lough Neagh tributaries due to an impassable barrier on the Lower River Bann; but a landlocked variety of River lamprey is present in the lough and migrates into the tributaries to spawn. However, there is no data available on the distribution of River or Brook lamprey in the River Main catchment.

Eel

8.76 The European eel stock has been in rapid decline throughout its range since around 1980. This has led to the passing of the European Eel Regulation (EC) 1100/2007 which aims to return the European eel stock to more sustainable levels of adult abundance and juvenile eel recruitment. Member States are required to implement Eel Management Plans in each eel river basin, in this case the North Eastern and Neagh-Bann River Basin Districts.

8.77 The European eel is not listed under Annexe II but has recently been added to the International Union for Conservation of Nature (IUCN) Red List of Threatened Species in the category of Critically Endangered (King *et al*, 2011).

8.78 There is no published data available on the distribution of eel in the Glencloy River catchment but the species is expected to have a limited distribution to below the main waterfall cascade barriers present at south-eastern Site boundary, which is expected to prevent upstream migration of elvers **(Vol 2 Figure 8.2)**. In addition, the short and steep catchments of the Glens of Antrim coastal streams, coupled with a basalt underlying geology, is expected to contribute to low eel production, with most eel restricted to a few kilometres in the lower reaches of these streams (DEFRA, 2010).

8.79 There is no data available on the distribution of eel in the River Main catchment.

Brown trout

8.80 Brown trout are a priority species for conservation action in Northern Ireland, as required under the Wildlife and Natural Environment Act (Northern Ireland) 2011. Again, no data is available on Brown trout stocks within the Glencloy River but the species is expected to be widely distributed and, given the potential low productivity geology, a significant proportion of the stock likely migrates to sea and returns to freshwater to spawn.

8.81 In the River Braid and River Main, brown trout are widely distributed and a small proportion of the stock migrates to sea to return to freshwater to spawn. However, a unique variety of Brown trout, the Dollaghan, occurs in Lough Neagh and most of its tributaries including the River Main catchment. The life cycle is similar to the Sea trout in that spawning and the juvenile life stages take place in the inflowing rivers, with subsequent migration to the lough where a period of rapid growth is followed by a return migration to natal rivers to spawn. These fish can grow to a large size (3-8kg), and are highly sought after by anglers

Salmon & Trout Stock Data

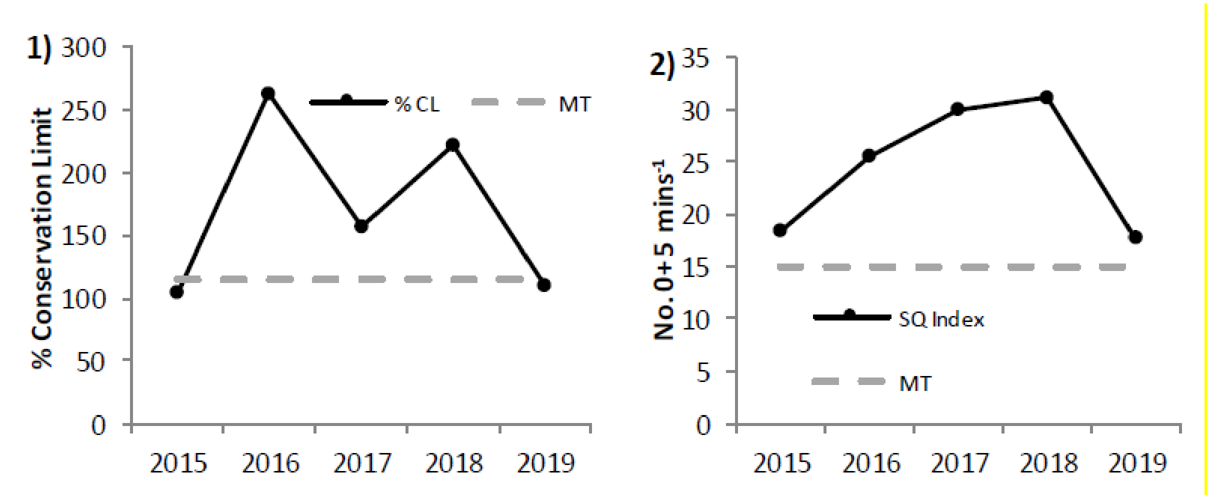
8.82 A key factor in assessing the status of salmon stocks is determination of Conservation Limits for individual river systems. The Conservation Limit for Atlantic salmon is defined by NASCO as: *the spawning stock level that produces long term average maximum sustainable yield as derived from the adult to adult stock and recruitment relationship*.

In simpler terms the Conservation Limit for a river is the number of spawning salmon required to ensure that salmon are reproducing in sufficient quantities to produce the next generation of fish.

8.83 Annual monitoring of salmon (and trout) stocks in Northern Ireland is conducted by DAERA IFD and AFBI but no data is available for the Glencloy River. A number of salmon index rivers are monitored in Northern Ireland to determine compliance with conservation targets. DAERA and AFBI have established a management target for each of the Index Rivers including the River Main. The management target is a precautionary abundance reference point and represents 115% of the conservation limit to allow for losses due to angling and poaching/ predation. Annual returns of wild adult salmon to the Main are computed from partial counts of adult fish at the counting installation at Randalstown and percentage compliance with the conservation limit and management target between 2015 and 2019 is shown in **Chart 1**.

8.84 These data indicate considerable variability in the annual return of adult fish, and that the management target has been achieved in only three of the last five years. Declining runs of adult fish are attributed to a significant reduction in natural survival of young salmon during the marine phase (Kennedy, *pers comm*)

Chart 1. Conservation limits in relation to management targets for (1) adult salmon escapement and (2) juvenile salmon recruitment in the River Main 2015-2019 (Source: Kennedy et al. 2020)



Juvenile Fish Stocks

8.85 Fry distribution and abundance are an indication of the distribution and level of spawning by adult fish. Trends in abundance of juvenile salmon and trout are monitored by DAERA IFD/ AFBI through annual or rotational semi-quantitative electrofishing surveys according to a methodology developed by Crozier & Kennedy (1994).

8.86 The semi-quantitative electrofishing method has been calibrated separately for trout and salmon based on extensive studies in river reaches of known juvenile salmonid density. This has resulted in the development of an abundance classification system (Abundance Index) for salmon with five categories: Absent, Poor, Fair, Good, Excellent (Crozier and Kennedy, 1994). The Abundance Index for trout has six classifications: Absent, Poor, Poor/Fair, Moderate, Good, Excellent (Kennedy, unpublished; **see Table 8.4**).

8.87 No juvenile salmonid stock data was available from DAERA IFD for the Glencloy River.

8.88 The distribution and abundance indices for Aged 0 trout and salmon fry at DAERA IFD monitoring sites on the Ticloy Water and Upper Braid catchment in 2019, which is hydrologically connected to the Site, are indicated in Vol 3 **Figures 8.3 and Figure 8.4**.

8.89 These data demonstrates that there is a low level of salmon spawning in the main channel Ticloy Water ca. 3.6km downstream of the Site boundary. Further downstream in the main channel Upper River Braid, salmon spawning and fry recruitment ranges from Poor to Good abundance with some spawning also occurring in the inflowing Priests Burn and Glen Burn tributaries.

8.90 In contrast to salmon fry, trout fry have a wider distribution and occur at Fair to Excellent abundance on the Ticloy Water at distances of 2.2km to 3.0km downstream of the Site boundary. Trout spawning and recruitment also is widely distributed in the Upper Braid downstream of the Site drainage of the Ticloy Water and occurs at Fair to Good abundance.

Angling

8.91 The Glencloy River is a spate river but its potential to offer quality fishing is limited by the extent of suitable habitat for salmon, which is mainly limited to the lower few kilometres of the main channel below successive series of waterfalls and cascades. There also are reasonable stocks of resident brown and migratory sea-trout present (Peter Irvine, pers. comm.). The owner(s) of fishing rights in the river are unknown.

8.92 The River Main is an important salmon and trout angling system with good quality fishing both on the main channel and tributary rivers, including the Braid Water. Most of the fishing is administered by local angling clubs although some reaches are retained by riparian owners, while the lower stretch adjoining Lough Neagh is retained by Shanes Castle Estate.

8.93 Adult salmon enter the river in July if there has been sufficient rainfall to stimulate their advance through the Lower Bann and Lough Neagh, and fish can be caught up to the end of the season on 31 October. Migratory trout (dollaghan) tend to run the river from August onwards and there is also a native stock of brown trout.

8.94 The Maine Enhancement Partnership (MEP) was formed by local angling clubs and fishery owners during the 1990s with the objective of improving fish stocks in the system. MEP was the forerunner of the recently formed Maine Rivers Trust which seeks "*to conserve, protect, rehabilitate and improve the rivers, streams and watercourses of the Maine rivers catchment*".

8.95 The River Braid is a spate river with angling controlled over a 7-mile stretch by the Braid Angling Club that runs from Broughshane downstream towards Ballymena. The river is fished for a population of small to medium sized brown trout and migratory Lough Neagh dollaghan. Atlantic salmon also is a quarry, with fish entering the Braid from mid to late summer.

Site Survey: Fisheries Habitat

Overview

8.96 The Development spans both the Upper Glencloy River and Ticloy Water. Eight tributaries drain into the main Glencloy via the Site boundary with Tributary 2 considered in this report as the main Upper Glencloy River. Site drainage is described in further detail in **Chapter 9 Geology & Water Environment**.

8.97 The fish habitat survey consisted of a walkover assessment of the main drainage streams (as shown in Vol 3 **Figure 8.5**), and main channels of the Glencloy River and Ticloy Water.

8.98 In addition, a walkover assessment of salmonid habitat was conducted within the Site boundary on the upper part of these small watercourses both by foot and aerial drone (DJI Phantom 4 Pro 2+), with a focus on areas of watercourse and site track intersection. The aim was to inform on potential culverting requirements for fish passage.

General Description / Observations

Ticloy Water

8.99 This watercourse drains the south-western part of the Site and flows in a southerly direction to the Site boundary then veers south-west to join with the Braid River approximately 4km downstream. At the Site, and bordering the proposed Development, the channel varies from 1.3-2.4m wide and cuts through rough sheep grazing pasture. The banks are open and the bed is largely boulder, cobble and pebble with extensive aquatic mosses, occasional areas of bedrock, and little siltation of the bed. The gradient is moderate with flow habitat a mixture of riffles, runs and occasional deep long pools. Salmonid habitat quality is largely grade 2 and 3 nursery with grade 2 resting pools of up to 0.6m depth (Vol 3 **Figure 8.6; Plate 1**).

8.100 240m upstream of the Site boundary, the channel becomes very slow flowing and up to 0.7m deep for approximately 220m and runs adjacent to a patch of plantation conifer. The stream bed is characterised mainly by silt, peat and infrequently scattered boulders and cobble (Vol 3 **Figure 8.6; Plate 2**). Habitat here is mainly grade 2 and 3 resting pools; Aged 1 and older trout were observed darting in the pools.

8.101 Further upstream, the gradient increases slightly resulting in improved flow, shallower depths, and mainly grade 3 nursery habitat with occasional grade 3 pools, all potentially supporting juvenile salmonids. Approximately 1.1km further upstream within the Site, the Ticloy Water channel is much narrower ranging 0.4-0.7m wide and very shallow. The bed is mainly comprised of pebble and cobble and habitat quality is barely grade 3 nursery though the possibility that small resident trout are present cannot be ruled out (Vol 3 **Figure 8.6; Plate 3**).

8.102 At the upper Site boundary, the Ticloy Water runs through heavily grazed rough sheep pasture where the gradient increases; the channel is very narrow (ca. 0.4-1.0m wide) and shallow (ca. 0.02-0.05m depth) with bedrock, cobble, boulder and shingle/ fines. Habitat quality is barely grade 3 nursery and the habitat has a lower likelihood of supporting resident trout (Vol 3 **Figure 8.6; Plate 4**). It should be noted that during the fish surveys in July 2021, a section of the channel near to the Site boundary was dry but bounded upstream and downstream by wet reaches; this is indicative of a flow losing reach presumably due to groundwater loss or seepage.

8.103 Overall, (and apart from the drying reach) there were no obvious physical barriers to fish movement throughout the main section of river within the Site boundary. There is good potential to support trout in the mid to lower reaches within the Site but lower potential towards the source of the Ticloy Water.

Ticloy Water – Tributary 1

8.104 This small channel cuts through sheep pasture to meet the main Ticloy Water at the Site boundary adjacent to plantation forestry. The channel is drain-like and has its outflow via a field drain pipe. Overall, there is no fisheries value due to a lack of open bed and seepage water (**Vol 3 Figure 8.6; Plate 5**). *This stream was therefore screened out from full baseline surveys.*

Ticloy Water – Tributary 2

8.105 This stream flows east to west across the middle of the Site to meet the Ticloy Water at the Site boundary. Though initially very narrow and shallow at the Ticloy confluence, this small stream has a clean boulder and cobble bed with no silt and a reasonable flow. Habitat is largely a mixture of grade 3 nursery and infrequent small pools where small resident trout may reside **(Vol 3 Figure 8.6; Plate** 6).

8.106 Further upstream from the confluence with the Ticloy Water, the channel receives seepage drainage from several small drains with no obvious hard bed while the main channel flows from a marshy area; here there is no fisheries value.

8.107 Above the marshy area, the stream re-appears as a moderately flowing, very narrow (ca. 0.3m wide) and shallow (ca. 0.05m) channel mainly of cobble and pebbles. The stream intersects a farm access track via a 0.3m dia. pipe culvert (**Vol 3 Figure 8.6; Plate 7**). The shallow depth and lack of upstream passage due to the marsh downstream, couple with the limited available channel to upstream source, suggests very low fisheries value in this vicinity.

Glencloy River – Tributary 1

8.108 This small tributary is located within the south-west of the Site boundary, draining an area of bog and rough pasture to the south-east before meeting Curraghvohil lough west. The lake is actually an area of marsh and floating mats without open water. The stream is very narrow (ca. 0.2-0.45m wide), drain-like and shallow, emerging as seepage in a grassy area adjacent to a small conifer copse (Vol 3 **Figure 8.6; Plate 8a**). Fisheries potential is very low and trout are unlikely to be present.

8.109 Further downstream, the watercourse enters an area of shallow gradient before meeting the marsh area to the south-west of Curraghvohil Lough west; here the channel is barely flowing, narrow (ca. 0.2-0.25m) but up to 0.3m deep with a peat bed up to 0.5m deep. The banks are unstable and the channel appears "ditch-like" with low fisheries potential (Vol 3 **Figure 8.6; Plate 8b**).

Glencloy River - Tributary 2 (Upper Glencloy River)

8.110 This is the largest of the tributaries that drain the Site to the Glencloy River. It is indicated on the designated salmonid river layer as the Upper Glencloy River, though in its lower reaches below the main farm access track towards the Site boundary, the channel is very deep (up to 1.2m) and slow flowing before merging to form the wetland at the periphery of Curraghvohil lake east in an area of marsh and floating vegetation mats. Above this, the channel cuts through marsh and boggy ground with depths up to 1.0m and a bed characterised by pebbles, silt and peat (**Vol 3 Figure 8.6; Plate 9**). Habitat is largely grade 2 holding water that would support larger trout and eels.

8.111 Further upstream, the stream intersects a farm access lane where it is crossed by a concrete bridge underlain by 5 round pipe culverts that are perched on their downstream end potentially limiting upstream movement of fish (**Vol 3 Figure 8.6; Plate 10**). The channel is ca. 2.0-4.0m wide but narrows 30m upstream to 1.1.5m with depths to 0.4m. Flow is generally good with riffles, runs, deep pools and a habitat mixture of grade 2 nursery and grade 2 resting pools.

8.112 From a further 100m upstream, the channel supports grade 2 and 3 nursery and pools, with some small grade 2 and 3 spawning fords along a series of pronounced meanders that extend for ca. 300m. Above this, the channel gradient increases and there is a greater proportion of bedrock; the width is narrower (1-1.8m) while habitat quality remains very good, comprising grade 2 nursery and pools.

8.113 The main channel bifurcates approximately 450m south of the northern Site boundary with the true right side tributary entering over very steep rocky terrain via a boulder cascade (**Vol 3 Figure 8.6; Plate 11**). It is highly unlikely that fish could pass at this point while the gradient steepens further via a series of small falls and cascades that are impassable towards a steep cut.

8.114 At the bifurcation, the main upper channel continues for a short distance upstream before flowing via a track crossing and boulder blockage that would prevent fish movement upstream (Vol 3 **Figure 8.6; Plate 12**). The stream above the track splits in two with each channel steep, boulder and cobble strewn, and shallow, and of low fisheries value.

8.115 Overall, there were no obvious physical barriers to fish movement at up to 1km upstream of the farm track with high potential to support resident trout and eels. Upstream of this, barriers to fish movement and steep gradients limit fisheries potential.

Curraghvohil Lakes

8.116 The western “lake” is an area of marsh and floating bog mats without open water and hence has no fisheries potential (Vol 3 **Figure 8.7; Plate 13**, right side of image). The eastern lake is skirted on its northern boundary by the lower reaches of Tributary 2, with the lower channel of the tributary becoming indistinct from the extensive marginal marsh and floating bog area to the north and north-west of the lake (Vol 3 **Figure 8.7; Plate 14**).

8.117 The open lake has heavy macrophyte growth and dense fringing reed/ fen. There is a small open water area towards the lake centre. For Health and Safety reasons the open water part of this lake is inaccessible but the potential to support salmonid fish was low given the limited area of open water and extent of weed growth; salmonids require clean well oxygenated areas of open water. It is possible that eels would occur in this habitat although it is doubtful that they can access this location given the steep series of cascades and waterfalls present in the upper Glencloy River some 950m downstream (see Glencloy River description below).

Glencloy River tributary 3

8.118 The reach immediately above where this tributary meets tributary 4 is narrow and slow flowing (0.3-0.4m wide) with a bed of cobbles and pebbles and habitat at best of grade 3 nursery (Vol 3**Figure 8.7; Plate 15**). There are several possible barriers to upstream movement of migratory fish caused by in-channel drainage pipes that are perched with a stone wall within the channel that causes flow obstruction.

8.119 Further upstream in this tributary, the channel intersects the main farm track in a large field heavily grazed by sheep. A round passable pipe culvert runs beneath the farm track. The channel upstream is initially of poor quality due to widening caused by sheep poaching and a stream bed of silt and pebbles. Some areas are grade 3 nursery and grade 3 spawning pebbles where flow improves and habitat coarseness increases but the main improvement in habitat occurs upstream and outside of this large grazing field.

8.120 Here, the channel is 0.4-0.6m wide and is dominated by clean cobble, boulder and pebble consistent with grade 3 nursery and small deep resting pools (Vol 3 **Figure 8.7; Plate 16**); small numbers of resident trout would be expected.

8.121 Further upstream, the first main physical barrier to movement of resident trout occurs as a vertical stone waterfall ca. 1.0m high that may limit upstream movement of salmonids, although habitat above this would support small resident trout (i.e. pools, Vol 3 **Figure 8.7; Plate 17**).

8.122 Above this, a series of steep and potentially impassable cascades and falls occurs over smooth bedrock and large boulders that would prevent upstream passage of trout and provides poor habitat quality (Vol 3 **Figure 8.7; Plate 18**). Above this, the channel narrows and has little flow; several small pools occur and could harbour trout though physical barriers throughout this upper section may be a limiting factor.

8.123 Overall, there were no obvious physical barriers to fish movement at up to 600m upstream of the farm track with high potential to support resident trout and eels. Upstream of this, barriers to fish movement and steep gradients limit fisheries value.

Glencloy River tributary 4

8.124 Just upstream of the confluence with the main Glencloy River (ca. 285m downstream of the farm access track), the stream is 1.3-1.6m wide with a mainly cobble and boulder bed characterised by high coverage of aquatic mosses. There are no barriers to fish movement downstream to the main Glencloy River confluence and habitat is mainly grade 3 nursery and small grade 2 and 3 resting pools (Vol 3 **Figure 8.7; Plate 19**).

8.125 Further upstream below the main farm access track, the stream narrows to 0.3-0.6m and ca. 0.2m depth with increased flows over shallow riffles and pools though the stream bed is highly silted; habitat is barely grade 3 nursery (Vol 3 **Figure 8.7; Plate 20**). Upstream of the access track, the channel flows within an area of rough sheep grazing and rushes with habitat mainly cobble, pebble and occasional large boulders consistent with grade 3 nursery and some small areas of pebbles that could be used for trout spawning. The channel at ca. 400m upstream of the farm track comprises runs with cobble, pebble and scattered boulders again consistent with grade 3 nursery habitat (Vol 3 **Figure 8.7; Plate 21**). Above this, there is a section of incised channel with a peat bed with little cover and fisheries value.

8.126 Ca. 500m upstream of the farm access track, the channel gradient increases through a series of meanders of riffle/ run and deep pools consistent with grade 3 nursery and grade 2 pools that would support resident trout (Vol 3 **Figure 8.7; Plate 22**).Ca. 620m upstream of the track, there is a rough vehicle crossing above which the channel becomes increasingly narrow and incised within an area of blanket bog, though the presence of moderate flows, pebble and cobble, creates some grade 3 nursery and long deep grade 2 pools with small vertical falls potentially passable by resident trout in a reach that extends for 200m further upstream of this point (Vol 3 **Figure 8.7; Plate 23**). Above this at up to 1km upstream of the track the channel depth shallows considerably with drainage sourced from several small drain-like channels with low fisheries potential (Vol 3 **Figure 8.7; Plate 24**)

8.127 Overall, there were no obvious physical barriers to fish movement at up to 1km upstream of the farm track with high potential to support resident trout and eels. Upstream of this, barriers to fish movement, shallow depths, and steeper gradients have the potential to limit fisheries value.

Glencloy River tributary 5

8.128 This small tributary drains an area within the site and was initially surveyed ca. 620m downstream of the site at north of the main farm access track (Vol 3 **Figure 8.8; Plate 25**). The stream is unfenced within rough sheep grazing pasture and is shallow, ca. 1.2-1.5m wide, with pool pockets up to 0.25m deep, of moderate flow, and characterised by boulder, cobble and small pebbles. Flow habitat is mainly run and glide with small pools consistent with grade 2 and 3 nursery.

8.129 The stream narrows further upstream and runs through gentle gradient pasture where there remains potential to support resident trout. ca. 390m upstream, the channel splits with the true left side tributary very narrow, shallow and of low fisheries potential. The true right side tributary passes over a very steep area of ground as an impassable waterfall (Vol 3 **Figure 8.8; Plate 26**)

8.130 Above the waterfall, the channel is initially of reasonable habitat quality with smalls riffles and runs but narrows and becomes incised as it runs through rough pasture and blanket bog; fisheries potential is very low and given the downstream waterfall, no fish are expected above this (Vol 3 **Figure 8.8; Plate 27**).

Glencloy River tributary 6

8.131 This small tributary occurs downstream of the site boundary and is unlikely to intercept any site drainage. However, the channel is piped for ca. 500m at approximately 750m downstream of the site boundary; above this, the channel is very shallow with little flow and not suitable for supporting fish due to its drain-like nature (Vol 3 **Figure 8.8; Plate 28**). *This stream was therefore screened out from full baseline surveys.*

Glencloy River tributary 7

8.132 This small tributary has the potential to intercept drainage from a small portion of the extreme north-west of the landholding boundary. The channel was almost dry while the gradient very steep; in addition, the stream was piped for up to 40m across a farm lane at ca. 620m downstream of the landholding boundary, with the pipe perched and impassable (**site 13 - Vol 3 Figure 8.8; Plate 29**). Overall, the lack of suitable water depth, very steep gradient, and barriers to movement, indicated very low fisheries and aquatic ecological value. *This stream was therefore screened out from full baseline surveys.*

Glencloy River tributary 8

8.133 This small tributary has the potential to intercept drainage from a small portion of the extreme south-west of the landholding boundary where the main access track will cross a side tributary (ca. 0.3m wide) and the main channel (ca. 0.5m wide; **site 14 - Vol**

3 Figure 8.8; Plate 34). The tributary sources from a boggy area in the vicinity of the proposed track crossings where the main channel and side tributary are "ditch-like" with little flow and a bed of peat and vegetation including emergent mint and horsetail. Overall, the habitat is unsuitable for fish. Approximately 60m downstream of the proposed crossing of the main drainage channel, the channel widens into a flush-like weed choked deep trench with excessive emergent vegetation including Greater branched bur-reed and watercress. The bed is deeply silted and peat-like and there is little flow and overall very low fisheries value.

8.134 Further downstream, the channel narrows for a small section to approximately 1.2m where there is good flow and a bed largely of boulder and cobble but this is soon followed by a shallower gradient area where cattle are freely roaming throughout the boggy pasture. The cattle are causing extensive poaching, erosion, and widening/ shallowing of the channel with low banks and high bed siltation (Vol 3 **Figure 8.8; Plate 35**). The stream passes a farm track via two concrete round pipes that would be passable to fish but the gradient increases sharply thereafter as it flows towards the confluence with the main Glencloy river via a steep cut through bog, scrub and wet woodland. Overall, fisheries value in the upper to middle reaches is very poor although a few resident trout may occur in the lower high energy reaches immediately above the Glencloy River.

Upper Glencloy River

8.135 The main channel of the Upper Glencloy River is fed by marsh seepage and outflows adjacent to Curraghvohil Lakes. Initially the channel is deep and sluggish as it emerges along the northern boundary of the lakes; with a bed of peat and small pebble, coupled with the depth, there would be adequate cover for larger trout and eels (Vol 3 **Figure 8.8; Plate 30**).

8.136 The channel runs through mainly rough sheep pasture for a further 390m to the point of the confluence with drainage from tributaries 3 and 4. Here the river channel gradient steepens; the channel is 2.5-3.8m wide with mainly riffle run and pocket pools characterised by large boulders, cobble and some bedrock consistent with grade 1 and 2 nursery and grade 2 and 3 resting pools (Vol 3 **Figure 8.8; Plate 31**).

8.137 Further downstream, the channel meanders through steeper ground resulting in a series of long cascades and waterfalls characterised by bedrock and insufficiently deep pools that would prevent upstream passage by migratory salmon and trout, thus limiting their upstream distribution in tributaries draining the site above this (site 9, Vol 3 **Figure 8.8; Plate 32**).

8.138 Below this, the gradient remains steep until the main bridge under the A42 road to Carnlough. Here, on the downstream side of the bridge, there is a perch and fall of ca. 1.2m with limited resting pools immediately downstream; just above this in the bridge invert, smooth concrete and shallow depth would prevent upstream passage from this point of migratory salmonids (Vol 3 **Figure 8.8; Plate 33**). The channel upstream of the bridge is largely boulder and cobble over a moderate gradient and consistent with grade 1 and 2 nursery where resident trout would be expected.

8.139 Overall, the Upper Glencloy above the series of main waterfalls and cascades along the site boundary, and above the main A42 bridge, has good potential to support resident trout and possibly eels. Downstream of the main A42, the potential presence of migratory fish species was assessed during field surveys (see para 11.106).

Site Survey: Stream Quality

8.140 Eight sites were surveyed in the watercourses draining the Development (Sites 2, 5-9, and 11; **Volume 3- Figure 8.5**) as follows:

- Site 2 – Ticloy Water at Site boundary.
- Site 5 – Glencloy Tributary 1 downstream of farm access track.
- Site 6 – Glencloy Tributary 2 downstream of farm access track at 5-pipe culvert
- Site 7 – Glencloy Tributary 3 downstream of farm access track
- Site 8 – Glencloy Tributary 4 downstream of farm access track
- Site 9 – Glencloy River main channel at Site boundary
- Site 11 – Glencloy Tributary 5 north of farm access track downstream and outside of Site boundary
- Site 14 – Gelncloy Tributary 8 ca. 30m upstream of farm access track

Note that Sites 3, 12 and 13 were screened out due to having either a drain-like nature and very low fisheries potential (site 3), a dry bed, or very poor fisheries and aquatic ecological potential (sites 12 and 13).

Chemical Water Quality: Basic Parameters

8.141 Apart from site 14 (Glencloy Tributary 8), all streams had satisfactory dissolved oxygen levels with lower conductivity recorded in tributaries 1 and 4 of the Upper Glencloy (**Table 8.10**); coupled with the lowest recorded pH values in both tributaries, this likely reflects the upper catchment dominance by blanket bog. Interestingly, further downstream in Tributary 1 at the Site boundary, pH was recorded at 6.6; these slightly acidic conditions again reflect the dominance of a large area of bog on the south-east side of this section of stream before it meets the marsh of Curraghvohil Lake west.

8.142 The slightly higher conductivity values of Tributaries 3 and 5 of the Upper Glencloy may reflect the considerable extent of sheep grazing in the riparian zone, with large areas of bank collapse and erosion/ poaching that would liberate dissolved ions into the water.

8.143 The lower dissolved oxygen levels of Tributary 8 (site 14), may reflect the extensive over grazing, poaching and tramping of banks by cattle, with high siltation and defecation in the channel obvious during the survey.

Table 8.10: Water chemistry parameters measured at seven survey sites measured in April 2021 (site 14 measured in November 2021).

Site	River/ stream location	Diss. Oxygen (mg/l; % sat)	Conductivity (µS/cm)	pH
2	Ticloy Water	11.8 (96%)	164	7.86
5	Glencloy Tributary 1	9.2 (91%)	140	7.0
6	Glencloy Tributary 2	13.0 (99%)	153	7.9
7	Glencloy Tributary 3	12.3 (95%)	204	8.0
8	Glencloy Tributary 4	8.9 (88%)	132	7.3
9	Glencloy main channel	13.1 (99%)	158	7.8
11	Glencloy Tributary 5	11.0 (97%)	266	7.65
14	Glencloy Tributary 8	8.9; (86%)	120	7.24

8.144 It should be noted that spot measurements of physico-chemical parameters provide only a snap-shot of stream water quality; consensus on overall quality should consider consider additional indicators such as those provided by stream macroinvertebrate communities (see below).

Physical Habitat Quality

8.145 Several of the streams draining the Site boundary were of moderate width (2.15-2.74m; site 2 – Ticloy Water; site 6 – Upper Glencloy river; site 9 – main channel Glencloy at site boundary; site 14 – Glencloy Tributary 8), shallow, and of moderate flow velocities (**Table 8.11**); their substrate was of intermediate to high coarseness, dominated by cobbles and boulders, although in the main channel Glencloy River, bedrock was common. These riverbed coarseness indices were generally above or close to values in rivers with good salmonid habitat quality reported elsewhere in Northern Ireland (Johnston, 2012). An exception was Tributary 8, which, although moderately wide, was severely poached and eroded due to extensive cattle grazing leading to low banks, channel widening and shallowing, with extensive siltation (41.8% bed cover; Table 8.11).

8.146 The remainder of the streams draining the Site were much narrower (0.4-1.1m width), generally shallower and slowing flowing, though all had substrate of moderate to high complexity except for Tributary 3 (site 7), which had a greater proportion of small pebbles and silt. Large areas of the bed were covered with a layer of silt, which is reflected in the higher fine sediment cover value (23%). There was marked poaching and bank collapse on this stream caused by intensive sheep grazing.

8.147 While Tributary 4 (Site 8) had a higher coarseness index (4.3), fine sediment cover was the highest of any stream (51%), and this also reflects its position in an area of intensive sheep grazing. The high coarseness value is largely an artefact of the dominance of bedrock in this stream (individual view score of 6).

Table 8.11: Stream habitat quality at each site from baseline surveys, April 2021.

Site	River/ stream	Sediment cover (%) & type	Mean width (m)	Mean water depth (m)	Mean flow velocity (ms-1)	Coarse-ness index (CI)	Substrate hetero-geneity (SD)	Inferred substrate
2	Ticloy Water	0.2; sand & silt	2.2	0.12	0.14	4.32	0.56	Mixture; coarse
5	Glencloy Tributary 1	62; silt	0.4	0.09	0.06	4.3	1.38	Heterogeneous, coarse
6	Glencloy Tributary 2	3.9; sand & silt	2.15	0.08	0.13	3.76	0.6	Mixture; inter-mediate coarseness
7	Glencloy Tributary 3	23.3; silt	0.83	0.066	0.12	3.25	1.36	Heterogeneous; intermediate coarseness
8	Glencloy Tributary 4	51; silt	0.66	0.09	0.09	4.3	1.54	Heterogeneous, coarse
9	Glencloy main channel	4; silt	2.74	0.14	0.14	5	1.08	Mixture; coarse
11	Glencloy Tributary 5	8; silt	1.1	0.07	0.14	4.04	0.73	Mixture; coarse
14	Glencloy Tributary 8	41.8; silt	2.2	0.055	0.13	2.44	1.35	Heterogeneous, low coarseness

Aquatic Ecology

8.148 Recorded benthic macro-invertebrate community metrics for the eight survey sites are shown in **Table 8.12**. Based on the benthic invertebrate indicator element, and the "one out, all out" philosophy, sites 2 (Ticloy Water), 6 (Glencloy Tributary 2), and 11 (Glencloy Tributary 5) were classed at "HIGH" WFD-based ecological quality based both on the NTAXA and WHPT_ASPT indicator elements. Sites 8 (Glencloy Tributary 4) and 9 (Glencloy main channel), were classed as having at least "GOOD" WFD-based ecological quality. The assessment generally corresponds with the high quality physical habitat assessed at these sites, where substrate was of moderate to high coarseness and fine sediment cover generally low.

8.149 The lower quality assessment of Moderate for site 5 (Glencloy Tributary 1) is consistent with the high level of silt observed on the stream bed, the small stream size and low flow. In addition, this stream was of short length and given the poor drain-like habitat observed downstream towards Curraghvohil Lake West, there would be limited potential for invertebrate colonisation. That fine sediment markedly exceeded the 20% cover threshold above which benthic biodiversity can be compromised (Clapcott et. al. 2011), also explains the lower diversity observed.

8.150 The Moderate quality assessment for site 7 (Glencloy Tributary 3) was based on the one out all out approach whereby, despite a "HIGH" WHPT-ASPT derived quality class, the "MODERATE" NTAXA derived quality determined the final classification.

8.151 The lowest overall quality assessment was for survey site 14 on Glencloy Tributary 8; although he ASPT quality derivation was "MODERATE", the assessment of "BAD" based on the low NTAXA derivation was the final assessment based on the "one out all out" philosophy. This quality assessment most likely is due to the high level of siltation, disturbance/ damage by livestock, and the limited pool of colonists from the source a short distance upstream.

Table 8.12: WFD-based ecological quality classes at each site derived from benthic invertebrate baseline surveys, April 2021.

Site	River/ stream	BMWP WHPT score	Number of taxa	N-TAXA WFD-based invert. class	WHPT ASPT	ASPT WFD-based invert. class
2	Ticloy Water	126.3	18	HIGH	7.01	HIGH
5	Glencloy Tributary 1	79.2	14	MODERATE	5.65	MODERATE
6	Glencloy Tributary 2	127	18	HIGH	7.05	HIGH
7	Glencloy Tributary 3	108.6	14	MODERATE	7.75	HIGH
8	Glencloy Tributary 4	118.8	18	HIGH	6.6	GOOD
9	Glencloy main channel	102.7	16	GOOD	6.4	GOOD
11	Glencloy Tributary 5	146.7	22	HIGH	6.66	HIGH
14	Glencloy Tributary 8	55.6	11	BAD	5.05	MODERATE

Site Survey: Juvenile Fish Stocks

8.152 The survey of fish stocks was conducted in early July 2021 at 13 sites (1, 2, 2b, 2c, 4, 5, 6, 7,7b, 8, 9, 11 and 14) located on the Ticloy Water, Glencloy River and associated tributaries **(Table 8.14; Volume 3 - Figure 8.9)**. The reduced selection of survey sites resulted from the omission of previous candidate watercourses that were screened out of further assessment due to the lack of fisheries potential, as described earlier (survey site 3, 12 and 13), and the low potential for fish in the upper to middle reaches of Tributary 8 of the Glencloy where stream quality and phsycial habitat assessment only was conducted. A habitat description only was conducted at Glencloy River site 10.

8.153 Fish survey sites generally corresponded with Stream Quality survey sites except at;

- site 1 on the Upper Braid Water, which was surveyed to assess the potential presence of salmon downstream of the site drainage;
- sites 2b and 2c on the Upper Ticloy Water, which were surveyed to determine potential fish presence in the upper reaches within the Site boundary;
- site 7b, which assessed the fish community in the upper reaches of Glencloy Tributary 3;

- site 15 on the Lower main Glencloy River, which was surveyed to determine the potential presence of salmon downstream of the site drainage.

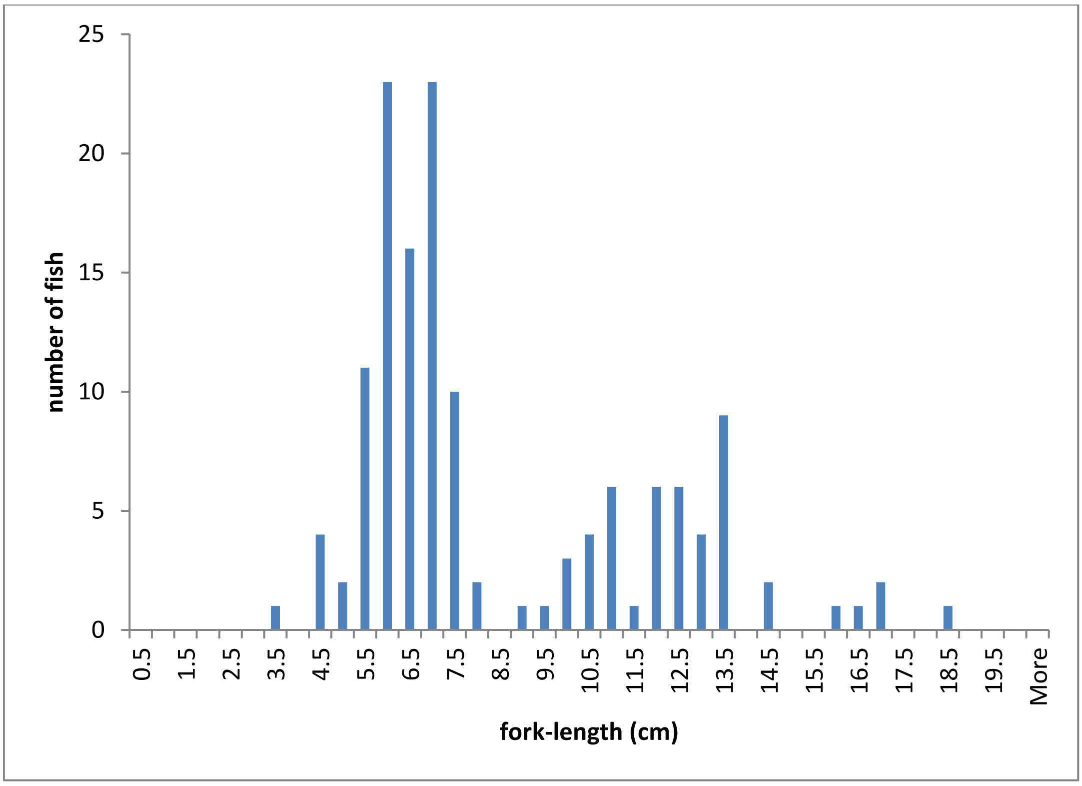
8.154 Salmon were absent at all surveyed sites within the Site boundary but occurred at Poor abundance in the Upper Braid Water at Fork Bridge ca. 3.6km downstream of the Site (site 1, Vol 3 **Figure 8.9**). Although salmon fry were absent in the main Glencloy River approximately 3.4km downstream of the Site boundary, Aged 1 and older salmon were present (site 15, Vol 3 **Figure 8.9; Table 8.13**)

8.155 Trout fry occurred at 11 of the 13 sites from Moderate to Excellent abundance throughout the Upper Glencloy River, Ticloy Water and most of the main tributaries within or draining the Site (**Figure 8.9**. Trout were absent only at site 5 in tributary 1 of the Glencloy River Water and at site 4 in tributary 2 of the Ticloy Water.

Population Age Structure

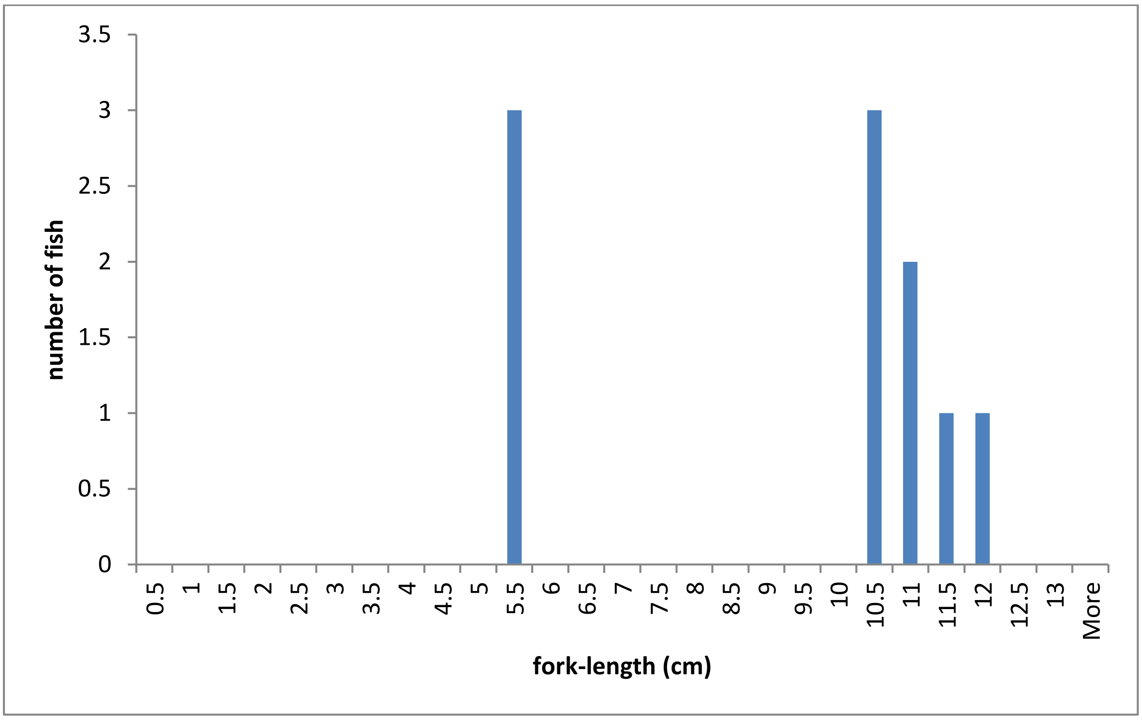
8.156 The age structure of the trout stocks in the Ticloy Water, and Glencloy River and tributaries, was verified by constructing composite length frequency distributions (**Chart 2**).

Chart 2: Length frequency distribution of trout caught in the Ticloy Water, Glencloy River and tributaries.



8.157 The trout length frequency shows a clear separation of Age 0 fry (<8.5cm) from Age greater than 1 fish (>9.0 cm). The trout length frequency indicates that fish aged 1 or older were dominant in the streams, with fish greater than 13.5.0cm likely to be Age 2 or older.

Chart 3: Length frequency distribution of salmon caught in the Upper Braid and Lower Glencloy River.



8.158 Although there were much fewer salmon, the length frequency shows a clear separation of Age 0 fry (<10.0 cm) from Age greater than 1 fish (>10.0 cm; **Chart 3**).

Fish Distribution & Abundance

8.159 The results of the semi-quantitative survey are shown in **Table 8.13** with the numbers of trout and salmon at each site separated into age groups.

8.160 The lack of salmon in any tributary within the Site (see Vol 3 **Figure 8.9**) is consistent with their distribution indicated by DAERA IFD, where they are constrained to the Upper Braid Water ca. 3.6km downstream of the Site **(Vol 3 Figure 8.4).** Although DAERA data were not available for the Glencloy River and tributaries, the presence of a two Aged greater than 1 fish in the lower river at site 15 is consistent with DAERA comments on the lack of suitable habitat until the lower few kilometres of the river.

8.161 Brown trout were widely distributed in the streams draining the Site, occurring from the Upper to Lower main Ticloy Water at Moderate to Excellent abundance (sites 2,2c and 2c) with at least two age classes present (**Table 8.13;** Vol 3 **Figure 8.9**). Trout were absent only in Tributary 2 of the Ticloy Water.

8.162 In the Glencloy River catchment, trout fry occurred at Excellent abundance in tributary 2 upstream of Curraghvohil Lakes (site 6), with good abundance of older trout also present. Trout fry occurred at Moderate to Excellent abundance in tributary 3 of the

Glencloy (sites 7 and 7b), with a greater abundance of Aged 1 and older trout occurring over 1km upstream of the existing farm track (site 7b). In the nearby tributary 4 of the Glencloy, trout fry also occurred at Good abundance, and downstream of tributaries 3 and 4 in the main Glencloy River at the Site boundary (site 9), trout fry occurred at Good abundance with good numbers of Aged greater than 1 fish also present. Just downstream of the Site boundary in tributary 5 of the Glencloy River, trout fry occurred at Moderate abundance with Aged greater than 1 fish also present.

8.163 In both the Upper braid and Lower Glencloy Rivers (sites 1 and 14, respectively), trout fry abundance was Moderate and Excellent with good numbers of Aged greater than 1 fish also present.

8.164 Overall, the data indicate that trout spawning and recruitment is extensive within the main Ticloy Water, Glencloy, and in particular the main drainage tributaries of the Glencloy River, with multiple age classes at most sites indicative of stable resident populations.

Table 8.13: Summary results of electrofishing survey indicating numbers of age 0 and older trout and salmon caught; fry abundance indices and other fish species also indicated.

Site	Watercourse	Trout (Age)		Salmon (Age)		Fry abundance index		Other species
		(0)	(1++)	(0)	(1++)	Trout	Salmon	
1	Braid Water	6	11	4	9	Moderate	Poor	10 loach; 3 stickleback
2	Ticloy Water	18	6	0	0	Excellent	Absent	1 eel; 20 loach
2b	Ticloy Water	5	3	0	0	Moderate	Absent	1 eel; 20 minnows
2c	Ticloy Water trib. 2	5	2	0	0	Moderate	Absent	24 loach
4	Ticloy Water trib. 2	0	0	0	0	Absent	Absent	
5	Glencloy trib. 1	0	0	0	0	Absent	Absent	
6	Glencloy trib. 2	39	17	0	0	Excellent	Absent	
7	Glencloy trib. 3	18	2	0	0	Excellent	Absent	
7b	Glencloy trib. 3	6	22	0	0	Moderate	Absent	
8	Glencloy trib. 4	13	5	0	0	Good	Absent	
9	Glencloy river	12	19	0	0	Good	Absent	
11	Glencloy trib. 5	5	9	0	0	Moderate	Absent	
15	L. Glencloy River	40	18	0	2	Excellent	Absent	4 eels

8.165 Stone loach (*Barbatula barbatula*) were distributed from the Upper to lower Ticloy Water, including the Braid Water, while stickleback occurred in the Upper Braid Water. Eels also occurred in the main Ticloy within the Site with two individuals of 30 and 45cm, with the latter approaching the size at which downstream migration of silver eels occurs in the late summer/ autumn. Four younger eels of a size range 12-15cm occurred in the lower Glencloy River (site 15), but no other eels were captured in the tributaries within the Site. The presence of multiple potentially impassable waterfalls downstream of the Site boundary (bellow site 9) may explain the apparent absence of eels and salmon.

Assessment of Effects

8.166 Potential effects were assessed for construction, operational and decommissioning phases of the Development. Construction impacts cover the discharge of suspended solids, release of other pollutants and interruption of fish passage. Post-construction (operational) impacts include habitat loss at watercourse crossings, obstruction of fish passage and surface water run-off.

8.167 Impact assessments are primarily based on their effect on salmonids either directly or upon their habitats. However, these assessments would be equally relevant to eels and lamprey if present in these waters.

Fisheries Significance / Aquatic Ecological Sensitivity

8.168 Using the information assembled through the baseline assessment, the Fisheries Significance/Sensitivity for the main watercourses draining the area within the Site Boundary and downstream of this area are shown respectively in **Table 8.14**. A watercourse was deemed to have a High/ Very High sensitivity if its WFD class was at least Good and/or Annex II species were present (e.g. salmon).

8.169 The main Ticloy Water within the Site boundary was assessed as generally of High to Very High sensitivity because of the assessed High WFD-based ecological quality, with the presence of a healthy trout population and eels also informing the assessment (**Table 8.14**).

8.170 Of the tributaries in the Site boundary within the Glencloy River catchment, tributary 1 was assessed at Medium sensitivity; although lacking fish and having poor fish habitat, the stream was assessed at Moderate WFD-based ecological quality.

8.171 Tributary 8 also was assessed at Medium sensitivity since, although WFD-based ecological quality was Bad, and habitat at and immediately downstream of track crossings was unsuitable for trout, the lower reaches of the stream had some potential to support small numbers of resident trout.

8.172 All other Glencloy River tributaries within and draining the Site were assessed at High or Very High sensitivity due to Good/ High WFD-based ecological quality assessed, while all also supported abundant trout populations; the main Upper Glencloy (Tributary 2) also was formerly designated as a salmonid river (**Table 8.14**).

8.173 The downstream main channel rivers, the Upper Braid Water and the Lower Glencloy River, were assessed at Very High sensitivity due to the presence of Atlantic salmon and their habitats.

Construction Phase

8.174 The potential for impacts on fisheries and aquatic habitats during the construction phase is mainly associated with ground disturbance and the entrainment of sediments in surface water drainage. There is also a potential impact from the accidental spillage of other hazardous substances (oil and fuel) used in the construction process.

8.175 Temporary obstruction of fish passage within the Site is a potential impact at several small tributaries where culvert crossings are proposed.

Table 8.14: Sensitivity of receiving watercourses within Site Boundary and downstream to Upper Braid and Lower Glencloy main channel.

River/Stream	Key Species/ receptors	WFD class	Sensitivity
Site drainage streams			
Ticloy Water main channel	Trout; trout spawning and nursery habitat; eels.	HIGH	High/ Very High
Glencloy Tributary 1	No fish; poor physical habitat quality	MODERATE	Medium
Glencloy Tributary 2 (main upper river)	Designated salmonid river; trout, good/ moderate trout spawning/nursery habitat	HIGH	Very High
Glencloy Tributary 3	Trout; moderate trout spawning/ nursery	MODERATE	Medium
Glencloy Tributary 4	Trout; moderate trout spawning/ nursery	GOOD	High
Glencloy main channel adjacent Site boundary	Trout; excellent trout nursery habitat quality	GOOD	High
Glencloy Tributary 5	Trout; good trout nursery habitat quality	HIGH	Very High
Glencloy Tributary 8	Although fish habitat very poor at track and downstream; N3 towards lower stream	BAD	Medium
Sensitive downstream watercourses			
Lower Glencloy River	Salmon; Trout; Sea trout; eels; possible lamprey spp.; good salmonid spawning and nursery habitat quality	GOOD	Very High
Lower Braid Water (including downstream River Maine)	Salmon present at Moderate-Excellent abundance; trout and migratory dollaghan; eels; possible river and brook lamprey	GOOD	Very High

Sediment Run-off

8.176 The release of fine sediment (grain size <2mm) is potentially a major cause of environmental impacts and is associated with clearly defined negative impacts (Newcombe and Jensen, 1996; Turley et al. 2014). Sensitive fish species such as brown trout and Atlantic salmon are highly vulnerable to suspended and deposited sediment in spawning and nursery habitats (Kemp et al. 2011). In spawning gravels, incubating salmonid eggs require good water circulation to provide oxygen and remove waste products. As deposited fine sediment content increases, gravels become embedded, resulting in restricted water circulation and reduced egg and alevin survival. After emergence, juvenile salmonids (fry) disperse downstream to suitable nursery rearing habitat generally within 100m (Kennedy, 1984), often in faster flowing riffles/ runs, where they establish feeding territories and compete for food.

8.177 Suspended sediment can lower water clarity leading to reduce prey capture efficiency and may affect respiration rates by clogging of gills (Kemp et al. 2011). Deposited sediment can reduce habitat complexity and quality by in-filling of substrate, thus reducing territory size leading to increased aggression and ultimately lower carrying capacity. Deposited fine sediment can also indirectly affect growth and survival of juvenile salmonids by reducing the quality of habitat for preferred invertebrate prey species (Suttle et al., 1994).

8.178 Adult salmonids are prone to gill-clogging and visual impairment at high levels of suspended sediment but are much less reliant on substrate complexity, tending to occupy deeper pools, particularly during the spawning season. Adult salmonids are also more mobile than sessile eggs or juvenile stages, and thus more capable of avoiding adverse local conditions (Kemp et al. 2011).

8.179 Freshwater benthic macroinvertebrates are also an important component of river ecosystems, acting both as sentinels of general water and habitat quality, and as an important food resource for higher trophic levels such as fish and birds. Pulses of fine sediment can cause behavioural drift, whereas excessive fine sediment can reduce the quality of physical habitat by smothering and blocking of interstitial spaces and water flow (Allan, 1999). As fine sediment infiltration increases, invertebrate abundance and community diversity is reduced, resulting in the replacement of sensitive taxa (mayfly, stonefly and caddis) by more tolerant types (worms, midge larvae, molluscs; Matthaei et al. 2006; Kemp et al. 2011).

8.180 Sediment release and entrainment can also increase the risk of nutrient addition and alterations in channel morphology and hydrology (Levesque and Dube, 2007). For example, excavated bank material or soils associated with the construction process could increase inputs of sediment bound phosphorus, which could negatively affect aquatic biota by causing excessive algal and macrophyte growth, and depressed oxygen levels.

8.181 Fine sediment is partly managed by the water quality objectives and standards of the EC Freshwater Fish Directive 2006/44/EC (FWFD), where a mean total suspended solids (TSS) concentration of 25 mg/L is specified for salmonid waters. While Article 6 of the Water Framework Directive has now repealed the FWFD, new standards that provide the same level of protection have been proposed (UKTAG, 2010). However, there is no national environmental standard or guideline for deposited fine sediment in the UK. Fine sediment cover above a threshold of 20% bed cover, based on recommendations in New Zealand by Clapcott et al. (2011), and published research (e.g. O'Connor & Andrew,1998; Kemp et al. 2011), provides a general indication of increasing risk for both invertebrates and salmonids.

8.182 The discharge of suspended solids during construction of the proposed Unshinagh Wind Farm could result from:

- Excavations associated with construction of access tracks and turbine foundations
- Excavations associated with watercourse crossings
- Surface peat disturbance and subsequent erosion of the underlying soils
- Stockpiling of soils and excavated materials
- Run-off from access roads
- Landslide resulting from slippage of access roads or excavated materials.

8.183 The proposed site is hydrologically connected to watercourses of significant fisheries interest via on-site and off-site watercourses which are potential routes for suspended solids run-off. The main Ticloy Water and Glencloy River channels, and the associated tributaries of the Upper Glencloy within the Site boundary, are of particular significance due to their importance in providing spawning and nursery for trout, and nursery habitat for eels; downstream the Upper Braid and Lower Glencloy River also support Atlantic Salmon, listed in Annexe II of the EU Habitats Directive, and provide recreational angling value. All of these watercourses would be susceptible to sediment run-off particularly because of the presence of sensitive salmonid fish species.

Release of other pollutants

8.184 As the Site drains into tributaries of the Upper Glencloy River and the Ticloy Water, there is potential for spillage or release of diesel, oil or other polluting substances, with likely negative impacts on resident fish together with invertebrate organisms that underpin the generally Good/ High ecological health observed in these streams.

8.185 During construction, with high usage of plant fuel and oil, there is an increased risk of accidental spillage and discharge to the any of the drainage streams and thence to the Upper Braid and River Main, and to the Lower Glencloy River. Similarly, the application of ready-mix concrete in construction processes carries some risk of inadvertent discharge with the potential to impact on resident fish and invertebrate organisms in these watercourses.

Fish passage: temporary obstruction

8.186 Poor management of works adjacent to stream banks or at crossing points may lead to obstruction of the channel during periods of fish migration and spawning. It is intended to install pipe culverts at crossings of minor watercourses and bottomless culverts at major watercourse crossings. For clarity, minor watercourses are those where a 10m buffer is proposed from all site works. A 50m buffer is proposed from site works at all other major watercourses within the Site.

8.187 As per Chapter 9 (Geology & Water Environment), the layout of the Development would indicate 20 crossings of watercourses within the planning application boundary (**Figure 8.9**), six of which are of significant watercourses and fourteen of minor watercourses. Culverts will ensure that track crossings are accommodated and that the length of affected channel is minimised in order to comply with Revised PPS15 policy FLD4.

8.188 On the Ticloy Water sub-catchment there are 6 crossings as follows;

- Four crossings of minor watercourses; three on the track linking Turbine 9 with Turbine 11; one north-northwest of Turbine 8
- Two crossings of major watercourses, both on the main Ticloy Water; one linking the site track north-west to Turbine 10 and the other linking Turbines 8 and 9.

8.189 Within the Ticloy Water sub-catchment, temporary obstruction of fish passage is likely only on the two main Ticloy Water channel crossings where trout fry occurred at Moderate abundance and habitat quality was moderate. In addition, other fish species such as eels, stone loach and minnow were present.

8.190 On the Glencloy River catchment, there are 14 crossings as follows;

- One crossing of a minor watercourse at Tributary 1 near the existing farm track north of Turbine 8.
- Five crossings along Tributary 2 including one major watercourse crossing on the lower reaches near the existing farm track and four in several minor inflowing watercourses in the vicinity of Turbines 7, 12 and 13.
- Two crossings of Tributary 3, one in the headwaters near Turbine 4 and the other in a small inflowing stream near Turbine 6.
- One crossing of Tributary 4 in the upper reaches south-west of Turbine 3.
- Two crossings of Tributary 5 both in upper catchment minor inflowing watercourses near Turbine 1 and south of Turbine 3.
- One major crossing of the Glencloy River ca. 500m east of the outflow from Curraghvohil Lake East
- Two crossing of drains of Tributary 8 in the south of the Site along the main entrance track.

8.191 Within Tributary 2 of the Glencloy River catchment, temporary obstruction of fish passage is likely only in the lower river crossing where trout fry occurred at Excellent abundance. There was very low fisheries potential at the remaining 4 crossings of minor inflowing watercourses in the vicinity of Turbines 7, 12 and 13 and so obstruction of fish passage has a very low likelihood.

8.192 Within Tributary 3 of the Glencloy River catchment, temporary obstruction of fish passage is possible in the upper site of the main channel near Turbine 4 because of low to moderate fisheries habitat quality and the presence of small resident trout in the Upper reaches of this stream. However, the crossing of the small inflowing stream at Turbine 6 will not impact on fish passage as there is very low fisheries potential.

8.193 Within Tributary 4 of the Glencloy River catchment, there is potential for temporary obstruction of fish passage at the crossing south-west of Turbine 3 because of the presence of moderate salmonid habitat quality with small pools that could harbour a few resident trout.

8.194 Within Tributary 5, there is a very low likelihood of temporary obstruction of fish passage at both crossings of minor watercourses because of very poor habitat suitability.

8.195 Within the Upper drains of Tributary 8, there is no potential for the proposed track crossings to cause obstruction of fish passage because of the very poor habitat suitability for fish.

8.196 There is high potential for temporary obstruction of fish passage at the proposed crossing of the main Glencloy River east of Curraghvohil Lake East because of the excellent quality of trout habitat and Good abundance of trout fry nearby downstream (survey site 9).

Operational Phase

8.197 The potential for any impacts will be significantly reduced during the operational phase with the construction process complete, site infrastructure in place, and a reduced requirement for any hazardous materials on-site. Potential impacts at Unshinagh are essentially limited to surface water run-off, permanent fish passage obstruction, and loss of habitat.

Surface Water Run-off

8.198 Surface water run-off from hard surfaces (access tracks, hard stands, control buildings) could lead to sediment-laden run-off to the receiving watercourses with potential effects on fish and other forms of aquatic life as outlined above; however, the effects during the operational phase are expected to be less severe because no soil/ peat disturbance will occur.

8.199 Wash-out of areas of excavated peat during or following periods of heavy rainfall could also result in run-off of sediment to the receiving watercourses with potential increases in sediment load.

Fish Passage obstruction/ inhibition

8.200 The construction of bridges and culverts has the potential to prevent or hinder normal fish movement within the stream or upstream migrations of pre-spawning adults unless consideration is given at the design stage.

8.201 Obstructions can occur if inverts are not sufficiently embedded to below the water level or if the length and gradient over which the culvert is installed causes high flow and an inability to find flow refuges due to a lack of baffles or natural stream substrate.

8.202 Within the area of the planning application boundary track roads and associated watercourse crossings, an assessment of the main Ticloy Water, the main Glencloy River, and Tributaries 2,3 and 4 of the Glencloy River, either support or have potential to support trout and/or eels. As documented under “Fish Passage: temporary obstruction” there are specific crossings in these watercourses that also have potential to cause permanent obstruction of fish passage.

Habitat loss at stream crossings

8.203 Depending on the length of culvert used, a watercourse crossing may result in significant loss of habitat, particularly where the original channel bed is lost and cannot be restored. Removal of bed material also can result in long term loss of habitat and channel diversity. Enclosure of the channel over significant lengths restricts light penetration which inhibits growth of benthic algae and aquatic plants, in turn leading to reduced potential for macroinvertebrate and fish productivity

8.204 All proposed watercourse crossings in the application area that are within the Ticloy Water and Glencloy River catchment could each result in the loss of a very small area of stream habitat but this is expected to have a negligible effect on primary (algae/ plants) and secondary production (macroinvertebrates) given the overall spatial scale in relation to existing watercourse area. However, several proposed crossings will occur in watercourses supporting trout and their habitat and could result in a small area of habitat loss unless mitigation is considered.

Decommissioning Phase

8.205 Decommissioning of the Development would have potential effects on fish stocks and aquatic habitats in the drainage tributaries and the more distant Upper Braid Water and Lower Glencloy Rivers. Impacts will be similar to those predicted for the construction phase but will ultimately depend on the level of reinstatement required.

8.206 In this case the decommissioning process will involve the removal of all above ground structures, removal of underground structures to one metre below ground level, and reinstatement of disturbed areas; access tracks are likely to remain for farm use. However, it is unlikely that any of the structures at or near to the main watercourses will be removed or modified in any way.

8.207 The effects of decommissioning on fish habitats and fish stocks are therefore likely to be similar to those of construction for sediment run-off and the release of other pollutants, although of lower magnitude.

Mitigation

Construction Phase

Sediment Run-off

8.208 Mitigation measures to control sediment run-off are described in detail in **Chapter 9** (Geology & Water Environment) and summarised as follows:

Buffer Zones

8.209 During the construction phase it is important that works should be avoided within the area of sensitive watercourses, with the preservation of intact vegetated buffer zones between development infrastructure and stream channels. To this end, buffer zones of 10m and 50m minimum width are specified in Chapter 9 for minor and major watercourses, respectively. The larger minimum buffer of 50m will apply to the main channel Ticloy Water, the Glencloy River, and the main channel of Tributaries 2, 3 and the lower reaches of Tributary 4 of the Glencloy River, all of which are watercourses in terms of potential fisheries sensitivity.

8.210 Turbine bases, access roads (apart from watercourse crossings) and associated infrastructure will be located out-with buffer zones

8.211 The application of buffer zones will minimise the risk of sediment run-off from site construction works to on-site watercourses and the most sensitive reaches (Ticloy Water, Glencloy River, Tributaries 2-5 of the Glencloy River) and more distant receiving reaches in the Upper Braid Water and Lower Glencloy River.

Timing of Works

8.212 DCAL (now DAERA) Inland Fisheries produced Guidelines for Fisheries Protection during Development Works (undated) which identifies the likely impact of construction and development work on fisheries habitat and outlines practical measures for the avoidance and mitigation of damage.

8.213 Of the major watercourses with potential fisheries sensitivity, the Development will require crossings on the main Ticloy Water, Glencloy River, and Tributaries 2-4 of the Glencloy River. Any in-stream works for the construction of watercourse crossings at these locations should be avoided between October 1st and April 30th (as per DAERA guidelines).

8.214 No restrictions to the timing of works would be required at all other minor watercourse crossings because of the lack of suitable salmonid habitat and thus low fisheries potential.

8.215 All works at stream crossings will adhere to the measures outlined in the Good Practice Guidance (GPP) notes (https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/guidance-for-pollution-prevention-gpps-full-list/,) particularly those near to water, including but not limited to the following;

- GPP1: Understanding your environmental responsibilities – good environmental practices;
- GPP5: Works and maintenance in or near waters;
- PPG6: Working at construction and demolition sites;
- GPP21: Pollution incident response planning;

8.216 It is also recommended that to minimise the risk of suspended sediment entrainment in surface water run-off, the site drainage system should only be constructed during periods of low rainfall and therefore low run-off rates.

Surface Water Management

8.217 The potential for pollution of watercourses by silt-laden runoff is addressed in detail in Chapter 9: Geology & Water Environment. A surface water management plan will be developed using the principles of Sustainable Drainage, based on the on-site retention of flows and use of buffers, swales, check-dams and other silt removal techniques.

8.218 Implementation of the management plan will prevent any adverse effects on the ecology of the principal receiving watercourses during the construction phase of the project.

Water Quality Monitoring

8.219 Chapter 9 also proposes the implementation of a water quality monitoring programme to examine the effects of the infrastructure construction works on surface water quality. It is recommended that the monitoring programme be continued through the operation and decommissioning phases of the Development.

Release of other pollutants

Site Management

8.220 All precautions will be taken to avoid spillages of diesel, oil or other polluting substances during the construction phase. This will be achieved through good site practices as described in the Good Practice Guidance notes proposed including:

- GPP1: Understanding your environmental responsibilities – good environmental practices;
- GPP5: Works in or near to Watercourses;
- PPG6: Working at Construction and Demolition Sites;
- GPP8: Safe storage and disposal of used oils;
- GPP21: Pollution incident response planning;
- GPP22: Dealing with spills; and
- GPP26: Safe storage – drums and intermediate bulk containers.

8.221 A Pollution Prevention Plan will be included as part of the Construction & Decommissioning Method Statement (CDMS) for the Development, to be agreed with the local planning authority at the pre-construction stage. This will incorporate a contingency plan setting out the procedure to be followed in the event of a significant spillage occurring.

Surface Water Management

8.222 The proposed surface water management plan and associated SuDS system will also facilitate the interception of diesel, oil or other polluting substances during the construction phase.

Fish passage: temporary obstruction

8.223 During the period late September to end April, instream works to install crossings in all major watercourses (Ticloy Water, Glencloy River, Glencloy Tributaries 2-4 inclusive) should be avoided so as to minimise disruption to the free movement of pre-spawning trout and the development of incubating eggs.

Operational Phase

Surface Water Run-off

8.224 As outlined in Chapter 9, site drainage will use the principles of SuDS, with installations to incorporate a "treatment train" of two to three stages of pollutant removal to all surface water runoff during the operational phase, as with the construction and decommissioning phases. Additional measures to prevent the release of suspended solids will include:

- Preservation of natural run-off patterns;
- Reduction of flow rates from access tracks through use of attenuating check-dams;
- Use of shallow ponds to aid settlement;
- Linear track drainage swales with regular outflow points throughout the SuDS system to limit the potential for large flows at single outflow points;
- Avoidance of peat storage within denoted 10m or 50m watercourse buffer zones or in areas of overland water flow.

Fish passage obstruction/ inhibition

8.225 The proposed installation of open bottom (clear-span) culverts at all major watercourse crossings where there is potential fisheries sensitivity, will ensure free movement of any fish present in the channel and would prevent any change in channel morphology or flow alteration due to in-stream structures.

Loss of habitat at stream crossings

8.226 The installation of open bottom (clear-span) culverts at all major watercourse crossings (i.e. those with salmonid fisheries potential) will ensure no loss of the habitat of fish or the potential productivity of algae/ plants and benthic invertebrates.

Decommissioning Phase

8.227 Mitigation measures during decommissioning will be the same as during the construction phase with regard to addressing the potential for run-off of suspended solids and other polluting substances. However, the level of mitigation will be determined by the level of reinstatement required.

Residual Effects

8.228 The potential effects of the Development on fish stocks and their habitats in the Ticloy Water, Glencloy River and associated tributaries draining the Site, are measured against proposed mitigations, as a means of assessing the residual effects of the project.

8.229 The magnitude of the potential effects and their residual significance were assessed according to the procedure outlined in the Methodology section of this chapter. It is the residual effects associated with the Development that most accurately reflect the overall predicted effects on fisheries and the aquatic environment during the construction, operational and decommissioning phases.

Construction Phase

8.230 Mitigation measures employed through the surface water management plan outlined in Chapter 9 based on SuDS technology to control drainage and silt management on the Development site will remove the potential for damage to fish or their habitat from siltation of spawning and nursery habitats. These measures in association with the Pollution Prevention Plan will also minimise the risk for release of other construction related polluting substances into the river network. Fisheries interests are mainly focused on watercourses where 50m hydrological buffers are proposed, which will further mitigate the risk of surface run-off and the release of other pollutants.

For the tributaries with fisheries interests, including those where major watercourse track crossings are proposed within the Site, avoidance of any in-stream works between October 1st and April 30th will reduce the risk of temporary obstruction of fish passage. There will be no effect on fish migrations or spawning activity in any other tributary.

8.231 The magnitude and significance of potential effects during the construction phase before mitigation are summarised for each watercourse in **Table 8.15** along with the predicted residual effects after mitigation.

8.232 Without mitigation, the effects during the construction phase for watercourses draining the immediate Development, are predicted to be at worst of ***Major Magnitude*** and of ***Large/ Very Large Significance***, depending on specific effects and the sensitivity of individual watercourses e.g. the release of other pollutants to the Ticloy Water, tributaries 2-5 and 8 of the Glencloy, and the main Glencloy River, as watercourses with good trout abundance and/ or Good to High WFD status, potential to support trout in their lower reaches (Tributary 8), and the confirmed or likely presence of eels. However, with mitigation the effects are reduced to ***Neutral***.

8.233 This assessment also applies to the sensitive Upper Braid Water and Lower Glencloy River, which occur downstream of watercourses draining the Site, but also contain Annex II listed Atlantic salmon and possibly lamprey spp.

8.234 Effects associated with sediment run-off also depend on watercourse sensitivity; without mitigation the effects during the construction phase of sediment are predicted to be at worst of ***Moderate Magnitude*** and of ***Moderate/ Large Significance*** in most watercourses. However, with mitigation the effects are reduced to ***Neutral***.

8.235 Effects associated with temporary disruption of fish passage also depend on watercourse sensitivity; with the exception of Glencloy Tributaries 1 and 8 (where watercourse crossings are planned but there are no fish or habitat quality is very poor), and Glencloy Tributary 5, (where two crossings of the Upper tributary will occur in locations of very low fisheries habitat quality), without mitigation the effects during the construction caused by temporary obstruction of fish passage are predicted to be at worst of ***Moderate Magnitude*** and of ***Moderate/ Large Significance***. However, with mitigation the effects are reduced to ***Neutral***.

Operational Phase

8.236 Although there will be an increase in the area of hard surface due to the Development, the surface water management plan / drainage design features for the control and attenuation of storm water run-off will protect receiving watercourses from excessive inputs of sediment.

8.237 There are a number of water crossings proposed in major tributaries and in the main Glencloy River where there are fisheries interests; provided that open bottom culverts are installed as planned, there will be no loss of salmonid habitat or reduced productivity nor any impact on fish passage obstruction.

8.238 The magnitude and significance of potential effects during the operational phase before mitigation are summarised for each watercourse in **Table 8.16** along with the predicted residual effects after mitigation.

8.239 Without mitigation the effects during the operational phase are predicted to be at worst of ***Moderate Magnitude*** and of **Large/ Very *Large Significance***, depending on specific effects and the sensitivity of individual watercourses. For example, permanent obstruction of fish passage in the main Glencloy River at the proposed track crossing close to the Site's southern boundary could essentially prevent any upstream migration of spawning trout above this and into the main Glencloy tributaries within the wider Site area. However, with mitigation the effects are reduced to ***Neutral***.

Decommissioning Phase

8.240 The magnitude and significance of potential effects during the decommissioning phase before mitigation are summarised for each watercourse in **Table 8.17** along with the predicted residual effects after mitigation.

8.241 Without mitigation the effects during the decommissioning phase are predicted to be at worst of ***Minor Magnitude*** and of **Moderate/ Large *Significance***, depending on specific effects and the sensitivity of individual watercourses. For example, the release of other pollutants could impact on highly sensitive watercourses such as the Upper Braid Water and Lower Glencloy River where Atlantic salmon are present. Mitigation measures will ensure that the effects remain as ***Neutral***.

Table 8.15: Construction Phase - Magnitude and Significance of Effects without Mitigation, and Residual Effects after Mitigation.

River/ Stream	Key receptors	Sensitivity	Potential Effect	Magnitude of Effect	Significance without Mitigation	Residual Effect after Mitigation
Ticloy Water main channel	Trout present; WFD status High	High/ Very High	Sediment run-off	Moderate	Moderate/ Large	Neutral
			Release of other pollutants	Major	Very Large	Neutral
			Fish passage: temp. obstruction	Moderate	Moderate/ Large	Neutral
Glencloy Tributary 1 (Upper Glencloy River)	WFD status Moderate; No fish	Medium	Sediment run-off	Moderate	Moderate	Neutral
			Release of other pollutants	Moderate	Moderate	Neutral
			Fish passage: temp. obstruction	No impact	-	-
Glencloy Tributary 2 ** only in lower reach crossing near existing farm track*	Trout present; WFD status High; designated salmonid water	High/ Very High	Sediment run-off	Moderate	Moderate/ Large	Neutral
			Release of other pollutants	Major	Very Large	Neutral
			Fish passage: temp. obstruction*	Moderate	Moderate/ Large	Neutral
Glencloy Tributary 3 ** only in headwater crossing of main channel*	Trout present; WFD status Moderate	Medium	Sediment run-off	Moderate	Moderate	Neutral
			Release of other pollutants	Major	Large	Neutral
			Fish passage: temp. obstruction*	Moderate	Moderate	Neutral
Glencloy Tributary 4	Trout present; WFD status Good	High	Sediment run-off	Moderate	Moderate/ Large	Neutral
			Release of other pollutants	Major	Very Large	Neutral
			Fish passage: temp. obstruction	Moderate	Moderate/ Large	Neutral
Glencloy Tributary 5	Trout present; WFD status High	Very High	Sediment run-off	Moderate	Moderate/ Large	Neutral
			Release of other pollutants	Major	Very Large	Neutral
			Fish passage: temp. obstruction	No impact	-	-

River/ Stream	Key receptors	Sensitivity	Potential Effect	Magnitude of Effect	Significance without Mitigation	Residual Effect after Mitigation
Glencloy Tributary 8	Trout absent in upper reaches but potential in lower reaches; WFD status Bad	At best Medium	Sediment run-off	Moderate	Moderate	Neutral
			Release of other pollutants	Majore	Large	Neutral
			Fish passage: temp. obstruction	No impact	-	-
Glencloy River main channel	Trout present; WFD status Good	High	Sediment run-off	Moderate	Moderate/ Large	Neutral
			Release of other pollutants	Major	Very Large	Neutral
			Fish passage: temp. obstruction	Moderate	Moderate/ Large	Neutral
Lower Glencloy River downstream of the development	Salmon & Trout present; possible lamprey; WFD status Good	Very High	Sediment run-off	Moderate	Moderate/ Large	Neutral
			Release of other pollutants	Major	Very Large	Neutral
			Fish passage: temp. obstruction	No impact	-	-
Lower Braid Water (including downstream River Maine)	Salmon & Trout; potential Lamprey spp.; WFD status Good	Very High	Sediment run-off	Moderate	Moderate/ Large	Neutral
			Release of other pollutants	Major	Very Large	Neutral
			Fish passage: temp. obstruction	No impact	-	-

Table 8.16: Operational Phase – Magnitude and Significance of Potential Effects without Mitigation, and Residual Effects after Mitigation.

River/ Stream	Key Species	Sensit-ivity	Potential Effect	Magnitude of Effect	Significance without Mitigation	Residual Effect after Mitigation
Ticloy Water main channel	Trout present; WFD status High	High/ Very High	Surface water run-off	Minor	Moderate	Neutral
			Fish passage obstruction	Moderate	Large	Neutral
			Habitat loss at stream crossings	Minor	Moderate	Neutral
Glencloy Tributary 1		Medium	Surface water run-off	Minor	Slight	Neutral

River/ Stream	Key Species	Sensit-ivity	Potential Effect	Magnitude of Effect	Significance without Mitigation	Residual Effect after Mitigation
(Upper Glencloy River)	WFD status Moderate; No fish		Fish passage obstruction	No change	Neutral	Neutral
			Habitat loss at stream crossings	Negligible	Neutral	Neutral
Glencloy Tributary 2	Trout present; WFD status High; designated salmonid water	High/ Very High	Surface water run-off	Minor	Moderate	Neutral
			Fish passage obstruction	Moderate	Large	Neutral
			Habitat loss at stream crossings*	Minor	Moderate	Neutral
Glencloy Tributary 3	Trout present; WFD status Moderate	Medium	Surface water run-off	Minor	Slight	Neutral
			Fish passage obstruction	Moderate	Moderate	Neutral
			Habitat loss at stream crossings	Minor	Slight	Neutral
Glencloy Tributary 4	Trout present; WFD status Good	High	Surface water run-off	Minor	Slight/Moderate	Neutral
			Fish passage obstruction	Moderate	Large	Neutral
			Habitat loss at stream crossings	Minor	Slight/Moderate	Neutral
Glencloy Tributary 5	Trout present; WFD status High	Very High	Surface water run-off	Minor	Moderate/ Large	Neutral
			Fish passage obstruction	No impact	Neutral	Neutral
			Habitat loss at stream crossings	Negligible	Neutral	Neutral
Glencloy Tributary 8	Trout absent in upper reaches but potential in lower reaches; WFD status Bad	At best Medium	Surface water run-off	Minor	Slight	Neutral
			Fish passage obstruction	No change	Neutral	Neutral
			Habitat loss at stream crossings	Negligible	Neutral	Neutral
Glencloy River main channel	Trout present; WFD status Good	High	Surface water run-off	Minor	Slight/ Moderate	Neutral
			Fish passage obstruction	Major	Large/ Very Large	Neutral

River/ Stream	Key Species	Sensit-ivity	Potential Effect	Magnitude of Effect	Significance without Mitigation	Residual Effect after Mitigation
			Habitat loss at stream crossings	Minor	Slight/ Moderate	Neutral
Lower Glencloy River downstream of the development	Salmon & Trout present; possible lamprey; WFD status Good	Very High	Surface water run-off	Minor	Moderate/ Large	Neutral
			Fish passage obstruction	No impact	-	-
			Habitat loss at stream crossings	No impact	-	-
Lower Braid Water (including downstream River Maine)	Salmon & Trout; potential Lamprey spp.; WFD status Good	Very High	Surface water run-off	Minor	Moderate/ Large	Neutral
			Fish passage obstruction	No impact	-	-
			Habitat loss at stream crossings	No impact	-	-

Table 8.17: Decommissioning - Magnitude and Significance of Effects without Mitigation, and Residual Effects after Mitigation.

River/ Stream	Key receptors	Sensitivity	Potential Effect	Magnitude of Effect	Significance without Mitigation	Residual Effect after Mitigation
Ticloy Water main channel	Trout present; WFD status High	High/ Very High	Sediment run-off	Minor	Moderate	Neutral
			Release of other pollutants	Minor	Moderate/ Large	Neutral
Glencloy Tributary 1 (Upper Glencloy River)	WFD status Moderate; No fish	Medium	Sediment run-off	Minor	Slight	Neutral
			Release of other pollutants	Minor	Slight	Neutral
Glencloy Tributary 2	Trout present; WFD status High; designated salmonid water	High/ Very High	Sediment run-off	Minor	Moderate	Neutral
			Release of other pollutants	Minor	Moderate/ Large	Neutral
Glencloy Tributary 3	Trout present; WFD status Moderate	Medium	Sediment run-off	Minor	Slight	Neutral
			Release of other pollutants	Minor	Moderate	Neutral
Glencloy Tributary 4		High	Sediment run-off	Minor	Slight	Neutral

River/ Stream	Key receptors	Sensitivity	Potential Effect	Magnitude of Effect	Significance without Mitigation	Residual Effect after Mitigation
	Trout present; WFD status Good		Release of other pollutants	Minor	Moderate	Neutral
Glencloy Tributary 5	Trout present; WFD status High	Very High	Sediment run-off	Minor	Moderate	Neutral
			Release of other pollutants	Minor	Moderate/ Large	Neutral
Glencloy Tributary 8	Trout absent in upper reaches but potential in lower reaches; WFD status Bad	At best Medium	Sediment run-off	Minor	Slight	Neutral
			Release of other pollutants	Minor	Moderate	Neutral
Glencloy River main channel	Trout present; WFD status Good	High	Sediment run-off	Minor	Slight	Neutral
			Release of other pollutants	Minor	Moderate	Neutral
Lower Glencloy River downstream of the development	Salmon & Trout present; possible lamprey; WFD status Good	Very High	Sediment run-off	Minor	Moderate	Neutral
			Release of other pollutants	Minor	Moderate/ Large	Neutral
Lower Braid Water (including downstream River Maine)	Salmon & Trout; potential Lamprey spp.; WFD status Good	Very High	Sediment run-off	Minor	Moderate	Neutral
			Release of other pollutants	Minor	Moderate/ Large	Neutral

Cumulative Effects

Additional Developments

8.242 This section considers other wind farm developments which, in combination with the Proposed Development, could give rise to the potential for cumulative effects on fisheries and the aquatic environment in local rivers. In this context, the potential for cumulative effects is only relevant with regard to existing or proposed developments that are either hydrologically connected or which drain to the same receiving environment. It is therefore more important to consider additional developments in the context of river catchments, both locally and on a wider river basin scale.

8.243 From a fisheries and aquatic ecology perspective, there are no other wind farm developments which have been constructed or are in the planning process within the Glencloy River catchment. As a result, there is no potential for cumulative effects on fisheries/ aquatic ecology arising from other wind farms within the catchment.

8.244 There are no listed Wind Farm developments within the Ticloy Water sub-catchment of the Upper Braid/Main catchment and so there is no potential for any cumulative effects in the immediate sub-catchment. However, there are thirteenadditional wind farm developments that are wholly or partly within the wider River Main catchment and might thus be considered to have the potential for cumulative impacts on the freshwater environment (**Table 8.18**).

Table 8.18. Additional Wind Farm developments/ proposals within the River Main indicating their location by WFD waterbody within the Braid & Main LMA.

Wind Farm	Planning reference	WFD Waterbody	Number of turbines	Status
Carnalbanagh	LA02/2017/0594/F	**Glen Burn (Upper Braid) / Glenarm River**	**7**	**Approved but under Holding direction**
Rathsherry	G/2011/0162/F	Clogh River	9	Operational
Elginny Hill	G/2011/0041/F	Clogh River / Upper Braid River (Artoges tributary)	11	Operational
Elliots Hill	G/1993/0648	Kells Water (Moorfields)	10	Operational
Castlegore Wind Farm	G/2011/0136/F	Kells Water	4	Approved; Awaiting Construction
Ballyutoag Wind Farm	T/2014/0478/F	Six-Mile-Water BUT outside of Main catchment	5	Approved; Awaiting Construction
Connaught Road Wind Farm	Not available	Lower Main	2	Operational
Ballymena Wind Park Ltd	Not available	Lower Braid	2	Operational
Wolf Bog	G/2004/0597/F	Kells Water (Moorfields)	5	Operational
Whappstown	G/ 2011/0052/F	Kells Water (Moorfields)	4	Consented

Wind Farm	Planning reference	WFD Waterbody	Number of turbines	Status
Carnalbanagh	LA02/2017/0594/F	**Glen Burn (Upper Braid) / Glenarm River**	**7**	**Approved but under Holding direction**
Corby Knowe	T/ 2006/0832/F	Kells Water (Kells)	3	Operational
Glenbuck	D/ 2012/0042/F	River Main (Dunloy)	4	Operational
Gruig	D/2004/0790/F	Cloghmills Water	10	Operational
Long Mountain	D/2006/0104/F	Dunnstown Burn	12	Operational

8.245 Aside from wind farm developments, the only other developments with the potential for effects on the aquatic environment of the Glencloy are hydroelectricity schemes. Two hydroelectricity schemes are consented in the Glencloy River catchment (**Table 8.19**).

Table 8.19. Small-scale hydroelectricity developments/ proposals within the Glencloy River.

Planning reference	Scheme ID number	Hydro details	Status
F/2013/0207/F	1	96Kw generator; 310m NE of 144A Ballymena Rd Carnlough	Consented
F/2013/0241/F	2	40kW; Lands approximately 800m West of 147 Ballymena Rd Carnlough	Consented

Assessment

8.246 The greatest risk to the aquatic environment from Wind Farm developments is during the construction phase when land excavation and possible in-river works are conducted, resulting in a heightened risk of sediment, release of other pollutants, and obstruction of fish passage. Although there have been documented incidents of sediment run-off from a wind farm at Bin Mountain in County Tyrone, and a large peat-slip at Meenbog Wind Farm on the Donegal/ Tyrone border (November 2020), no reports of similar issue shave been documented in any of the operational sites in the River Main catchment.

8.247 The Castlegore Wind Farm is planning approved but awaiting construction and is located where streams drain to the Kells Water sub-catchment of the River Main, over 20km upstream of where the Kells Water has its confluence with the River Main; the lower Kells Water confluence with the River Main is over 7km downstream of where the Braid Water has its confluence with the River Main, while the Ticloy Water within the Proposed Development is over 23km upstream of the Braids confluence with the River Main. Hence the distance between the developments to the receiving River Main, coupled with mitigations outlined in the Environmental Statement that accompanied the Planning

Application for Castlegore Wind Farm (ABO Wind, 2011), will ensure that there is a very low likelihood of cumulative impacts on fisheries and aquatic ecology of the River Main.

8.248 The Ballyutoag Wind Farm is planning approved and awaiting construction but flows to the separate Six-Mile-Water catchment and so does not interact with the lower River Main catchment thus ensuring no potential for cumulative effects on fisheries and aquatic ecology.

8.249 The Carnalbanagh Wind Farm planning application resubmission was recently approved by Mid and East Antrim Borough Councils Planning Committee but as of early November 2021, was placed under a Holding Order by the Department for Infrastructure. The northern extent of the application area has the potential to interact with a small tributary of the Glen Burn, itself a tributary of the River Braid that has its confluence with the main Braid ca. 5.6km downstream; the River Braid at this confluence is located ca. 8.0km downstream of where the Ticloy Water drains the Unshinagh landholding boundary. As such, there is some potential for drainage from Unshinagh to have a cumulative effect together with the Carnalbanagh Wind Farm.

8.250 The ES for Carnalbanagh (Chapter 9: Hydrology, Hydrogeology and Peat Stability), assessed that there were no significant water features within the application area and that the proposed mitigations, including implementation of SUDS measures, shallow drains, check dams, watercourse buffers, development of a surface and groundwater monitoring plan, avoidance of watercourse crossings and adherence to all relevant PPGs, would result in only a marginal increase in the risk of impacting on sensitive water environments such as wells and springs close to construction works. Therefore, given that the drainage of Caranalbanagh and Unshinagh are on separate and distant tributaries of the River Braid, and with full implementation of the measures proposed in the current Proposed Development together with those specified for the Carnalbanagh Wind Farm, the likelihood of cumulative impacts on the fisheries and aquatic ecology interests in River Braid and River Main downstream are very low.

8.251 For the two consented hydroelectric schemes on the Glencloy River; the then Department of the Environment determined that they fell within Category 3 (I) of Schedule 2 of the Planning (Environment Impact Assessment) Regulations (Nl) 2012 and determined that the planning applications did not require an accompanying Environmental Statement

- scheme ID no. 1 (**Table 8.19**); it was noted that there were no concerns from a water quality or fisheries perspective from Inland Fisheries Division or NIEA; Inland Fisheries were content that the recommended residual flow was adequate for protecting fisheries interests in the lower Glencloy River.
- Scheme ID no. 2 is located in the middle Glencloy River in the section above the extensive series of waterfalls along the Site boundary of the Proposed Development. The scheme was not deemed of concern to Inland Fisheries Division or NIEA in terms of water quality and fisheries interests; the proviso again was that the recommended residual flow was deemed adequate to

maintain fisheries interests in the flow depleted reach of the middle Glencloy River.

8.252 In view of the mainly operational nature of the majority of Wind Farm developments listed in **Table 8.18**, and the distance and proposed mitigations for the Castlegore Wind Farm, implementation of the measures as described for the current Proposed Development will ensure that no cumulative impacts occur on the fisheries and aquatic ecology interests in the Ticloy Water, Upper Braid Water and River Main.

8.253 Similarly, the lack of other operational and planned Wind Farms within the Glencloy River catchment, coupled with the mitigations proposed and agreed to for the two hydroelectric developments, supports the contention that no cumulative effects on fisheries and aquatic ecology are likely to arise as a result of the Proposed Development.

Summary

8.254 This chapter outlines the potential effects of the Development on the fish stocks and fish habitats of the receiving watercourses in the Ticloy/ Upper Braid Water and the Glencloy River catchment. It provides relevant baseline information on fisheries and aquatic ecological health enabling the potential effects to be identified and evaluated.

8.255 It has been determined that potential impacts are primarily related to the sediment run-off and release of other pollutants to the receiving watercourses with related effects on fish stocks and the wider stream ecosystem. Additionally, there is potential for temporary and permanent obstruction of fish passage and the loss of habitat at new track crossings of tributaries where trout are present. Without mitigation it is considered that these impacts have the potential to be of Major Magnitude and of Very Large Significance depending on the sensitivity of individual watercourses.

8.256 A series of specific mitigation measures have been designed to avoid adverse effects on fisheries and aquatic ecology with regard to both construction and operational phases of the project.

8.257 Hydrology and site drainage issues have been considered in detail in Chapter 9, which outlines a surface water management system and drainage (SuDS) designed to control drainage and silt management on the Site.

8.258 It is concluded that, provided the mitigation measures are implemented as specified, construction and operation of the proposed Development will have a neutral impact on the fish stocks and aquatic ecology of the Ticloy/ Upper Braid Waters and the Glencloy River and associated tributaries draining the Site.

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9

Geology & Water Environment

9 Geology and Water Environment

Introduction

Terms of Reference

9.1 This chapter considers the likely significant effects on the receiving hydrological, geological and hydrogeological environments; associated with the construction, operation and decommissioning of the proposed windfarm at Unshinagh, near Carnlough, Co. Antrim, hereinafter referred to as 'the proposed development'.

9.2 The impacts caused by the construction, operation and decommissioning phases of the proposed development are assessed, and mitigation measures are provided where required.

9.3 The assessment also identifies where hydrological features may constrain the layout of the proposed development.

Supplementary Assessments

9.4 This Chapter is supported by:

- Technical Appendix 9.1: Surface Water Management Plan;
- Technical Appendix 9.2: Flood Risk & Drainage Assessment;
- Technical Appendix 9.3.1: Geotechnical Assessment: Peat Slide Risk Assessment;
- Technical Appendix 9.3.2: Geotechnical Assessment: Mine Risk Assessment;
- Technical Appendix 9.4: Consultation Records; and
- Figures 9.1 to 9.4

9.5 Reference should be made to **Chapter 1: Introduction & The Proposed Development** for information regarding detailed construction proposals.

9.6 Changes to the hydrological / hydrogeological regime may create resultant effects on ecology within surface and groundwater dependent ecosystems. Therefore, this chapter is further supported by:

- Chapter 6: Ecology; and
- Chapter 8: Fisheries & Aquatic Ecology Assessment

Statement of Authority

9.7 The assessment has been carried out by McCloy Consulting Ltd.; an independent environmental consultancy specialising in the water environment, with specialist knowledge of hydrological and hydrogeological assessments.

9.8 The key staff members involved in this project are as follows:

- Iain Muir MSc CEnv MIEnvSc – Project Consultant and Chartered Environmentalist experienced in Environmental Impact Assessment (EIA) specialising in the water environment, undertaking hydrology, water quality and flood risk assessments for major infrastructure projects in highland environments, and renewable energy projects in the UK and Ireland; and

- Kyle Somerville BEng (Hons) CEng MIEI – Associate and Chartered Engineer with experience in the fields of hydrology, surface water management, groundwater screening assessments and geology assessments for wind farm developments in the UK and Ireland, and has overseen outline and detailed design of surface water management for in excess of thirty onshore wind farm developments in the UK and Ireland.

Scope of Assessment

9.9 This report will assess the effects of the proposed development on hydrology and surface water quality, hydrogeology and groundwater quality, and geological features. The assessment covers the construction, operational, maintenance and decommissioning phases of the proposed development.

9.10 This assessment identifies the hydrological constraints within land under applicant control; herein referred to as 'the survey boundary' and assesses the potential effects of the following:

- Existing natural and artificial drainage patterns;
- Water quality of surface water and groundwater;
- Surface and groundwater dependent ecosystems;
- Usage of surface water and groundwater including abstractions;
- Groundwater - surface water interactions;
- Aquifer systems and their vulnerability;
- Superficial and bedrock geology at the site; and
- Structural geology of the area and its environs.

9.11 In order to quantifiably assess the preceding, this report:

- Outlines relevant policy relating to the water environment;
- Summarises consultations provided in response to scoping requests;
- Provides baseline information and identifies sensitive receptors;
- Identifies potential likely effects, including potential likely cumulative effects;
- Assesses the significance of any adverse effects and resulting impacts based on the magnitude of the impact and the sensitivity of the receptors;
- Discusses management of design evolution and details mitigation measures;
- Provides a residual impact assessment; and
- Discusses the cumulative effects of the proposed development in conjunction with other proposed and existing developments in the vicinity.

Legislation and Planning Policy

9.12 Relevant Environmental Planning legislation, policy and industry best-practice guidance relevant to an assessment of hydrogeology and the water environment are summarised in **Table 9.1** and the following sections.

Relevant European and National Planning Policy

Table 9.1: Relevant European and National Planning Policy

Legislation	
NI	Control of Pollution (Oil Storage) (Amendment) Regulations (Northern Ireland) 2011
	Drainage (Environmental Impact Assessment) Regulations (Northern Ireland) 2017
	Water Resources (Environmental Impact Assessment) Regulations (Northern Ireland) 2017
	The Environmental Liability (Prevention and Remediation) (Amendment) Regulations (NI) 2009
	The Groundwater (Amendment) Regulations (Northern Ireland) 2016
	Nature Conservation and Amenity Lands (NI) Order 1985
	The Private Water Supplies Regulations (Northern Ireland) 2017
	The Surface Waters (Dangerous Substances) (Classifications) Regulations (NI) 1998
	Drainage (Northern Ireland) Order 1973 / Drainage (Amendment) (Northern Ireland) Order 2005
	The Environment (Northern Ireland) Order 2002
	Fisheries (Northern Ireland) Act 1966
	Water (Northern Ireland) Order 1999
	The Water Supply (Water Quality) Regulations (Northern Ireland) 2017
	Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017
	Water Framework Directive (Classification, Priority Substances and Shellfish Waters) Regulations (NI) 2015
	The Water (Amendment) (Northern Ireland) (EU Exit) Regulations 2019
	Groundwater (Amendment) Regulations (Northern Ireland) 2016
	The Surface Waters (Dangerous Substances) (Classifications) Regulations (NI) 1998
UK	UK TAG on the WFD (UK Environmental Standards & Conditions) 2008

Regional and Local Planning Policy

9.13 The proposed development has been reviewed in relation to local planning policy specific to geology and the water environment. A detailed planning policy and legislation review is included within **Chapter 2: Planning Policy**.

Regional Development Strategy 2035

9.14 The RDS promotes a sustainable approach to the provision of water and sewerage services and flood risk management including grey water recycling, rainwater harvesting and sustainable surface water management e.g., Sustainable Drainage Systems (SuDS).

Planning Policy Statements (PPS)

Strategic Planning Policy Statement (SPPS)

9.15 In working towards sustainable development, the aim will be to conserve both the archaeological and built heritage and natural resources (including wildlife, landscape, water, soil and air quality), taking particular care to safeguard designations of national and international importance.

PPS15 – Revised Planning and Flood Risk

9.16 Revised PPS15 sets out planning policies to "minimise flood risk to people, property and the environment", emphasising sustainable development and the conservation of biodiversity. The policy refers to the use of Sustainable Drainage Systems (SuDS) to minimise effects on the receiving water environment.

9.17 The policy that development proposals facilitating sustainable drainage would be considered favourably by the planning authority as such a sustainable drainage approach should be adopted by the Development.

9.18 Flood risk and drainage planning policy is similarly established by the Strategic Planning Policy Statement (SPPS). Transitional arrangements stated in the SPPS at paragraph 1.10 to 1.12 confirm that until a Plan Strategy is adopted, existing policies will apply together with the SPPS. Where the SPPS is silent or less prescriptive on a matter then this should not be judged to lessen the weight afforded to the retained policy.

9.19 In relation to flood risk planning policy, RPPS15 is more prescriptive on all aspects of matters for consideration, and the policy direction contained in RPPS15 is consistent with that stated in the SPPS.

PPS18 - Renewable Energy

9.20 PPS18 sets out the planning policy for development that generates energy from renewable resources and aims to facilitate the siting of renewable energy generating facilities in appropriate locations within the built and natural environments.

9.21 Policy RE1 of PPS18 states that, 'Development that generates energy from renewable resources will be permitted provided the proposal, and any associated buildings and infrastructure, will not result in an unacceptable adverse impact on…local natural resources, such as air quality or water quality.'

Larne Borough Council, Larne Area Plan 2010

9.22 The proposed development is located within Mid & East Antrim Borough Council (MEABC) boundary. MEABC are currently preparing a new Local Development Plan (LDP) for the

Borough up to 2030. In the interim, the current area plan for MEABC is the Larne Area Plan 2010.

9.23 The Larne Area Plan 2010 contains no policy or guidance relevant to geology, hydrogeology or hydrology. Drainage policy DR2 within the policy states that “Where a designated watercourse runs adjacent to or through a development site the department will require the provision of a 5m wide working strip along at least one bank of the watercourse.

9.24 The department will monitor all new development proposals to ensure that storm water run-off can be adequately catered for and does not compound existing flood problems”. The plan also states that policies regarding utilities and new infrastructure are set out in “the Rural Strategy” and that “the need for such facilities will be balanced against the objective of conserving the environment and protecting amenity”.

9.25 The Larne Area Plan 2010 highlights the importance of the designation of a hierarchy of sites which are of high nature conservation importance. The scale of importance of summarised in the below table.

Mid & East Antrim Borough Council, Local Development Plan 2030 (Draft)

9.26 The Draft Local Area Plan 2030, although not yet adopted, outlines planning policy pertinent to the water environment.

9.27 CS8 sets out policy to protect main river corridors by ensuring floodplain capacity is not hindered as well as considering water quality and pollution prevention to protect aquatic and riverine ecosystems.

9.28 FRD1 to FRD6 sets out policy to manage development that may be at risk from flooding or that may increase the risk of flooding elsewhere; to protect flood defence and drainage infrastructure; and to promote sustainable drainage solutions to improve water quality.

9.29 As the draft Plan Strategy is only at consultation stage it holds no material weight in decision making.

Guidance on Conservation of Geological Features - Earth Science Conservation Review

9.30 The Earth Science Conservation Review (ESCR) is the means whereby areas of geological interest in Northern Ireland are assessed to determine their importance to science and hence to earth science conservation.

9.31 The objective of the ESCR is to define systematically all earth science localities (geological and/or geomorphologic) in Northern Ireland. The overall aim of the process is to encourage conservation of such areas to protect them from potential threats such as landfill, changes to natural systems and coastal defence work.

Industry Guidelines

9.32 The Pollution Prevention Guidelines (PPGs), published by the Northern Ireland Environment Agency (NIEA) in conjunction with the Environment Agency for England and

Wales, and the Scottish Environment Protection Agency (SEPA) are currently being replaced by updated Guidance for Pollution Prevention (GPPs). Guidance notes relevant to the proposed development include:

- NIEA Guidance for Pollution Prevention (GPPs):
    - GPP 1: Understanding your environmental responsibilities - good environmental practices;
    - GPP 2: Above ground oil storage tanks;
    - GPP 4 Treatment and disposal of Wastewater where there is no connection to the public foul sewer;
    - GPP 5: Works and Maintenance in or near Water;
    - GPP 8: Safe Storage and Disposal of Used Oils;
    - GPP 20: Dewatering Underground Ducts and Chambers;
    - GPP 21: Pollution Incident Response Planning;
    - GPP 22: Dealing with Spills; and
    - GPP 26 Safe Storage – Drums and Intermediate Bulk Containers.
- In the absence of revised specific guidance, works shall similarly consider the lapsed NIEA Pollution Prevention Guidance Notes (PPGs):
    - PPG 3 Use and Design of Oil Separators in Surface Water Drainage Systems
    - PPG 6: Working at Construction and Demolition Sites;
    - PPG 7: The Safe Operation of Refuelling Facilities; and
    - PPG 18: Managing Fire Water and Major Spillages.

9.33 Other relevant industry guidance includes:

- BS6031: 2009 Code of Practice for Earthworks;
- BS 5930 2015: Code of Practice for Site Investigations;
- CIRIA C532 - Control of Water Pollution from Construction Sites (2001);
- CIRIA C692 - Environmental Good Practice On-Site (2010);
- CIRIA C609 - Sustainable Drainage Systems: hydraulic/structural/water quality (2004);
- CIRIA C753- The SuDS Manual (2015);
- CIRIA C689- Culvert Design and Operation Guide (2010);
- DEFRA Construction Code of Practice for Sustainable Use of Soils on Construction Sites (2009);
- DAERA - A Guide to EIA and Planning Considerations: Environmental Advice for Planning Practice Guide - Water Features Survey (2018);
- DAERA - A Guide to EIA and Planning Considerations: Wind Farms and Groundwater Impacts (2019);
- DAERA Standing Advice on Pollution Prevention Guidance;
- DAERA Standing Advice on Commercial or Industrial Developments;

- DAERA Standing Advice on Culverting;
- DAERA Standing Advice on Abstraction and Impoundments;
- DAERA Standing Advice on Sustainable Drainage Systems;
- DAERA Standing Advice on Discharges to the Water Environment and;
- GSNI (2021) Guidance for Planning Developments in Areas of Abandoned Mines. .

Consultation

9.34 Pre-application consultation and data gathering to form opinion and requirements with regards to the hydrological and geological environments was sought from local and regional stakeholder organisations, including organisations who would be anticipated to be consulted by the planning authority in relation to the planning application. The consultation is intended to pre-empt any pre-application or in-application consultation that would be undertaken on notification or submission of the planning application and EIA. The informal consultation excludes NIEA:NED whose concerns are addressed separately in **Chapter 6 Ecology**.

9.35 A summary of the specific data provided by, and information / concerns raised by the various stakeholders is included in the following table. Site specific input provided is included in the following baseline assessment. Stakeholder responses are included in **Technical Appendix 9.4.**

Table 9.2: Consultation Summary

Consultees		Summary of Response	Addressed in Assessment
Mid and East Antrim Borough Council	Environmental Health	Identified 1 no. Private Water Supplies located within the enquiry area surrounding the proposed development. MEABC also advised that additional information may be sought from Drinking Water Inspectorate for Northern Ireland (within Department of Agriculture, Environment and Rural Affairs).	9.99
DAERA	NIEA Private Water Supply / Drinking Water Inspectorate	Advised that the Drinking Water Inspectorate's Private Water Supplies app should be consulted to identify if there are any registered private water supplies within the specified distances of the site/location. There are two private drinking water supplies registered with the Inspectorate within 5km of the outlined site. Stated that DWI does not hold information on private water supplies which supply single dwellings, and any details should be obtained from the Environmental Health Department of Mid and East Antrim Borough Council.	
DAERA	Fisheries Inspectorate / Inland Fisheries	Confirmed the closest aquaculture site is salmon cages located at Red Bay. An impact would only occur should sediment be allowed to leave the development site and tidal conditions be such that it would carry material towards the cages.	9.168

Consultees		Summary of Response	Addressed in Assessment
		Stated that there is unlikely to be a potential impact.	
DAERA	Environmental Crime Department	Confirmed no records of unlicensed landfills within 2km of the proposed development.	9.76
DAERA	NIEA Water Management Unit	Conducted a search of the groundwater monitoring database and found there are 2 no. groundwater abstraction points within the search area. Provided water quality data and River Waterbody Class (2018) for waterbodies within 5km the proposed development. WMU also noted that all the information requested (except for groundwater quality), is available on the new Water Information Request Viewer.	9.99 and 9.146
Department for Infrastructure	Rivers	Confirmed there are no designated watercourses or culverts under the terms of the Drainage (Northern Ireland) Order 1973 within or bounding the site. Stated there may be undesignated rivers about which DfI Rivers is unaware. Confirmed the DfI had no record of any historical flood calls at the location of the proposed development. In relation to PPS15 (revised), DfI highlighted the following: **FLD 1** – DfI Rivers Flood Maps (NI) show the site is affected by numerous watercourses which are not modelled. Taking the precautionary approach embodied within PPS 15, DfI Rivers PAMU recommends that the applicant's agent establishes a Q100 level of all the undesignated watercourses within the site. For design purposes all finished levels should be placed at a minimum of 600mm above the appropriate Q100 fluvial flood + Climate Change levels. **FLD 2** – The site is affected by numerous watercourses. Where a new development proposal is located beside watercourse it is essential that an adjacent working strip is retained to facilitate future maintenance. The working strip should have a minimum width of 5 metres, but up to 10 metres where considered necessary, and be provided with clear access and egress at all times. **FLD 3** – DfI Rivers advises that in accordance with the Revised PPS 15, Planning and Flood Risk, FLD 3, Development and Surface Water (Pluvial) Flood Risk outside Flood Plains, a Drainage Assessment is required because: • It is a development in excess of 1 hectare • It is a change of use involving new buildings and or hard standing exceeding 1000 square metres • Surface water run-off from the development may adversely impact other development or features. If the proposal is to discharge into a watercourse, then an application should be made to the local DfI Rivers	9.157 to 9.164 (Refer to Appendix 9.2 Flood Risk and Drainage Assessment)

Consultees		Summary of Response	Addressed in Assessment
		office for consent to discharge storm water under Schedule 6 of the Drainage (NI) Order 1973.	
Department for Economy	Geological Survey of Northern Ireland (GSNI)	GSNI database search identified numerous mine workings associated Cullinane mine in proximity to the development site. Details on the mine working were provided. Provided guidance on working near abandoned mines. Recommended that a Mine Risk Assessment should be carried out as well as a landslide risk assessment as part of any planning proposal. Confirmed that mineral prospecting licences in the area have been relinquished.	9.77 to 9.79 Mine Risk Assessment included as part of Appendix 9.3.2.
NIEA	Water Management Unit – Pollution Prevention Team	Pollution Prevention Team provided general information in relation to pollution prevention. Recommends all necessary source control and mitigation measures to prevent pollution of the water environment during construction, operational or maintenance phase of a project are identified and employed. Highly recommends the relevant PPGs and GPPs are identified, and their precepts adhered to, in particular PPG5 and PPG6. Recommends the NIEA Pollution Prevent Team be consulted about any work, to be conducted in or near a waterway, or liable to affect any waterway, to agree a Method Statement with contractors (8 weeks) prior to the commencement of any works. Risks to the water environment, potential pollution pathways, best practices principles and mitigation measures to minimise risks should be identified, incorporated in contractors' Method Statements and be in place prior to the commencement of any works. Provided examples of mitigation measures; Construction phase site drainage plans should be considered at an early, to ensure site water is minimised (e.g. utilising cut off channels) collected, channelled and treated prior to discharge. Water should be collected in cut of drains and check dams and channelled to settlement features (built and maintained according to industry bet practice) for treatment of suspended solids prior to discharge. Phased stripping and minimisation of exposed land to control suspended solid generation should be considered. Use of settlement systems for settlement of suspended solids from site drainage. These should be built and maintained according to industry best practice. Any works in a waterway must be conducted 'in the dry' e.g., behind coffer dams, use of over pumping, the use of temporary diversions etc. The NIEA Pollution Prevention Team do not permit machinery to enter any waterway at any time. NIEA must be consulted prior to commencement of any such works to ensure	9.255 to 9.262

Consultees		Summary of Response	Addressed in Assessment
		appropriate mitigation measures are in place. The Pollution Prevention Team work with contractors to ensure minimal disturbance and generation of suspended solids during the placement and removal of cofferdams/diversions etc. The NIEA do not encourage in stream settlement as a primary mitigation measure, the contractor must strive to ensure the generation of suspended solids is prevented/ minimised in the first instance. The use of downstream settlement measures is considered a secondary line of protection. Management and maintenance of mitigation measures to ensure effective functioning. Prevent pollution by fuel/oil, from leaking machinery, there must be regular inspections of machinery working near any waterway. Safe refuelling, handling and storage practices for earth stockpiles and secondary containment for chemicals, oil, fuels etc. Compliance with the requirements of Control of Pollution (Oil Storage) Regulations (NI) 2010. Emergency spill procedures should be addressed Highlights requirements of the Control of Pollution (Oil Storage) Regulations, the primary requirement being secondary containment must be provided for oil stored in above ground containers over 200L with 110% capacity.	

9.36 A copy of consultee responses is included in **Technical Appendix 9.4**.

Assessment Methodology

Baseline Characterisation

9.37 This qualitative assessment has been undertaken based on experienced professional judgement and assessment of compliance with statutory and industry guidance, including site visits for verification.

Study Area

9.38 Potential effects were considered within the ‘survey boundary’ (refer to para.9.10) within which the planning application boundary lies (hereafter referred to as the ‘Site’), and the wider geological and hydrogeological setting of the area.

9.39 The hydrological study area includes surface water catchments draining the area within the Site and the downstream river reaches affected by this area as defined by the relevant River Basin Management Plans, Local Management Areas (LMAs) and Catchment Stakeholder Groups.

9.40 The hydrogeological and geological study area extends to the underlying aquifer catchments and extents of the geological units.

Additional Areas Considered

9.41 Consideration has been given to potential likely significant effects in respect of the proposed turbine delivery route and access route. Details of the work comprising junction widening, passing bays and general road widening, and potential effects on the geology and water environment are summarised within **Chapter 11: Transport & Traffic**.

9.42 A potential grid connection route is described within **Technical Appendix 2.1: Assessment of Potential Grid Connection**. Although the grid route is not part of the proposed development consideration has been given to potential likely significant effects.

Desk Study

9.43 The desktop study involved collation and assessment of the relevant information from the following sources:

- Close scale Ordnance Survey mapping in addition to aerial photography to assess land use and environs and to identify water features and watercourse catchments;
- Local authority and regulatory body consultation responses;
- NIEA river quality data and natural heritage data;
- DfI Rivers Flood Maps NI;
- NIEA Drinking Water Inspectorate and Water Management Unit data;
- Review of CEH Flood Estimation Handbook (web portal) for details of river catchment data;
- Review of Inland Fisheries information;
- Review of detailed site topographic survey;
- GSNI GeoIndex (1:10,000 bedrock and superficial geology maps);
- GSNI GeoIndex (aquifers and aquifer vulnerability);
- GSNI GeoRecords database;
- General Soil Type Map of Northern Ireland at 1:250 000 scale;
- NIEA Groundwater quality data and abstractions / discharges database; and
- NIEA Drinking Water Inspectorate and Water Management Unit data.

Determination of Sensitivity, Magnitude, Likelihood and Significance

9.44 This assessment determines the nature, scale and significance of the effects of the proposed development on the baseline (current) scenario in accordance with a methodology stated within The Institute of Environmental Management and Assessment guidance[1].

9.45 The potential impact significance is defined by the combination of the sensitivity of the receptor and the magnitude of the effect. Following this, an overall impact significance

[1] Institute of Environmental Management and Assessment (2004) Guidelines for Environmental Impact Assessment.

is determined by considering the potential impact significance and the likelihood of the effect occurring.

Sensitivity Criteria

9.46 The scale and sensitivity of the receiving environment (receptor) has been categorised on a scale of "Very High" to "Low". The sensitivity criteria used for this assessment are presented in **Table 9.3** and are based on:

- Vulnerability of a receptor to a particular pressure (degree of environmental response to any particular effect); and
- The importance or 'value' of the receptor e.g. an area of international importance should be considered more sensitive to effect than a local area of little or no conservation value.

Table 9.3: Evaluation of Hydrological / Hydrogeological Receptor Sensitivity Criteria

Scale / Sensitivity of the Environment (Receptor)		
International and / or Very High	Attribute has a very high quality / rarity at an international scale.	Important on a European or global level, e.g. Ramsar Sites, SAC, SPA and Habitats Directive Sites with dependence on the water environment.
National and / or High	Attribute has a high quality and rarity at a national scale.	Important in Northern Ireland, e.g. ASSI or National Nature Reserve (NNR) with respect to the hydrological / geological environment. WFD classification of 'High' with the watercourse providing a nationally important resource or supporting river ecosystem. Public water supplies and highly productive aquifers or local water supplies, including private water supplies where there is no alternative to private supplies. Principal aquifer providing a nationally important resource. Source Protection Zone 2 (Outer Source Protection Zone).

Scale / Sensitivity of the Environment (Receptor)		
Regional and / or Medium	Attribute has a medium quality and rarity at a regional scale.	Important in the context of the region, e.g. catchment scale issues, main river within the catchment, local Nature Reserves or Sites of Local Importance for Nature Conservation (SLNCI), designated geological features considered important for their educational, research, historic or aesthetic importance. WFD classification of 'Good' with the watercourse providing an important resource or supporting river ecosystem or upstream of a designated fishery. Active floodplain area. Designated fishery, catchment regionally important for fisheries. Domestic private water supplies located within vicinity of mains water supply or private water supplies used only for agricultural purposes and not drinking water. Surface and groundwater dependent terrestrial ecosystems in hydraulic continuity with the Site. Principal aquifer providing a regionally important resource e.g., industrial use with limited connection to surface water. Source Protection Zone 3 (catchment of groundwater source).
Local and / or Low	Attribute has a low quality and rarity at a local scale.	WFD classification of 'Moderate' or less with the watercourse providing a locally important resource or supporting river ecosystem. Geological features not currently identified as ASSI, ESCR that may require protection in the future. Domestic private water supplies located within vicinity of mains water supply or private water supplies used only for agricultural purposes and not drinking water. Surface or groundwater dependent terrestrial ecosystems in hydraulic continuity with the Site. Aquifer providing a locally important resource e.g. For agricultural or small-domestic supplies.

Magnitude of Effect

9.47 The magnitude of change / effect is influenced by the timing, scale, size and duration of the hazardous effect; magnitude has been categorised on a scale of “High” to “Low”; defined in **Table 9.4**.

Table 9.4: Evaluation of Magnitude of Effect Criteria

Magnitude of Effect / Description		Definition of Criteria	
High	Fundamental change resulting in loss of an attribute and /or the	Water Quality	Potential high risk of pollution to surface water changing water quality status.

Magnitude of Effect / Description		Definition of Criteria	
	quality and integrity of conditions.	Water Supply	Loss of local water supply or change in quality with respect to drinking water standards (DWS).
		Flood Risk / Erosion Potential	Significant increase in risk due to a significant change in the proportion of hard standing and altered surface water flows.
		Groundwater	Significant change in groundwater levels, flow regime, groundwater quality or extensive change to an aquifer.
		Surface and Groundwater Dependent Ecosystem	Loss of or extensive change to a surface or groundwater dependent ecosystem or fishery.
		Geology and Soils	Partial (greater than 50%) or total loss of a geological site or mineral deposit. Major or total loss of topsoil, soils or peatland.
Medium	Detectable change to conditions resulting in non-fundamental temporary or permanent consequential changes.	Water Quality	Potential medium risk of pollution to surface water, changing water quality status.
		Water Supply	Temporary loss of local water supply or minor change in quality of supply with respect to drinking water standards.
		Flood Risk / Erosion Potential	Detectable increase in flood risk and erosion potential due to a medium change in the proportion of hardstanding and altered surface water flows.
		Groundwater	Measurable change in groundwater levels, groundwater flow regime, groundwater quality or identifiable change to an aquifer.
		Surface and Groundwater Dependent Ecosystem	Partial loss or change to a surface or groundwater dependent ecosystem or fishery.
		Geology and Soils	Partial loss of topsoil, soils or peatland, or where the value of the area would be affected, but not to a major degree

Magnitude of Effect / Description		Definition of Criteria	
Low	Results in minor effect on attribute of insufficient magnitude to affect the use or integrity.	Water Quality	Minor deterioration in water quality unlikely to affect the most sensitive receptor or insignificant change in water quality conditions not exceeding those expected due to naturally occurring fluctuations.
		Water Supply	Minor change in pressure or flow to local water supply or minor change in quality of supply with respect to drinking water standards.
		Flood Risk / Erosion Potential	Minor changes in the proportion of hardstanding and altered surface water flows result in no detectable increase in flood risk and erosion potential.
		Groundwater	Any measurable change in groundwater levels that does not affect groundwater flow regime, groundwater quality with regards to DWS or result in any change to an aquifer.
		Surface and Groundwater Dependent Ecosystem	Any measurable change to a surface or groundwater water dependent ecosystem or fishery.
		Geology and Soils	Small effect on a geological/ geodiversity site or mineral deposit (up to 15%). Partial loss of topsoil, soils or peatland, or where soils will be disturbed but the value of the area would not be affected.
Negligible	Results in negligible effect on attribute	Water Quality	No perceptible change in water quality.
		Water Supply	No change in pressure or flow to local water supply and negligible change in quality of supply with respect to drinking water standards.
		Flood Risk / Erosion Potential	No measurable change in the proportion of hardstanding and altered surface water flows result in no detectable increase in flood risk and erosion potential.

Magnitude of Effect / Description		Definition of Criteria	
		Groundwater	No measurable change in groundwater levels, groundwater flow regime, groundwater quality with regards to DWS. No change to an aquifer.
		Surface and Groundwater Dependent Ecosystem	No measurable change to a surface or groundwater water dependent ecosystem or fishery.
		Geology and Soils	Very slight change from geological, mineral and soil baseline conditions

Impact Significance Criteria

9.48 The magnitude of effect and receptor sensitivity are combined to evaluate and qualify if an impact is of high, moderate, low or negligible significance as outlined in **Table 9.5.**

Table 9.5: Evaluation of Potential Effect Significance

Scale / Sensitivity of the Environment (Receptor)	Magnitude of Effect			
	Negligible	Low	Medium	High
International / Very High	Moderate	Moderate	High	High
National / High	Low	Moderate	Moderate	High
Regional / Medium	Negligible	Low	Moderate	Moderate
Local / Low	Negligible	Negligible	Low	Low

Likelihood of Occurrence Criteria

9.49 The likelihood of the potential effects occurring is assessed based on historical data, quantitative analysis and professional judgement based on relevant experience as shown in **Table 9.6.**

Table 9.6: Evaluation of Likelihood of Occurrence

Likelihood of occurrence	Criteria
Certain	Likely consequential effect in medium term and inevitable in long term (within the life of the development).
Likely	Possible consequential effect in the medium term and likely but not inevitable in the long term.
Unlikely	Unlikely that any consequential effect would arise within the lifetime of the development.
Rare	It is unlikely that any consequence would ever arise.

Determination of Overall Impact Significance

9.50 Potential Impact Significance (**Table 9.5)** and Likelihood of Occurrence (

9.51 Table 9.6) are combined to determine an Overall Impact Significance as shown in the matrix in **Table 9.7**.

Table 9.7: Evaluation of Overall Significance

Potential Significance	Likelihood of Occurrence			
	Rare	Unlikely	Likely	Certain
High	Minor	Moderate	Major	Major
Moderate	Minor	Minor	Moderate	Major
Low	Not Significant	Minor	Minor	Moderate
Negligible	Not Significant	Not Significant	Minor	Moderate

Site Characteristics & Baseline Conditions

Site Description

9.52 The proposed development is located c. 2 km south-west from the village of Carnlough, Co. Antrim. Glenarm is c 3.8 km to the east and Ballymena c. 14 km to the south-west of the Site. The survey boundary has an area of approximately 7.77 km^2 (777 ha); the application Site has a total area of approximately 2.08 km^2 (208 ha).

Topography

9.53 The topography of the Site predominately falls from north to south and east. From a maximum height of c. 340 m OD at the summit of Binnagee, the fall in gradient through the central section of the Site towards Slane Road in the south is gradual. The decrease in height to 167 m OD at Slane Road occurs over c. 5.6 km. The fall in gradient to the east is steeper with a low point of c. 121 m OD on Ballymena Road located c. 2.4 km from the Binnagee summit. The central section is notably flat with the 'bowl' effect of the surrounding higher ground creating a wide boggy area – this area is shown on OSNI mapping as Currigvohil Loughs.

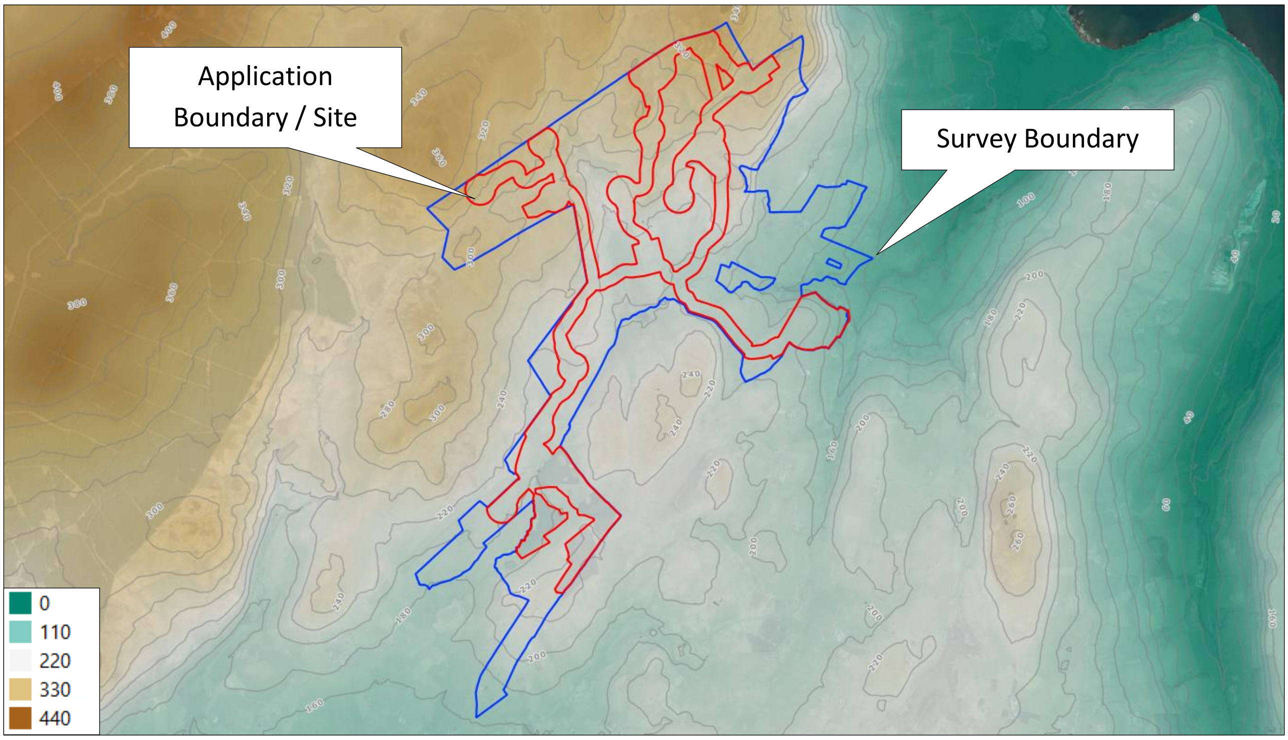
Land Cover

9.54 The northern-most part of the Site consists of a gently undulating upland plateau which descends into improved agricultural fields to the east in close proximity to the A42 Carnlough/Ballymena Road, and to swathes of semi-improved wet grasslands and coniferous forestry blocks to the south. The central part of the Site lies on the fringes of an upland lake which supports a wide fringe of sedge fen, wet heath and mire habitats.

9.55 The higher elevation areas in the northern-most part of the Site are dominated by a complex mosaic of wet heath, mire, rush-pasture and acid grassland habitats which vary according to variations in peat depth, slope, aspect, local topography and a combination of both past and current grazing pressure.

9.56 Peat is noted throughout the survey boundary. The NIEA Natural Environmental Map Viewer classifies these discrete areas within as ‘Priority Habitats’. Further detail is provided in Chapter 6: Ecology.

Plate 9-1: Topography



Meteorological Data Summary

9.57 The Standard Percentage Runoff (SPR) is a parameter used in runoff and flood estimation, which represents the percentage of total rainfall likely to contribute to direct runoff and storm flow. Review of the Site in relation to FEH catchment descriptors indicates a SPR of between 42 and 48.5%. For context, SPR values in the UK range from 2% (sand or chalk with slow response / low runoff) to a maximum of 60% (peat bog with rapid response / high runoff).

9.58 Rainfall data from the Killylane climate station[2] (approx. 16 km south-west from the proposed development) recorded an annual average rainfall total of 1330 mm during the 1981 – 2010 climatic period. Based on the Meteorological Office banding of annual average rainfall (1981 – 2010), rainfall in the vicinity of the Site is within the fourth

[2] Met Office, Killylane Climate. Available at https://www.metoffice.gov.uk/public/weather/climate/gcg9gvrs8 (Accessed 20/10/2021).

highest of nine bands (1250 – 1500 mm) and is typical for elevated regions in Northern Ireland.

Geology

Agricultural Land Classification

9.59 DAERA published a classification index for Agricultural Land Classification (ALC) in 1997 based on a document "Agricultural Land Classification of England and Wales" published by the Ministry of Agriculture and Fisheries and Food (now Department for Environment, Food and Rural Affairs)[3] in 1988. The index classifies agricultural land into five grades based on climate, topography, soil, slope and altitude characteristics; with Grade 1 excellent quality and Grade 5 very poor quality.

9.60 Using the guidance from the ALC of England and Wales, along with available site information including site walkover observations and gradients the land the most suitable land classification for the Site ranges from Grade 3b – 'moderate quality agricultural land' for the majority of the Site and Grade 4 – 'poor quality agricultural land', in the central and northern areas of the Site.

9.61 The loss or partial loss of agricultural function on the Site is therefore not significant and does not inform constraints to development.

Soil Conditions

9.62 The Soil Map for N. Ireland (World Reference Base Classification)[4] classifies the soil cover across the majority of the Site as 'Leptosols', which are a very shallow soil which have an inability to hold water.

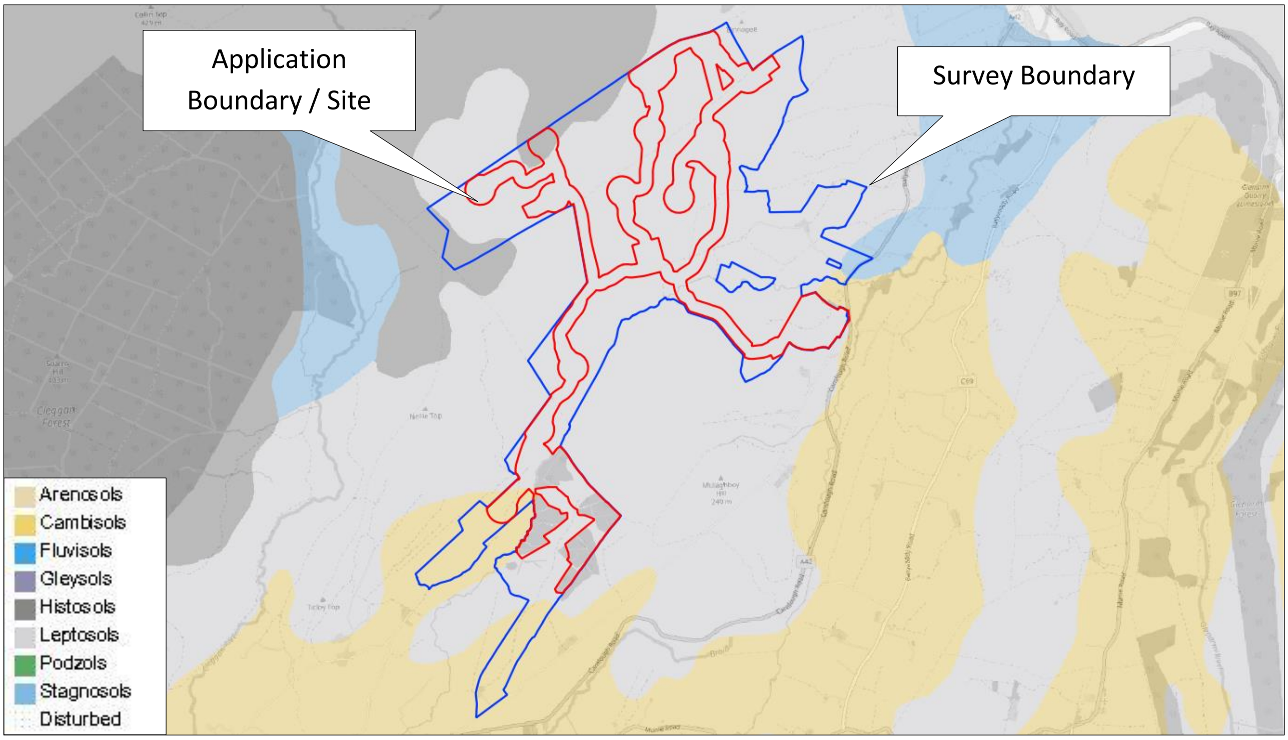
9.63 A small area around the eastern periphery of the Site is classified as 'Stagnosols'. Stagnosols comprise of very poorly draining clay soils, they are developed on unconsolidated materials, such as glacial till and alluvial deposits, due to stagnating water and poor drainage. For use of agricultural purposes, this soil type requires drainage channels.

9.64 In the southern and south-western section of the survey boundary, the underlying soils are classed as 'Cambisols'; their aggregate structure and high content of weatherable minerals means they usually can be exploited for agriculture dependent on terrain and climate.

3 Ministry of Agriculture, Fisheries and Food: Agricultural Land Classification of England and Wales (1988) http://publications.naturalengland.org.uk/file/5526580165083136

4 http://mapapps2.bgs.ac.uk/ukso/home.html?layer=AFBIWRB

Plate 9-2: Soils

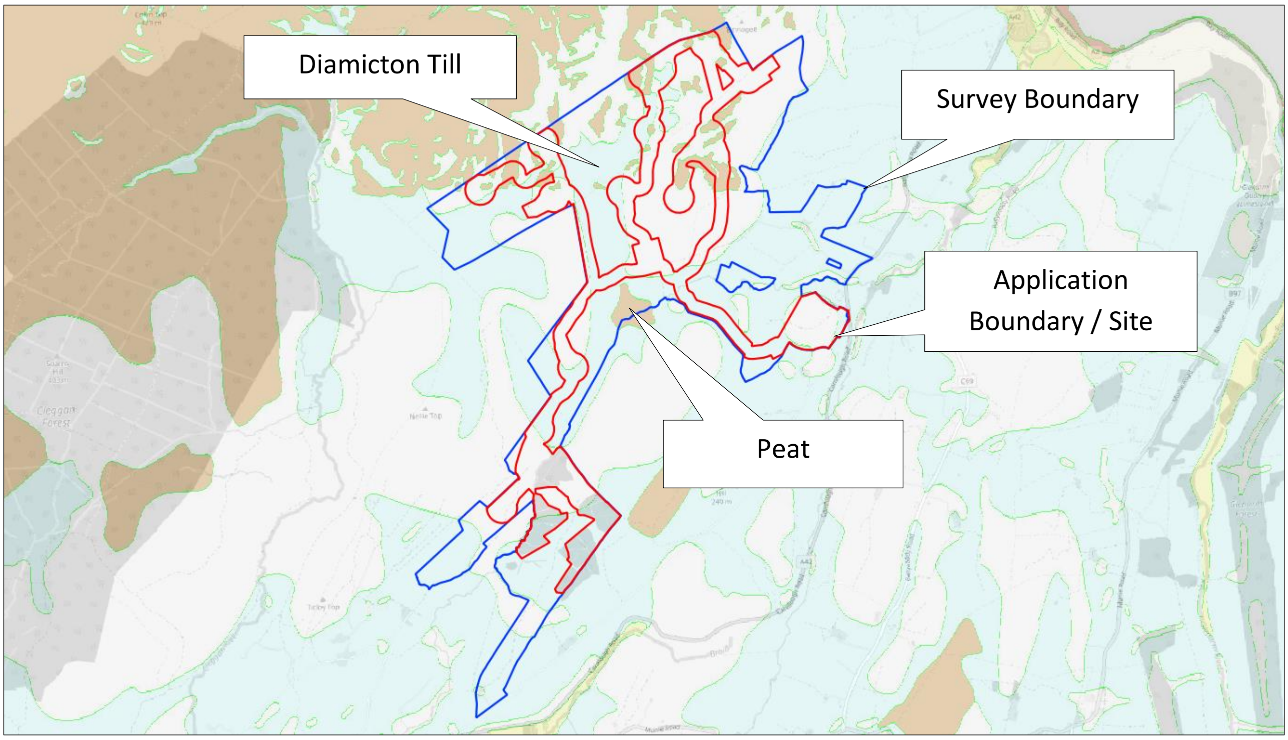


Superficial Deposits

9.65 The Site has been reviewed in relation to the 1:10,000 mapping available from the GSNI GeoIndex WMS layers.

9.66 The majority of the Site is underlain by diamicton till comprising materials ranging from clay to large boulders and is generally poorly sorted and undifferentiated. GSNI mapping also indicates discrete areas of peat throughout the study area.

Plate 9-3: Superficial Deposits based on GSNI 10K Datasets

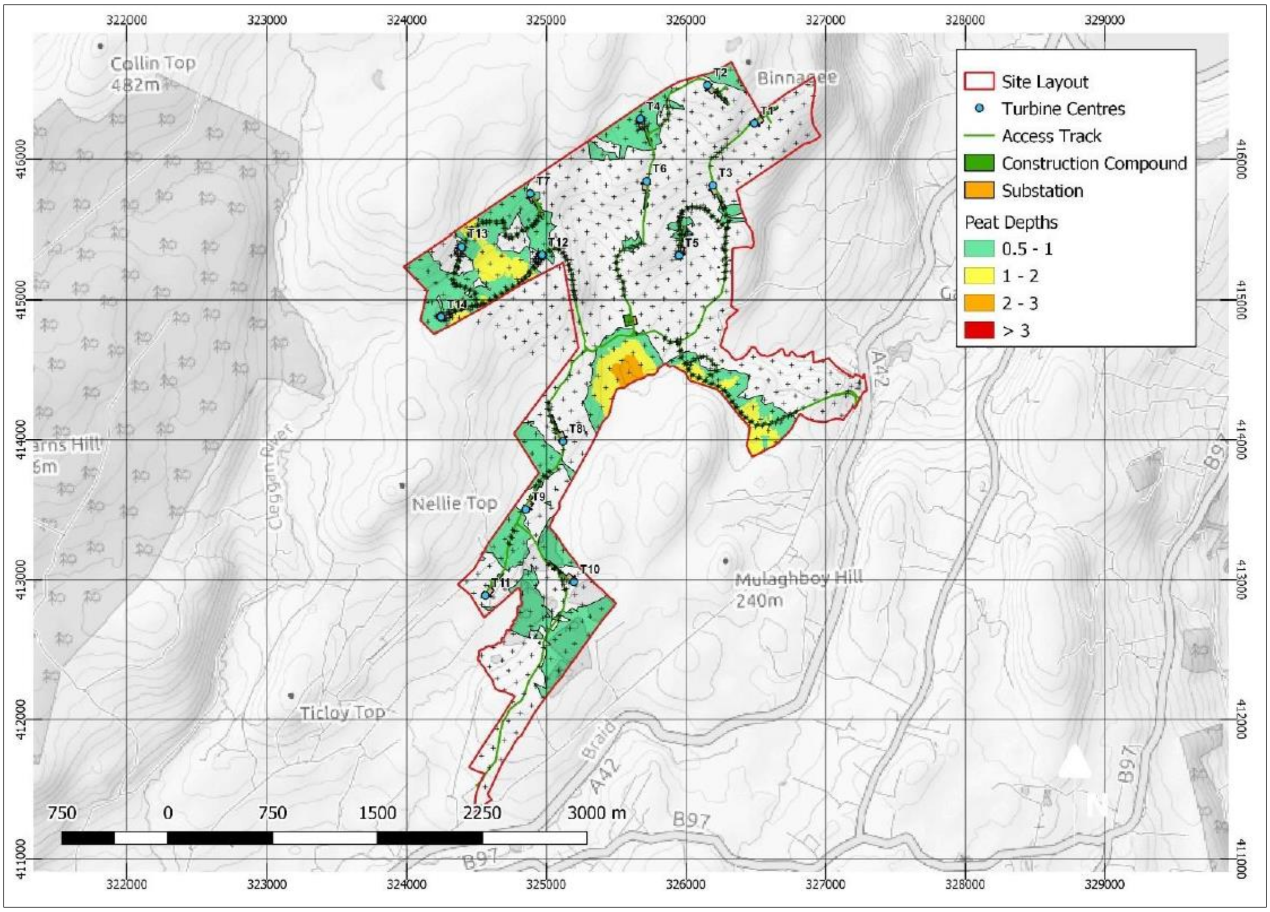


Peat

9.67 The presence of peat coverage is initially identified by GSNI 1:10,000 mapping (shown on Plate 9-3) and the NIEA Natural Environment Map Viewer, both of which indicate peat coverage within the Site. A Phase 2 Peat Slide Risk Assessment (PSRA) has been produced by a 3rd party for the applicant and is included in **Appendix 9.3.1** and the findings of that intrusive investigation take precedent over desktop sources in relation to peat coverage at the Site.

9.68 The PSRA confirmed much of the Site to have no peat accumulations. Where peat is present, an interpolated peat depth map of all 1,195 soil probes collected during the peat survey is shown on **Plate 9-4** below. The deepest recorded areas of peat are in excess of 5.0m, these are in localised pockets and avoided by any proposed windfarm infrastructure. The Stage 2 PSRA is included in **Appendix 9.3.1**.

Plate 9-4: Peat Depth (excerpt from PSRA – Appendix 9.3.1)



Bedrock Geology

9.69 The bedrock geology of the Site has been reviewed in relation to the 1:10,000 mapping available from the GSNI GeoIndex WMS layers. The entire Site is underlain by Upper and Lower Basalt Formations with a seam of Interbasaltic Formation recorded at the eastern and north-eastern extents of the Site boundary. Further detail is provided in the Stage 2 PSRA included as **Appendix 9.3.1**.

Exposed Bedrock

9.70 Site walkovers identified a small area (c. 150 m^2) of exposed bedrock though the area is noted to be 175 m west of both the Site and survey boundaries.

Faults

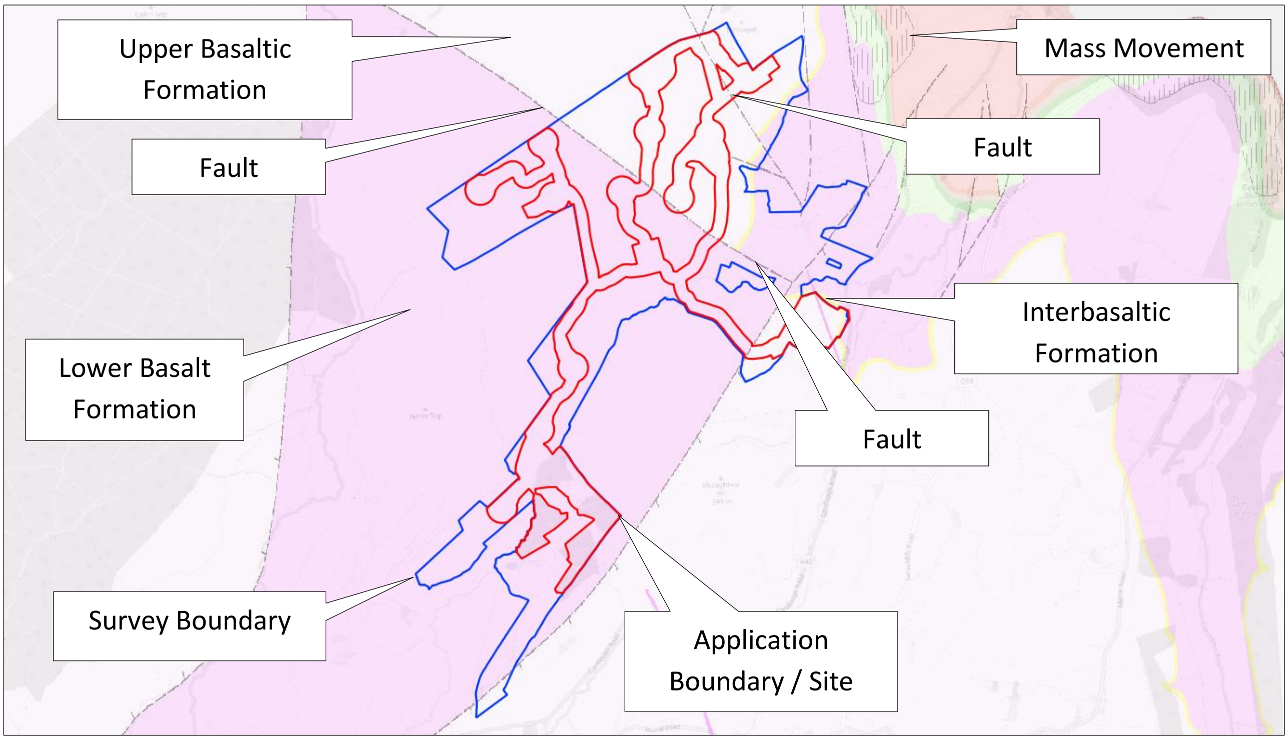
9.71 BGS data mapping identifies three faults within the Site boundary; two marking the boundary between the Lower and Upper Basalt Formations; and one orientated in a south-east to north-west east direction through the Upper Basalt Formation at the north of the Site.

9.72 The locations of large regional fault systems are *inferred* from the BGS mapping. Their presence is noted in the Geotechnical Assessment (Appendix 9.3.1); however, they are not considered further as a source of potential local ground instability.

Mass Movement

9.73 A review of the 1:10,000 mapping on the GSNI GeoIndex indicates the steep lands to the northeast of the Site near Carnlough have historically been affected by landslip. The area is shown to be c. 400 m from the north-eastern extent of the Site. Its presence is noted in the Geotechnical Assessment (Appendix 9.3.1); however, it is not considered further as a source of potential local ground instability.

Plate 9-5: Solid Geology



Radon

9.74 The UK interactive radon map, based on the Indicative Atlas of Radon in Northern Ireland, indicates a portion of the Site is subject to elevated radon potential. In the north-eastern section of the Site the maximum radon potential is 1-3 %, i.e., this is the percentage of homes above the action level[5].

[5] Government recommendations state that radon levels should be reduced in buildings where the average is more than 200 becquerels per metre cubed (200 Bq m-3). The 'action level' refers to the annual average radon concentration in a building.

Waste and Minerals

Waste Site Licence Exemptions and Sites

9.75 NIEA datasets informed of no waste sites situated within 1 km of the Site.

Landfills

9.76 A review of the opensource NIEA authorised landfill sites dataset does not identify any features within 1 km of the proposed application Site.

9.77 An information request made to the DAERA Environmental Crime Department confirmed the department is not aware of any unlicensed landfills within 2 km of the Site.

Historic Quarries / Mines

9.78 A review of GSNI Historic Mine Workings (Group) dataset identified a number of shafts and adits[6] along the eastern extent of the survey boundary. Further information was sought from GSNI Minerals Branch during consultation who provided a layout of historic mine workings in the vicinity of the Site based on historic mapping.

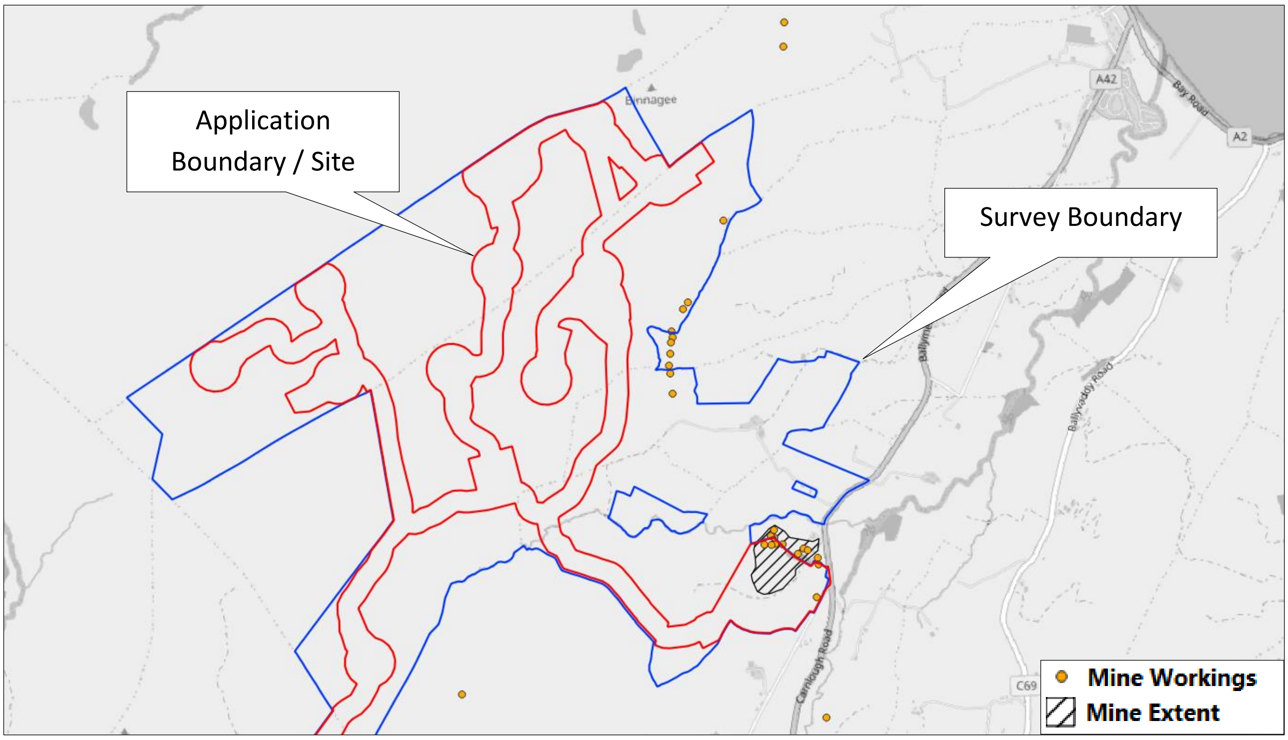
9.79 GSNI advised that the mine workings in this location were associated with Cullinane Mine and that the mine workings were shallow; however, a mine risk assessment (MRA) should be carried out for the proposed development.

9.80 The MRA has been produced by a 3rd party for the applicant and is included in **Appendix 9.3.2.** It has assigned a risk rating to each element of the proposed development infrastructure (i.e., turbines, access tracks). It concludes that each has a 'negligible' or 'very low' risk throughout the Site. Only the access track from Ballymena Road into the Site has been assigned a low' risk rating due to it passing within 20m of the expected underground extents of the Cullinane Mine.

9.81 The MRA concludes that the presence of these possible underground workings in the vicinity of the access track should be considered further during the detailed site investigation (post-consent).

[6] A horizontal passage leading into a mine for the purposes of access or drainage

Plate 9-6: Historic Abandoned Mine Workings



Historic Land Uses

9.83 A review of DAERA WMU historical land use datasets identified two sites associated with historic metal mining and smelting (iron ore) within the eastern extent of the survey boundary.

9.84 As they are located down gradient, they are not considered to pose a potential impact to, or be affected by, the proposed development.

Active Quarries

9.85 Consultation of the GSNI GeoIndex (records from 2000) lists no active quarries within 1 km of the survey boundary.

Mineral Occurrences

9.86 Information available on the GSNI GeoIndex 'Mineral Occurrences (up to year 2000)' mapping shows 1 no. mineral occurrences c. 60 m to the east of the survey boundary close to Ballymena Road. The commodity is listed as 'Iron' with further comments indicting that 7 no. adits had been driven into the escarpment. As they are located down gradient, they are not considered to pose a potential impact to, or be affected by, the proposed development.

Mineral Licences

9.87 Consultation of the GSNI GeoIndex indicates that a large proportion of the Site is the is located within the boundaries of mineral prospecting licence Ref: LON3/14; Company: Lonmin NI.

9.88 During consultation, GSNI advised there is no longer any mineral prospecting licences active at the area and this licence has been relinquished. As such, there is no constraint to the proposed development associated with active mineral development.

Summary of Geohazards

Table 9.8: Summary of Identified Geohazards

Geohazard Type	Applicable to the Proposed Development?	Rationale / Potential Constraint	Consider Further?
Extractions	No	No active quarries were identified within 1 km from the Site.	No
Adit / Shafts (Mine Entries)	Yes	Located within the Site boundary. The Mine Risk Assessment (**Appendix 9.3.2**) reported that the turbine locations are not considered to be at risk of undergrounding mining beneath the turbine or crane hardstanding base. It recommends that further detailed site investigations should be carried out (post-consent) on the access track in the vicinity of Cullinane Mine.	No
Land Slip	No	GSNI holds records of an historical land slip c. 400 m from the north-eastern extent of the Site. None are recorded within the Site boundary.	No
Peat	Yes	There are discrete peat deposits within the Site boundary. The occurrence of peat is a potential constraint to development. The PSRA (**Appendix 9.3.1**) concludes that the deepest recorded areas of peat are in excess of 5.0m these are in localised pockets and avoided by any proposed windfarm infrastructure. The PSRA found that risk of run out and significant damage to the wider hydrological environmental is deemed low, provided the relevant control measures outlined in the PSRA are implemented at site. The wider geomorphological assessment and evidence from recorded peat depths would indicate that a large-scale translational mass movement of peat deposits is very unlikely.	No
Compressible Ground	Yes	Peat is present within the area of proposed turbines T4, T12, T13, and T14. The PRSA (**Appendix 9.3.1**) has assigned an overall 'low' risk at each location. The PSRA outlines key control measures which are required to ensure the risk of peat slide remains at residual (low) levels.	No
Landfill	No	There is no evidence (current or historic) of landfill presence within the Site boundary.	No
Karst Features	No	No recorded features within the vicinity of the Site.	No
Radon	Yes	The Site is within an area of low radon potential.	No

Hydrogeology

Aquifer Classifications

9.89 A review of the online data available on GSNI GeoIndex indicates the bedrock aquifer underlying the Site is classified as Bm(f), denoting it has moderate productivity and flow controlled by fracture networks within the rock with no intergranular flow[7].

9.90 The GSNI Groundwater Vulnerability Map indicates that groundwater at the Site has a classification of 5 (very high). The vulnerability mapping (informed by the 1:250,000 scale geological mapping) indicates the areas classed as 5 are absent of superficial deposits inferring the basalt bedrock is exposed.

9.91 The Site straddles two groundwater bodies. The northern section is located above the Glenariff Groundwater Body (UKGBNI4NE003) which has an overall WFD status (2020) of 'Good'. The overall status relates to both the quantitative and chemical (water quality) characteristics of the groundwater body. The southern section is located above the Ballymena Groundwater Body (UKGBNI4NB002) which has an overall WFD status (2020) of 'Poor'.

9.92 There are no superficial aquifers mapped within the Site boundary and there are not expected to be any unmapped potential aquifers present due to the absence of any superficial sand deposits within the boundary.

9.93 The nearest superficial aquifer is c. 2.1 km north-east of the Site at Carnlough, coinciding with the lower Glencloy River catchment.

Groundwater Recharge

9.94 Within the Site boundary most recharge will be direct where bedrock is at or close to surface. A proportion of recharge through overlying till deposits may also occur, especially where the deposits are thin.

9.95 The tertiary basalts underlying the main development are classified by the BGS as a locally important aquifer, with yields ranging from 0.5 to 20 l/s with typical rates around 5 to 10 l/s.

Groundwater Flow

9.96 Ground water movement in the tertiary basalts underlying the main development is confined to fractures within the rock, rather than intergranular flow. Discharge from the bedrock will mainly be to the local surface water network with potentially some limited discharge to the coast.

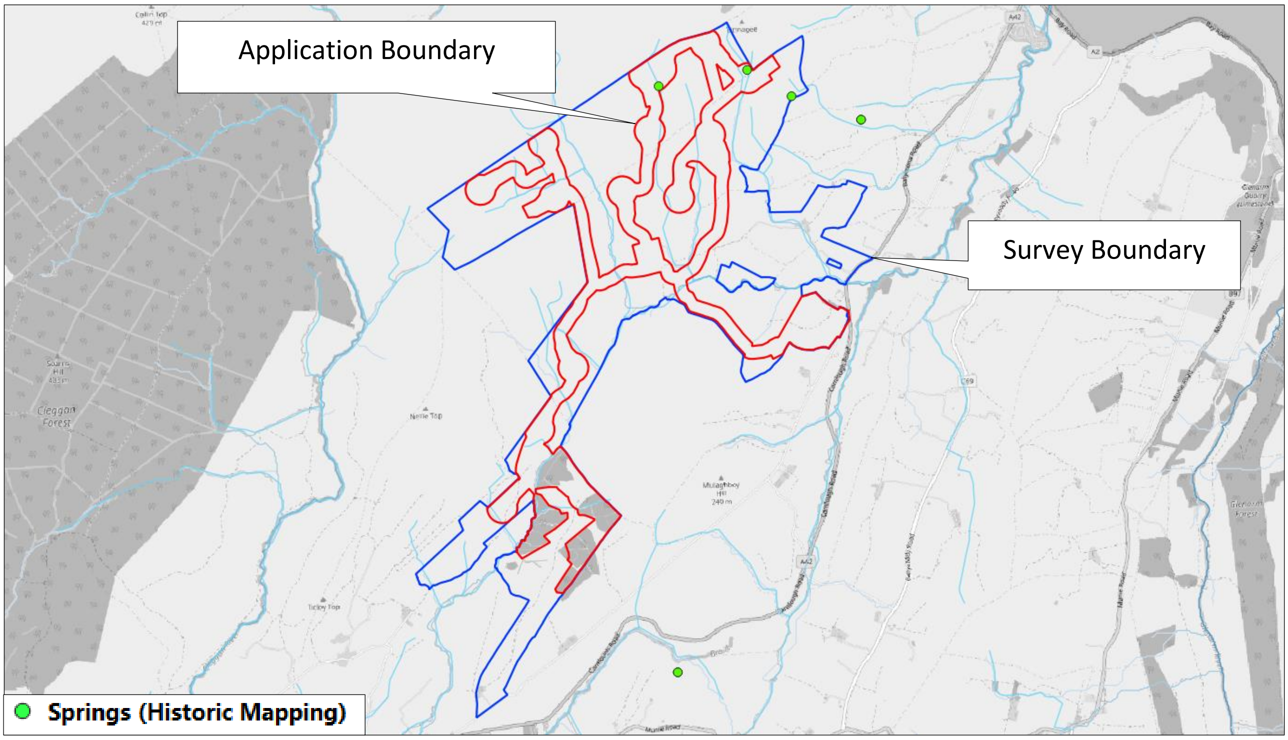
[7] Geological Survey Northern Ireland (2005) WFD Aquifer Classification Scheme for Northern Ireland. Available from https://www.daera-ni.gov.uk/

Springs / Wells

9.97 A review of the OSNI historical maps available from PRONI[8] and the Historical Map Viewer[9] indicated there are 3 no. historical springs within the Site boundary. These were found to coincide with the headwaters of minor watercourses (refer to para. 9.215) identified via OSNI mapping and verified during site walkovers. No wells were identified within the Site boundary.

9.98 GSNI do not hold records of any springs or wells within 1 km of the Site boundary.

Plate 9-7: Historic Springs identified from OSNI Historical First Edition (1832-1846)



Boreholes

9.99 GSNI and MEABC confirmed that they do not hold records of any water supply boreholes within 1 km of the Site boundary.

Groundwater Abstractions

9.100 In order to identify potential groundwater users, data was sought from a number of sources. Findings from this is summarised as follows:

- NIEA Water Management Unit carried out a search of the Groundwater Monitoring Database. In their response received 2nd April 2021, they provided information and data from a groundwater monitoring point 1.1 km north-east from the Site

[8] PRONI Historical Maps. Available from https://apps2.spatialni.gov.uk/EduSocial/PRONIApplication/index.html

[9] Department for Communities Historical Environment Map Viewer. Available from https://dfcgis.maps.arcgis.com/apps/webappviewer/index.html?id=6887ca0873b446e39d2f82c80c8a9337

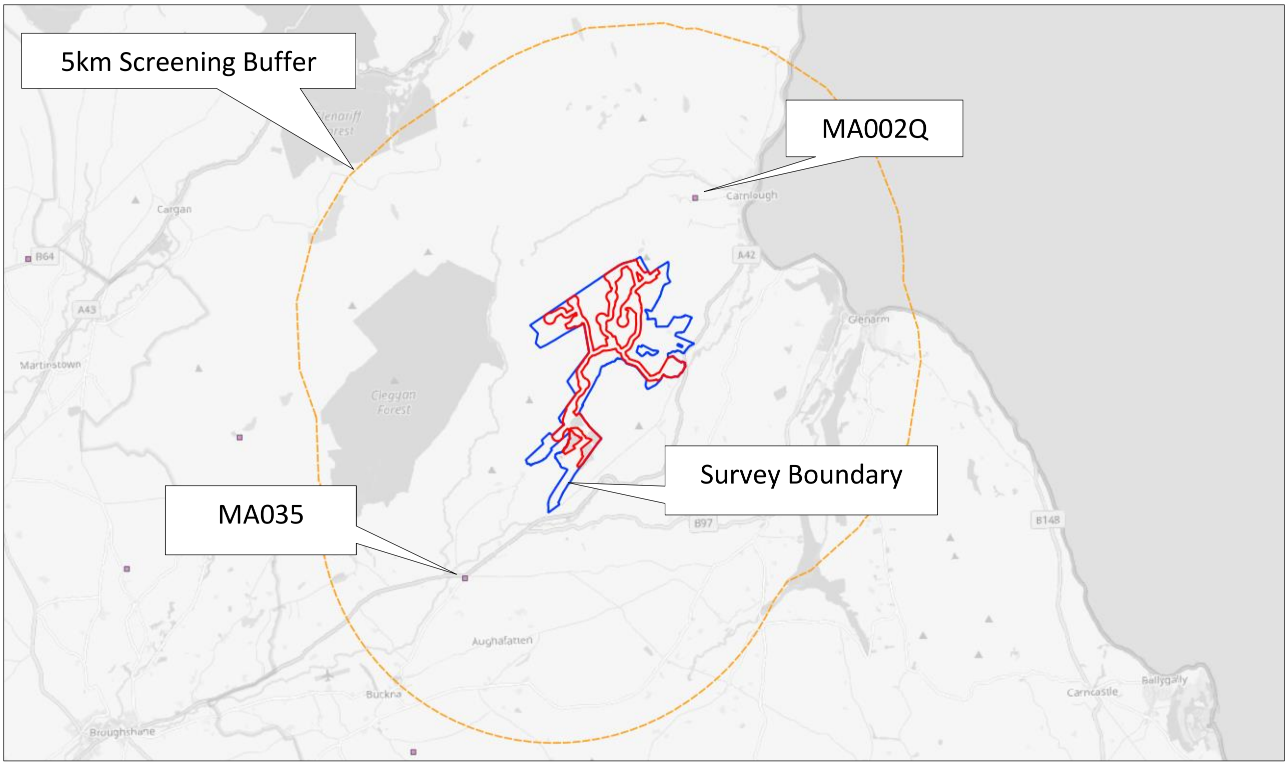
boundary (Bonnytober Spring) located near Carnlough. Their response is included in **Appendix 9.4**.

- Mid and East Antrim Borough Council (MEABC) was contacted with respect to information on private water supplies which supply single dwellings. In their consultation response received 4th May 2021, the Council advised there is one Private Water Supply located within the enquiry area surrounding the proposed development. The PWS was determined to lie c. 1.5 km north of the Site.

  It is considered that due to the distance, and the breaks in hydrological connection inferred by numerous surface water features between the Site and the single dwelling, the PWS could not feasibly be affected by works associated with the proposed development. Therefore, no further consideration is required within this assessment. The MEABC response is included in **Appendix 9.4**.
- NIEA Drinking Water Inspectorate (DWI) advised that their Private Water Supplies app be consulted to identify private drinking water supplies registered with the Inspectorate under the Private Water Supplies Regulations (Northern Ireland) 2017. A review of the app identified 2 no. within 5 km of the survey boundary. One (ref: MA002Q) was found to be the same PWS for which MEABC provided details in their consultation response. The second PWS (ref: MA035) is located at a property on Hazelbank Road (near the junction with Carnlough Road and Lisles Hill Road), approximately 2.3 km south-west from the survey boundary.

  As noted previously, it is considered unlikely that the PWS could feasibly be affected by works associated with the proposed development within the Site. PWS MA035 is located adjacent to the proposed grid connection route and is considered separately within **Technical Appendix 2.1: Assessment of Potential Grid Connection**. A copy of the DWI correspondence is included in **Appendix 9.4.**
- The DAERA Abstraction and Impoundment Licencing (AIL) information available on the Water Information Request Viewer was reviewed for licenced groundwater-fed abstractions in the vicinity of the Site. None were identified.

Plate 9-8: Drinking Water Inspectorate Recorded Water Supplies



9.101 In addition to identification of potential abstractions from records, the various consultees indicated that they do not hold a definitive database of individual properties served by a private water supply. In order to ensure a robust assessment, screening has been undertaken to identify properties potentially served by local, unrecorded water abstractions within the vicinity of the proposed development based on property and occupancy information determined by the applicant.

9.102 To a ensure a conservative assessment, a 500 m screening radius (i.e., 2 x NIEA Guidance) has been applied to the Site. Screened properties are shown on the following **Plate 9-9** and scheduled in **Table 9.9**.

Plate 9-9: Property Screening

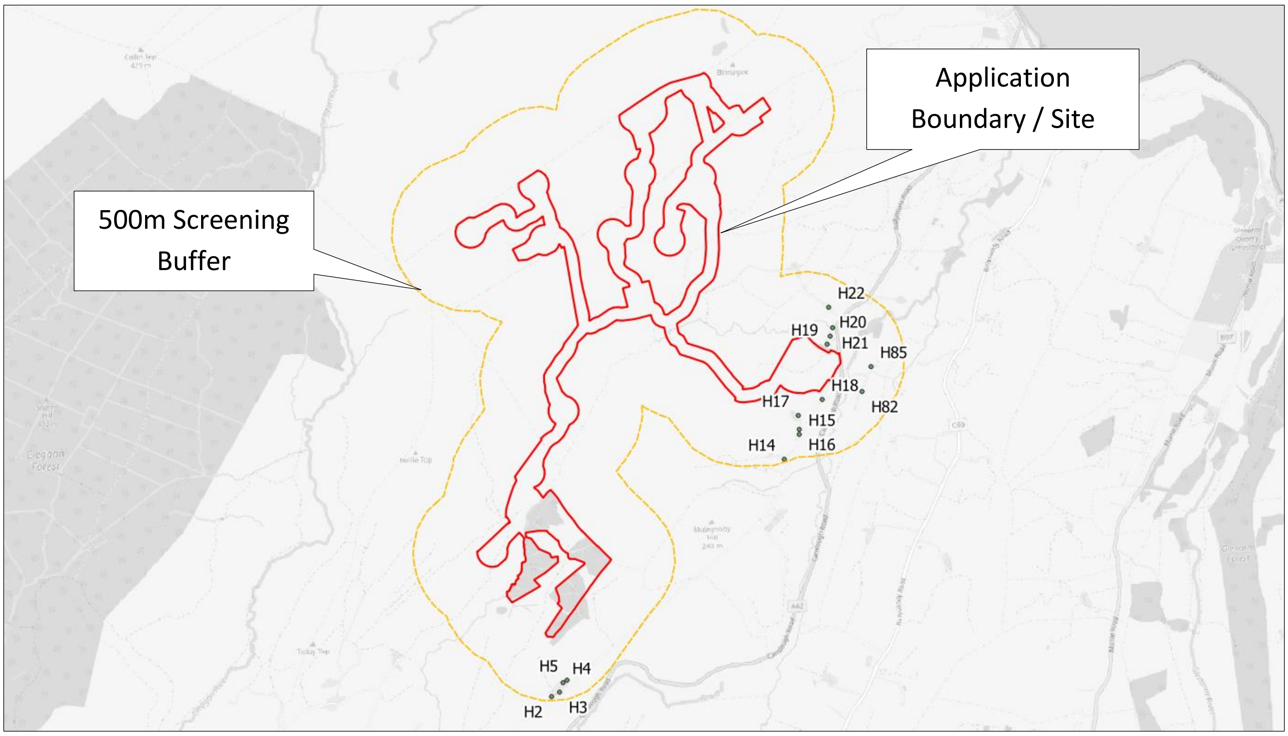


Table 9.9: Summary of Dwellings

Feature ID	Description	Significance and Rationale (for Scoping-out?)
H2	14 SLANE ROAD	NI Water main present, unlikely to rely on a private supply
H3	16 SLANE ROAD	NI Water main present, unlikely to rely on a private supply
H4	20 SLANE ROAD	NI Water main present, unlikely to rely on a private supply
H5	22 SLANE ROAD	NI Water main present, unlikely to rely on a private supply
H14	66 SLANE ROAD	NI Water main present, unlikely to rely on a private supply
H15	70 SLANE ROAD	NI Water main present, unlikely to rely on a private supply
H16	72A SLANE ROAD	NI Water main present, unlikely to rely on a private supply
H17	72 SLANE ROAD	NI Water main present, unlikely to rely on a private supply
H18	85 SLANE ROAD	NI Water main present, unlikely to rely on a private supply
H19	153 BALLYMENA ROAD	NI Water main present, unlikely to rely on a private supply
H20	149 BALLYMENA ROAD	NI Water main present, unlikely to rely on a private supply
H21	147A BALLYMENA ROAD	NI Water main present, unlikely to rely on a private supply
H22	147 BALLYMENA ROAD	NI Water main present, unlikely to rely on a private supply
H82	158 BALLYMENA ROAD	Not hydrologically connected to the proposed development site.
H85	154 BALLYMENA ROAD	Not hydrologically connected to the proposed development site.

9.103 The screening exercise confirms no additional properties downgradient from the Site that are likely to rely on private water supply abstractions; therefore, no private water supplies are likely to be affected by the proposed development.

Catchment Hydrology

Surface Water Bodies

9.104 DfI Rivers map of 'Designations approved by the Drainage Council (NI)' indicate there are no designated watercourses within the Site boundary. All watercourses within the application area are subject to riparian ownership and maintenance only.

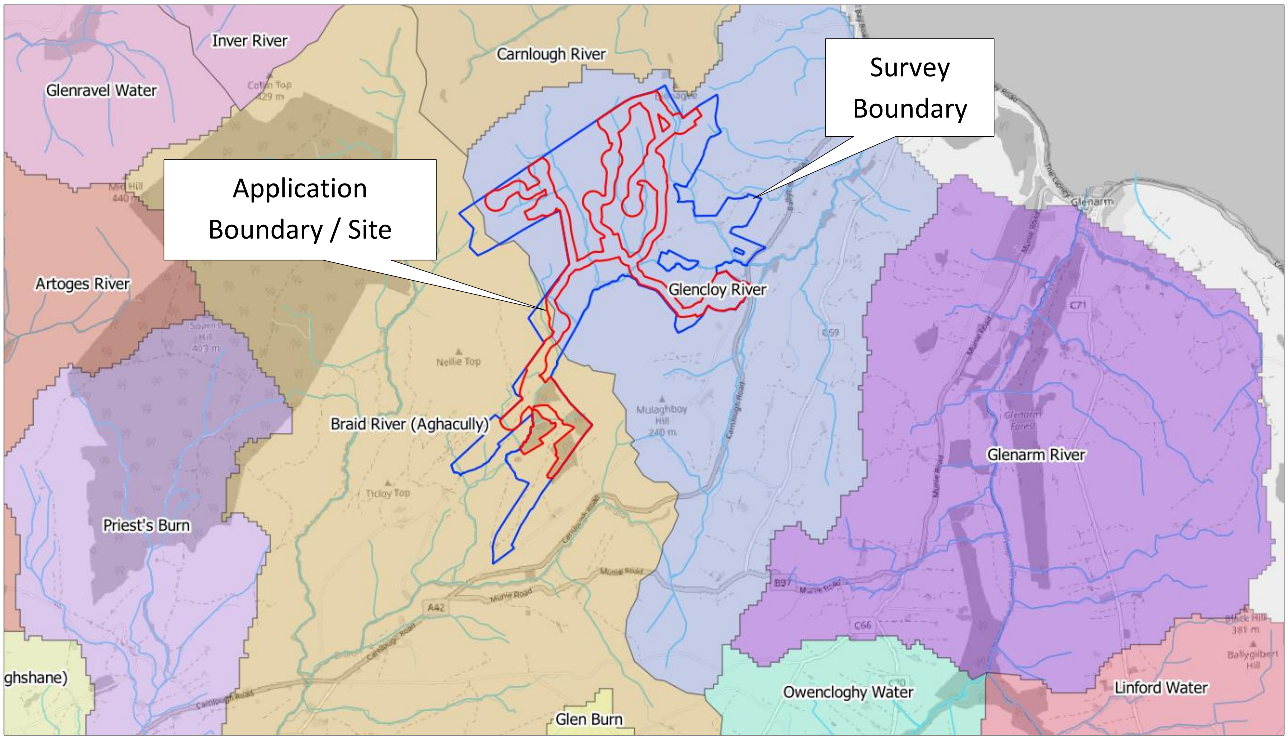
9.105 Site reconnaissance observations indicate that the current hydrology of the Site consists of a number of natural source watercourses and streams, and artificially modified drainage ditches and peat drains.

9.106 The hydrological regime of the Site and discharge locations of onsite watercourses as determined by desktop studies and site walkovers are shown on **Figure 9.1: Site Hydrology** (**included in Appendix 9.1**).

9.107 NIEA River Water Body dataset boundaries show the Site drains to two delineated and named waterbodies. The north of the Site drains to Glencloy River water body (UKGBNI1NE040403061) which has an area of 23 km^2, and the south of the Site drains via Tricloy Water to Braid River (Aghacully) (UKGBNI1NB030308214) which has an area of 35 km^2.

9.108 Desktop catchment analysis, terrain models, and ground truthing, verified that all water features flowing from the north eventually discharge to the North Channel (Irish Sea), whilst those in the south discharge to Braid River and ultimately the River Main into Lough Neagh.

Plate 9-10: Watersheds and NIEA Waterbodies



9.109 Drainage within the Site comprises headwaters of significant and minor watercourses, field drains / ephemeral features. Detailed site hydrology identified during site walkovers, and desktop analysis of flow routes and catchments based on height data is shown on **Figure 9.1: Site Hydrology**.

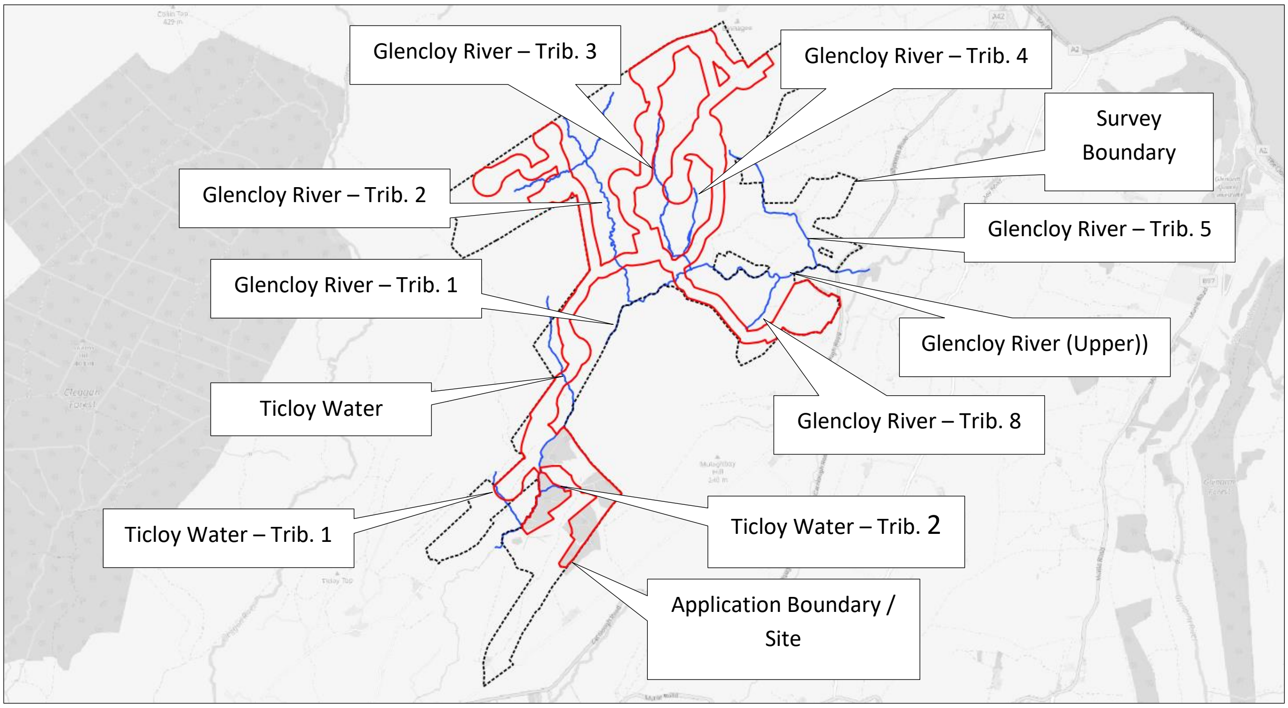
9.110 The area of lands within the Site comprises approximately 17% of the hydrological catchment of the Glencloy River and approximately 1.3% of the hydrological catchment of Braid River (Aghacully).

Sub-catchments / Watersheds

9.111 For purposes of differentiation of effects and consistency with associated assessments (i.e., Chapter 8 – Fisheries & Aquatic Ecology), the hydrology in the areas where development is proposed is divided into ten significant watercourse sub-catchments.

9.112 Two drain to the south into Ticloy Water (and thereafter to Braid River) and eight drain to the east toward Glencloy River discharging to the North Channel of the Irish Sea.

Plate 9-11: Internal Catchments



Ticloy Water

9.113 This watercourse drains the south-western part of the Site and flows in a southerly direction to the application boundary then veers south-west to join with the Braid River approximately 4km downstream. At the downstream extent within the Site it has a catchment area of c. 2.52 km^2.

9.114 The channel characteristics vary throughout its length within the Site boundary. In its lower reaches the gradient is moderate with flow morphology a mixture of riffles, runs and occasional deep long pools. The banks are open, and the bed is largely boulder, cobble and pebble with extensive aquatic mosses, occasional areas of bedrock, and little siltation of the bed.

9.115 Approximately 240m upstream of the Site, the channel becomes very slow flowing and up to 0.7m deep for approximately 220m and runs adjacent to a patch of plantation conifer. North of this, the gradient increases resulting in faster flows and shallower depths

9.116 At the upper Site boundary, the Ticloy Water runs through heavily grazed rough sheep pasture where the gradient increases; the channel is very narrow (ca. 0.4-1.0m wide) and shallow (c. 0.02 - 0.05m depth) with bedrock, cobble, boulder, and shingle / fines in the substrate. The Fisheries & Aquatic Ecology assessment (Chapter 8) concludes the watercourse has good potential to support trout in the mid to lower reaches but lower potential towards its source.

Ticloy Water – Tributary 1

9.117 This channel cuts through sheep pasture before flowing into the main Ticloy Water at the Site boundary adjacent to plantation forestry. It has a catchment area of 0.3 km^2 at its confluence with Ticloy Water. Much of the channel is typical of an excavated agricultural field drainage ditch and has an outflow via a pipe. The Fisheries & Aquatic Ecology assessment (Chapter 8) confirms there is no fisheries value in this watercourse due to a lack of open bed and seepage water.

Ticloy Water – Tributary 2

9.118 This watercourse flows east to west across the middle of the Site before flowing into the main Ticloy Water at the Site boundary. Though initially very narrow and shallow at the Ticloy confluence, this small stream has a clean boulder and cobble bed with no silt and a reasonable flow. It has a catchment area of c. 0.38 km^2 at its confluence with Ticloy Water.

9.119 Further upstream from the confluence with the Ticloy Water, the channel receives seepage drainage from several small drains with no obvious hard bed while the main channel flows through a marshy area. Beyond the marshy area, the watercourse is very narrow and shallow, with substrate noted as mainly of cobble and pebbles. The Fisheries & Aquatic Ecology assessment (Chapter 8) suggests very low fisheries value in this watercourse.

Upper Glencloy River

9.120 The main channel of the Upper Glencloy River is fed by outflows from Curraghvohil Loughs. Initially the channel is deep and sluggish as it emerges along the northern boundary of the loughs. The channel runs through mainly rough sheep pasture for a further 390m to the point of the confluence with drainage from tributaries 3 and 4 [refer to subsequent sections]. Here the river channel gradient steepens, channel width is c. is 2.5 - 3.8m wide with mainly riffle/run sequences, and pools characterised by large boulders, cobble and some bedrock.

9.121 Further downstream, the channel meanders through steeper ground resulting in a series of long cascades and waterfalls characterised by bedrock. Downstream from this point, the gradient remains steep until the main bridge under the A42 road to Carnlough. At this point on the eastern edge of the survey boundary, the watercourse has a catchment area of c. 7.32 km^2. The watercourse is considered in the Fisheries & Aquatic Ecology assessment (Chapter 8) to have good potential to support resident trout and possibly eels.

Glencloy River – Tributary 1

9.122 This tributary is located within the south-west of the Site boundary, draining an area of bog and rough pasture to the south-east before flowing towards the western side of Curraghvohil Loughs. The loughs are an area of marsh and floating mats without open water. The stream is very narrow (c. 0.2 - 0.45m wide) and shallow, emerging in a grassy area adjacent to a small conifer copse. At the point where the watercourse flows into the loughs it has a catchment area of c. 0.77 km^2.

9.123 Further downstream, the watercourse flows into a flat marshy area to the south-west of Curraghvohil Loughs; here the channel is near stagnant, with channel width c. 0.2 - 0.25m but up to 0.3m deep with a peat bed up to 0.5m deep. The Fisheries & Aquatic Ecology assessment (Chapter 8) suggests very low fisheries value in this watercourse.

Glencloy River - Tributary 2

9.124 At the confluence with Glencloy River - Tributary 1 at Curraghvohil Loughs, this watercourse has a catchment area of c. 2.78 km^2. In its lower reaches below the main farm access track towards the Site boundary, the channel is very deep (up to 1.2m) and slow flowing before merging to form the wetland at the periphery of Curraghvohil Loughs east in an area of marsh and floating vegetation mats.

9.125 Upstream from this, the channel cuts through marsh and boggy ground with depths up to 1.0m and a bed characterised by pebbles, silt and peat.

9.126 Further upstream, the stream intersects a farm access lane where it is crossed by a concrete bridge underlain by 5 round pipe culverts. The channel is c. 2.0 - 4.0 m wide but narrows 30 m upstream to c. 1 - 1.5 m with depths to 0.4 m, characterised by riffles, runs, and deep pools.

9.127 Th upper reaches of this watercourse is charactered by a series of pronounced meanders that extend for c. 300m. Beyond this, the channel gradient increases and there is a greater proportion of bedrock. The confluence between the main Glencloy River channel (as shown on OSNI mapping) and a tributary (Glencloy River - Tributary 2-1) meet perpendicular at a point of steep rocky terrain / cascades. Both watercourses are incised with steep banks and narrow, shallow channels upstream of this point. The Fisheries & Aquatic Ecology assessment (Chapter 8) concludes that this watercourse has high potential to support resident trout and eels.

Glencloy River – Tributary 3

9.128 The reach immediately upstream of the confluence of this watercourse and tributary 4 [refer to subsequent section] is narrow and slow flowing (c. 0.3 - 0.4 m wide) with a bed of cobbles and pebbles. At the point of the confluence, this watercourse has a catchment area of c. 0.55 km^2.

9.129 Further upstream, the channel intersects the main existing farm track in a large field heavily grazed by sheep. Sections of the channel upstream has been widened due to widening caused by sheep poaching. Here, the channel is c. 0.4 - 0.6 m wide and is dominated by clean cobble, boulder and pebbles.

9.130 In the upper reaches, a series of steep cascades and falls occurs over smooth bedrock and large boulders, beyond which the channel narrows and has little flow though several small pools were noted on site. The Fisheries & Aquatic Ecology assessment (Chapter 8) concludes that this watercourse has high potential to support resident trout and eels.

Glencloy River – Tributary 4

9.131 This watercourse has a catchment area of 0.6 km^2 at its confluence with Upper Glencloy River. Upstream of the confluence with the main (Upper) Glencloy River (c. 285m downstream of the farm access track), the stream is c. 1.3 - 1.6m wide with a mainly cobble and boulder bed characterised by high coverage of aquatic mosses.

9.132 Further upstream below the main farm access track, the stream narrows to c. 0.3 - 0.6m and c. 0.2m depth with increased flows over shallow riffles and pools though the stream bed is highly silted. Upstream of the access track, the channel flows within an area of rough sheep grazing and rushes with mainly cobble, pebble and occasional large boulders noted in the substrate.

9.133 Approximately 500m upstream of the farm access track, the channel gradient increases through a series of meanders of riffle / run and deep pools. Beyond a vehicle crossing, the channel becomes increasingly narrow and incised within an area of blanket bog. In this reach the moderate flows, pebble and cobble were noted.

9.134 Beyond this point, the channel depth shallows considerably with inflow to the main channel coming from small drainage channels noted throughout the area. The Fisheries & Aquatic Ecology assessment (Chapter 8) concludes that this watercourse has high potential to support resident trout and eels.

Glencloy River – Tributary 5

9.135 This tributary drains an area of c. 0.77 km^2. It is unfenced within rough sheep grazing pasture and is shallow, c. 1.2 - 1.5 m wide, with pool pockets up to 0.25m deep, of moderate flow, and characterised by boulder, cobble and small pebbles.

9.136 The stream narrows further upstream and runs through gentle gradient pasture c. 390m upstream, the channel splits with the left side tributary very narrow and shallow. The right-side tributary passes over a very steep area of ground as a waterfall. Beyond the waterfall, the channel is characterised by smalls riffles and runs but narrows and becomes incised as it runs through rough pasture and blanket bog. The Fisheries & Aquatic Ecology assessment (Chapter 8) concluded that above the waterfall, the channel is initially of reasonable habitat quality, but where it becomes incised as it runs through rough pasture and blanket bog, fisheries potential is very low.

Glencloy River – Tributary 6

9.137 This tributary has a catchment area of c. 0.4 km^2. No proposed infrastructure is located within its catchment boundary; therefore, it is not considered further in this assessment.

Glencloy River – Tributary 7

9.138 This tributary has a catchment area of c. 0.34 km^2. It has the potential to intercept drainage from a small portion of the extreme north-west of the landholding boundary. During site walkovers the channel was noted as being almost dry. The very steep gradient in addition to a 40m piped section led the Fisheries & Aquatic Ecology assessment

(Chapter 8) to conclude that the channel has a very low fisheries and aquatic ecological value.

Glencloy River – Tributary 8

9.139 This tributary has a catchment area of c. 0.51 km^2. It has the potential to intercept drainage from a small portion of the extreme south-west of the landholding boundary. Its source is from a boggy area where the main channel and another tributary are field drainage ditches with little flow and a bed of peat and vegetation. Overall, the habitat is unsuitable for fish at this reach of the watercourse.

9.140 Approximately 60m further downstream, the channel widens into a wider weed choked deep trench with excessive emergent vegetation, and is deeply silted with little flow and overall, very low fisheries value.

9.141 Further downstream, the channel narrows for a small section to approximately 1.2m where there is good flow and a bed largely of boulder and cobble. This is soon followed by a shallower gradient area where cattle are causing extensive poaching, erosion, and widening/ shallowing of the channel with low banks and high bed siltation.

9.142 The stream passes a farm track via two concrete pipes and thereafter the gradient increases sharply as it flows towards the confluence with the main Glencloy river via a steep cut through bog, scrub and wet woodland. Overall, fisheries value in the upper to middle reaches is very poor although a few resident trout may occur in the lower high energy reaches immediately above the Glencloy River.

Surface Water Quality

9.143 The following section is intended to provide a qualitative appraisal of existing surface water quality in those catchments the proposed development lies within.

9.144 Following the publication of the Water Framework Directive (Classification, Priority Substances and Shellfish Waters) Regulations (Northern Ireland) 2015, waterbodies are given a classification based on annual average / percentile results from several individual monitoring stations.[10]

9.145 The WFD classification is a combination of chemical, biological and hydromorphological elements; whereby, the overall status is the lowest of the combined constituents.

9.146 Approximately 76% of the Site boundary is located within the Glencoy River catchment (ultimately discharging into the Irish Sea), and approximately 24% within the Braid River (Aghacully) catchment which ultimately discharges the Maine River then to Lough Neagh.

[10] The European Water Framework Directive (2000/60/EC) has been transposed into Northern Ireland regulations through The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017. The Water (Amendment) (Northern Ireland) (EU Exit) Regulations 2019 ensures that the Water Framework Directive (as transposed) and the various supporting pieces of water legislation continue to operate here after 1 January 2021 (https://www.daera-ni.gov.uk/articles/water-framework-directive)

Table 9.10: River Water Body Status

River Waterbody	2018 Status	2021 Target	2027 Target
Glencloy River (UKGBNI1NE040403061)	Good	Good	Good
Braid River (Aghacully) (UKGBNI1NB030308214)	Good	Good	Good
Irish Sea (North Channel) (UKGBNI6NE030)	Good	Good	Good

9.147 NIEA Water Management Unit were consulted for surface water quality monitoring station sites and data (from 2009 onwards) within a 5 km radius of the Site. The below table provides a summary of the information provided on the monitoring sites. The complete consultation response, including raw chemical and biological data, is included in **Appendix 9.4**. Each of the above is contained within either the Glens and Rathlin or Braid and Main Local Management Area.

9.148 Glencloy River and Killycarn Trib (Braid) (of which Ticloy Water is a tributary) were designated under the WFD as Freshwater Fish Directive protected areas due to the presence of economically significant species. The Directive 2006/44/EC has since been revoked, however NIEA:WMU continues to recognise them as protected areas containing economically significant species.

Table 9.11: NIEA WMU Water Quality Classification

River Water Body ID	Location	Local Management Area	Sitecode	Monitoring Station	Final Status 2018
GBNI1NB030308214	Braid River (Aghacully)	Braid and Main	F10189	BRAID RIVER AT AGHACULLY BRIDGE	GOOD
GBNI1NB030302016	Priests Burn	Braid and Main	F10188	PRIESTS BURN AT BRECKAGH BRIDGE	GOOD
GBNI1NB030302022	Artoges River	Braid and Main	F10187	ARTOGES RIVER AT GREEN BRIDGE	GOOD
GBNI1NB030302233	Glenravel Water	Braid and Main	F10193	GLENRAVEL WATER AT CARROWCOWAN BRIDGE	MEP
GBNI1NE040403012	Glenarm River	Glens and Rathlin	F10479	GLENARM RIVER AT GLENARM	GOOD
GBNI1NE040403060	Carnlough River	Glens and Rathlin	F10463	CARNLOUGH RIVER AT DRUMNAHOE	GOOD
GBNI1NE040403061	Glencloy River	Glens and Rathlin	F10478	GLENCLOY RIVER AT GLENCLOY BRIDGE	GOOD
GBNI1NE040403064	Inver River	Glens and Rathlin	F10477	GLENARIFF RIVER AT CALLISNAGH BRIDGE	MEP

Project Specific Water Quality Assessment

9.149 In addition to a review of water quality data held by statutory bodies, independent water quality monitoring has been undertaken as part of this assessment to provide baseline water quality standards of water features within the application boundary prior to any development.

9.150 Sampling was carried out in April 2021. The prevailing weather conditions on the day of sampling were dry and sunny. The baseline assessment collected and assessed representative water samples from watercourses draining the Site for a range of physio-chemical parameters. Monitoring locations are shown on **Figure 9.3**.

9.151 Water quality results were assessed for compliance against key parameter limits outlined in the Water Framework Directive (2000/60/EC), transposed in Northern Ireland through the Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017, and the Directive 2013/39/EU is transposed through the Water Framework Directive (Classification, Priority Substances and Shellfish Waters) Regulations (Northern Ireland) 2015. In terms of the key indicators of water quality and / or pre-existing pollutants, chemical results obtained showed:

- pH results were within the naturally excepted range and classified ‘High’, based on WFD standards for this parameter;
- Dissolved oxygen levels are classified as ‘High’ under the WFD;
- Orthophosphate levels were found to be within expected ranges and within the range of Moderate to Good WFD classification status;
- BOD results signified ‘High’ water quality in all locations based on WFD classifications; and
- Ammoniacal Nitrogen concentrations signified ‘High’ water quality in all locations based on WFD classifications.

9.152 Water quality for watercourses draining the Site is generally consistent with the WFD status of ‘Good’ for the downstream waterbodies outlined previously. Therefore, preservation of the baseline water quality results within the upper reaches would be important at a local level to preserve the downstream NIEA classifications.

Industrial Consents

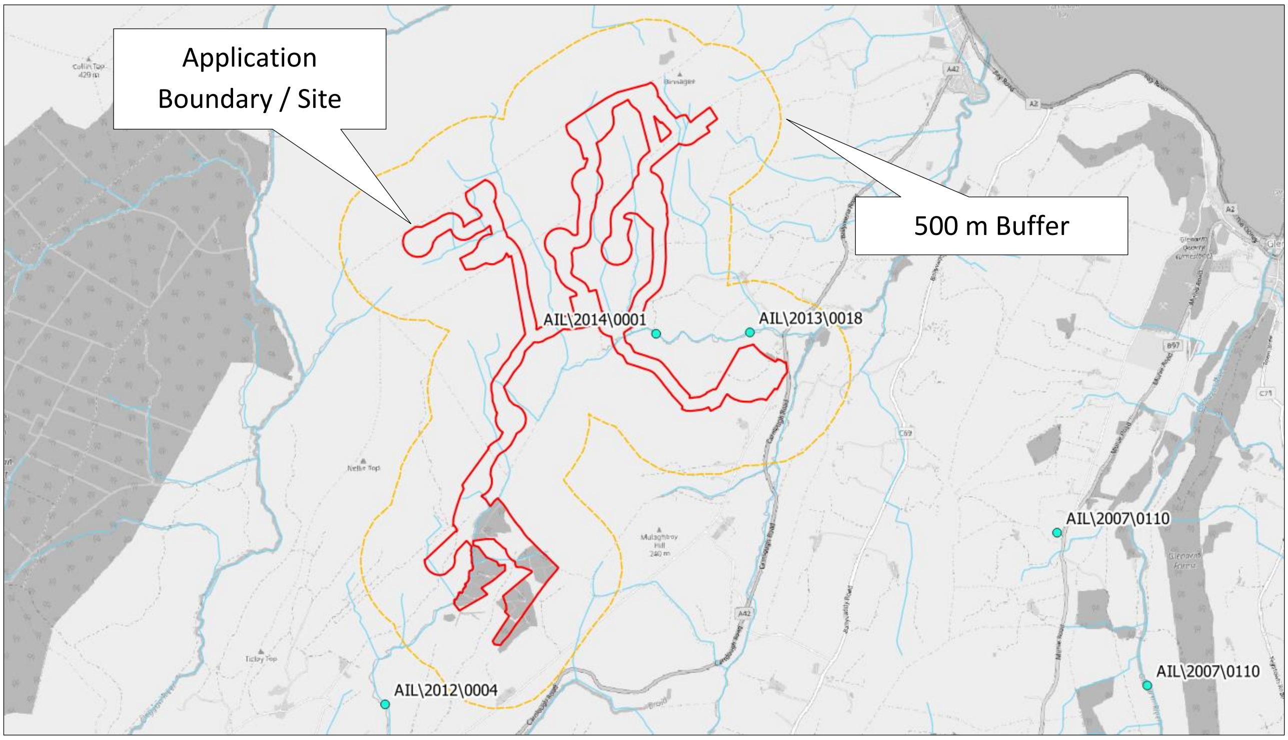
9.153 Review of DAERA mapping identified 8 no. industrial consents within 1 km of the proposed development boundary. All are described as private sewage (domestic) and are located down gradient from the proposed development; therefore, none are considered to pose a potential impact to, or be affected by, the proposed development.

Surface Water Abstractions

9.154 In order to allow assessment of potential for the proposed development to affect surface water abstractions in the catchment at and up to 5 km downstream of the Site, an initial screening review of the NIEA WMU Water Information Request Viewer[11] was carried out.

9.155 A 500 m screening radius has also been applied to the Site boundary. Two surface water abstractions are located on Glencloy River in the vicinity of the proposed development on within the screening buffer: AIL\2014\0001; and AIL\2013\0018. A third (AIL\2012\0004) is located further downstream on the Ticloy Water outside the screening buffer. Each is associated with Hydro Power and are located on watercourses originating within the proposed development boundary.

Plate 9-12: Surface Water Abstractions



Northern Ireland Water Infrastructure

9.156 A review of Northern Ireland Water assets information within 5 km of the proposed development recorded the following: 7 no. sewerage pumping stations (all located > 2 km east and north-east of the development along the Irish Sea coastline); 5 no. wastewater treatment works (the nearest to the development located 2 km north-east in Carnlough); and 4 intakes located c. 4 km north of the Site boundary (located upstream of Dungonnell Impounding Reservoir).

[11] Water Information Request Viewer. Available at: https://www.daera-ni.gov.uk/articles/information-requests Accessed 21/10/2021

9.157 It is considered that due to the distance between them (and in most instances the breaks in hydrological connection to link them), NI Water assets could not feasibly be affected by works associated with the proposed development. Therefore, no further consideration is required within this assessment.

Flood Risk

9.158 The proposed development was assessed in relation to Flood Maps (NI) and similar DfI Rivers datasets, which provide an indication of predicted flood extents for a 1% Annual Equivalent Probability (AEP) fluvial flood and 0.5% AEP Surface Water Flood, and for reservoir inundation. DfI Rivers have also been consulted regarding flooding; the response (Ref: IN1-21-4873) is included in **Appendix 9.4**.

Historical Flood Extents

9.159 Flood Maps (NI) indicates no recorded incidents of historic flooding in the vicinity of the Site. In their consultation response, DfI Rivers confirmed they held no record of floods on or immediately downstream from the proposed Site. The nearest flood call on record is at 101 Ballymena Road, Carnlough. This property is located c. 2.3 km north (downstream) from the proposed Site entrance.

Fluvial Flooding

9.160 Out of bank flooding from the upper reaches of several watercourses draining from the survey boundary toward the Glencloy River and Ticloy Water / Braid River are identified on the Flood Maps (NI) indicative predicted 1 % AEP fluvial (river) flood extents.

9.161 A site-specific flood modelling exercise has been undertaken to better define flood risk to the land, and supersede data shown on the indicative flood map. The outcomes of that assessment are detailed in a Flood Risk and Drainage Assessment, refer to **Appendix 9.2 – Flood Risk & Drainage Assessment** and mapped on **Figure 9.1.**

Pluvial Flooding

9.162 Surface water flooding are predicted by the indicative 0.5 % AEP surface water flood extent mapping at a limited number of discrete locations within the survey boundary, and generally coincide with the headwaters of watercourses. Surface water flooding coinciding with watercourses is more appropriately assessed as fluvial, and would be superseded by the site-specific flood modelling described at paragraph 9.161.

9.163 Surface water flooding would not constrain development but would inform design of the infrastructure with a view to ensuring that surface water flow paths are maintained, and a suitable standard of protection if afforded to any development adjacent to areas predicted to be affected by flooding.

Reservoir Flooding

9.164 The risk of reservoir flooding was assessed using Reservoir Flood Mapping for Emergency Planning[12], which shows the indicative area that may flood from an uncontrolled release of water from all possible dam failure scenarios. The site is unaffected.

Summary

9.165 Flood extents are shown on **Figure 9.1: Site Hydrology**. Mitigation of flood risk is described in subsequent sections and is addressed in detailed in **Appendix 9.2 - Flood Risk & Drainage Assessment** in the format normally requested by DfI Rivers in consultation.

Eco-Hydrology & Water Dependent Habitats / Species

9.166 Consideration has been given to local surface water and groundwater dependent ecosystems and habitats dependent on, or prone to change due to variation in, surface water and groundwater patterns on the Site within **Chapter 6: Ecology**. No further consideration is given to those aspects within this chapter.

Fisheries

9.167 Detailed consideration has been given to fisheries on and downstream of the Site within **Chapter 8: Fisheries and Aquatic Ecology**.

9.168 That assessment, when considered a wider survey boundary, has determined that:

- Ticloy Water is of high/ very high sensitivity and supports trout, trout spawning and nursery habitat, and eels.
- Glencloy River is of high sensitivity, supports trout and has excellent trout nursery habitat quality.
- Glencloy River Tributary 1 is of medium sensitivity, supports no fish and has poor physical habitat quality.
- Glencloy River Tributary 2 is of Very High sensitivity, is a designated salmonid river, supports trout, and has good/moderate trout spawning/nursery habitat.
- Glencloy River Tributary 3 is of medium sensitivity, supports trout and has moderate trout spawning/nursery.
- Glencloy River Tributary 4 is of high sensitivity, supports trout and has moderate trout spawning/nursery.
- Glencloy River Tributary 5 is of very high sensitivity, supports trout and has good trout nursery habitat quality.

[12] DfI Rivers (2017) Reservoir Flood Mapping for Emergency Planning. Available at http://riversagency.maps.arcgis.com/apps/webappviewer/index.html?id=006872dcdd7b43b89d352e0b93190e67. Accessed 21/10/2021

Aquaculture

9.169 Fisheries Inspectorate confirmed the closest aquaculture site is salmon cages located at Red Bay (c. 9 km north-east from the proposed development Site and located around the headland from the point where Glencloy River discharges into the Irish Sea). An impact would only occur should sediment be allowed to leave the development Site and tidal conditions be such that it would carry material towards the cages; therefore, potential for a significant potential effect on aquaculture is considered very unlikely. A copy of this correspondence is included in **Appendix 9.4**.

Water Framework Directive - Fisheries Classification

9.170 Glencloy River was given status under the now revoked Directive 2006/44/EC 'on the quality of fresh waters needing protection or improvement in order to support fish life'; more commonly known as the Freshwater Fish Directive.

9.171 NIEA Water Management Unit data available on the NIEA River Basin Planning Mapviewer[13] designates these watercourses as protected areas containing economically significant species.

Designated Sites

9.172 Designated sites such as; Special Areas of Conservation (SAC), Special Protected Areas (SPA), Areas of Special Scientific Interest (ASSI), and similarly designated environmental receptors, have been identified as part of this assessment.

9.173 Designated sites within a 5 km radius of the proposed development or located within upstream / downstream catchments from the Site were identified utilising the datasets available on the NIEA Natural Environment Map Viewer and Join Nature Conservation Committee[14] website, and were screened to identify:

- Terrestrial sites of geological importance on or immediately adjacent to the proposed development;
- Hydrological sites with sensitivities to the water environment that are connected to the proposed development, i.e. sites which lie in the upstream catchment of or are on downstream streamlines of the watercourses draining the proposed development;

9.174 Only sites meeting these criteria are discussed further in this assessment. Terrestrial sites with ground or surface water-dependent habitats are considered in **Chapter 6: Ecology.** Terrestrial sites with water-related reliance for birds (i.e., Antrim Hills SPA) are not considered further within this assessment and are considered in **Chapter 7: Ornithology**.

13 NIEA River Basin Viewer. Available at https://appsd.daera-ni.gov.uk/RiverBasinViewer/ Accessed 21/10/2021

14 Joint Nature Conversation Committee (2021) Special Areas of Conservation – overviewhttps://jncc.gov.uk/our-work/special-areas-of-conservation-overview/

Table 9.12: Initial Screening of Geology / Water-related Designated Sites

Name	Designation	Reason for designation and qualifying features relevant to this assessment	Distance from survey boundary at nearest point (km)	Considered further and rationale.
Garron Plateau	SAC (UK0016606)	Blanket bogs; *Saxifraga hirculus;* Alkaline fens; Natural dystrophic lakes and ponds; Northern Atlantic wet heaths with Erica tetralix; Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and / or of the Isoëto-Nanojuncetea; and Transition mires and quaking bogs.	The north-western extent of the Site boundary borders the designated site.	Yes: Designated site lies in the upstream catchment of watercourses draining the proposed development.
	Ramsar	The site qualifies under criterion 1a of the Ramsar Convention by being a particularly good representative example of a wetland complex including blanket bog (a globally restricted biotope), base-rich flushes and upland lakes.		
	ASSI (ASSI67)	The area is of special scientific interest because of its geology and peatland flora and fauna.		
Lough Neagh	ASSI	The area is of special scientific interest because it is a large shallow eutrophic lake occupying a downwarp in Tertiary basalt with its associated physical, chemical and biological characteristics.	28 km south-west	Yes: The designated site is hydrologically connected to the proposed development site.
Lough Neagh & Lough Beg	Ramsar	The site qualifies under Criterion 1 of the Ramsar convention by being the largest freshwater lake in the United Kingdom.	28 km south-west	Yes: The designated site is hydrologically connected to the proposed development site.

Garron Plateau SAC, Ramsar Site & ASSI

9.175 The feature requirements of Garron Plateau in relation to the flora and fauna which merited its designation include the ability to maintain (or restore where appropriate) the Active Blanket Bog, Alkaline fen (upland), Marsh saxifrage Saxifraga hirculus L, Oligotrophic to mesotrophic standing water with vegetation belonging to Littorelletea uniflorae and/or Isoeto-Nanojuncetea, Northern Atlantic wet heath, Natural dystrophic lakes and pools, and Transition mires and quaking bogs.

9.176 While adjacent to the designated site, areas where development are proposed are significantly (>50 m) downgradient of the designated site. As such, any proposed works associated with the development (excavations or similar) are sufficiently lower in gradient that they cannot have any drainage or similar effect that would affect the integrity of the qualifying features and, therefore, are discounted from further consideration.

Lough Neagh (ASSI), Lough Neagh & Lough Beg (Ramsar / SPA), Rea's Wood and Farr's Bay (SAC)

9.177 All onsite water features in the southern section of the Site ultimately drain to the Braid River, which is a tributary of the River Main, itself discharging to Lough Neagh. Deterioration of water quality is highlighted in conservation guidance[15] as a threat to water habitat quality.

9.178 Whilst the Site is hydrologically connected to Lough Neagh, the minor contributing catchment of the site to receiving watercourses which feed the designated site, combined with the considerable distance between the Site and receptor, mean any potential effects to water supply / quality as a result of construction or operation of the Development would cause no effect at the designated site and as such this receptor is discounted from further consideration.

9.179 The connectivity between the Site and Natura 2000 (N2K) sites (i.e., SAC and SPA) necessitates the preparation of a shadow Habitats Regulations Assessment (HRA). The HRA is included as an appendix to **Chapter 7: Ornithology** and includes further details on the designated sites. It concludes that the proposals will not have a significant effect on any N2K sites.

Baseline Summary and Receptor Sensitivities

9.180 The baseline assessment identified the receptors which have the potential to demonstrate a sensitivity to the proposed development; the receptors and their scale / sensitivity value are summarised in **Table 9.13**. Sensitivity is based on the baseline assessment and determined in accordance with the rationale previously described in **Table 9.3**.

Table 9.13: Receptor Sensitivity

Type	Receptor	Scale / Sensitivity	Rational
Geological	Soils / Drift Deposits	Local / Low	Site with little geological value or of widespread local abundance. Loss of the land on the Site would not be considered significant in the context of the region.
Hydrological	On-site significant watercourses (Ticloy Water)	National / High	Ticloy Water is noted in the fisheries assessment as having trout and eels present as well as recording trout spawning and nursery habitat. Fluvial flooding is predicted on Ticloy Water with FMNI flood extents indicating it an active floodplain area along its reaches within the Site boundary.

[15] https://loughneaghpartnership.org/wp-content/uploads/2017/10/LOUGH-NEAGH-SPA-CONSERVATION-OBJECTIVES.pdf

Type	Receptor	Scale / Sensitivity	Rational
	On-site significant watercourses (Glencloy River and significant tributaries)	National / High	Glencloy River has a WFD status of 'High'. It is also denoted as a designated salmonid river. The fisheries assessment highlights the river (and several of its tributaries) as having trout present with good/ moderate trout spawning/nursery habitats. Fluvial flooding is predicted on Glencloy River with FMNI flood extents indicating it an active floodplain area along its reaches within the Site boundary.
	On-site Minor Drainage	Local / Low	All other on-site watercourses are generally characterised by vegetated overgrown field drains / cut peat drainage / trackside drainage and have low fisheries and other ecological potential and have no other use of significant value.
	Lower Glencloy River	National / High	Salmon; Trout; Sea trout; eels; possible lamprey spp.; good salmonid spawning and nursery habitat quality. Two surface water abstractions are located on Glencloy River to the east of the proposed development. Both are associated with Hydro Power.
	Lower Ticloy Water / Lower Braid Water (including downstream River Maine)	National / High	River Braid has a WFD status of 'High'. The fisheries assessment also notes that salmon are present at Moderate-Excellent abundance. Trout and migratory dollaghan and eels are also present with possible river and brook lamprey. A surface water abstraction associated with hydro power is located on Ticloy Water downstream of the proposed development.
Hydro-Geological	Private Water Supply	Local / Low	Domestic private water supplies and potential water supplies have been identified within a screening distance from the Site.
	Bedrock Groundwater / Aquifers	Local / Low	Aquifer with 'moderate' productivity and no significant abstractions. Potential for discrete local supply sources.
	Shallow Groundwater / potential superficial Aquifers	Local / Low	No substantial superficial aquifers present at the Site.
Terrestrial	The Proposed Development	Local / Low	Proposed infrastructure prone to damage including potential for water damage of electrical infrastructure in a flood event; potential for structural damage of access infrastructure in the event of hydraulic incapacity.
	Buildings	Local / Low	The Site is shown to be within the radon affected area. Any buildings located within this area would be subject to inclusion of protection measures.

Type	Receptor	Scale / Sensitivity	Rational
	Local Small-scale Hydro Power Schemes	Local / Low	The Site is located in the upper reaches of watercourses utilised for local small-scale hydro power at three separate locations.

Predicted Environmental Effects

Preamble

9.181 This section outlines and describes the potential likely effects of the proposed development on hydrological patterns and water quality on the Site, and in the downstream environment, that have the potential to arise in the absence of mitigation. The following phases of the proposed development are considered;

- Windfarm construction;
- Windfarm operation and maintenance;
- Wind farm decommissioning

9.182 During each phase, some of the activities undertaken have the potential to modify hydrological regimes and affect water quality on the Site and the downstream environment. Due to the nature of the Site and work undertaken, the hazards and associated effects will be similar for each phase; with an increased likelihood during the construction phase.

Components Contributing to Predicted Environmental Effects

Activities Associated with Construction, Operation and Decommissioning

9.183 During construction, the proposed development comprises construction of infrastructure which would be likely to cause change to local hydrology and water quality, comprising earthworks, plant movements with associated use of lubricants and fuel oils, spoil handling and placement of aggregates and cementitious materials, and dewatering associated with construction of temporary compounds, turbine foundations, building foundations, access tracks, and cable trenches.

9.184 The operational phase of the proposed development (the designed operating life estimated to be 35 years) would cause runoff from access tracks, turbine bases and hard standings via drainage features, would require onsite welfare facilities with associated waste, includes the provision of battery energy storage systems (BESS) (i.e., 4 no. lithium ion battery energy storage containers), and potentially necessitates storage and use of oils, fuels and lubricants on-site, each with the potential to cause adverse effects on the environment without adequate avoidance, design, or mitigation measures.

9.185 Activities associated with the decommissioning phase at the end of the operating design life are generally as per those for the construction phase i.e. earthworks, plant movements with associated use of lubricants and fuel oils, spoil handling and placement of aggregates and cementitious materials, and dewatering associated with removal of turbines, buildings, hard standing areas and buried structures followed by reinstatement and restoration of ground cover.

Likely Significant Effects

9.186 The likely effects of the proposed development on the surface and ground water environment prior to any avoidance, careful design, or additional mitigation are summarised in the following sections.

Changes in Runoff and Flow Patterns

9.187 New temporary and permanent impermeable surfaces, as well as temporary compaction of soils due to construction phase plant and site traffic movements, may cause increased rate and volume of surface water runoff due to the reduced permeable area on the Site through which rainfall can infiltrate. Impermeable surfaces will cause an increased "flashy" response to rainfall events, with increased water velocities in new and existing drainage features. As a consequence, the effect would be likely to cause temporary or permanent increases in surface water runoff rates and volumes, leading to increased flood risk and increased effects of erosion and scour in downstream watercourses. Similarly, loss of permeable areas is likely to cause reduced potential for groundwater recharge affecting aquifers.

9.188 Significant excavations, in particular linear works such as access tracks, drainage ditches and cable trenches, are likely to act as barriers to runoff resulting in ponding, or development of preferential flow routes, diverting surface water away from its current route. Consequently, temporarily or permanently redirected surface water flows may starve areas where water currently flows, or cause flooding of areas where water currently does not flow.

9.189 Works to existing surface watercourses (such as installation of culverts) have the potential to cause an obstruction to flows and may alter conveyance capacities, potentially causing temporary or permanent restrictions in watercourse channels, affecting upstream water levels and increasing flood risk.

Changes to Water Quality

Sediment / Suspended Pollution

9.190 Temporary activities required to construct windfarm infrastructure would require excavations, ground disturbance (due to excavations and plant and vehicle movements), stripping and excavation of peat and soils, and temporary spoil deposition. Exposed soils have potential to release fine sediments in surface water runoff or where excavations come in contact with surface watercourses.

9.191 Construction of hardstanding areas and access tracks would require importing, handling and placement of aggregate, which would have the potential to release fine sediments into surface water runoff. The proximity of such works to a surface watercourse will increase the risk of pollution to the wider water environment.

9.192 Temporary surface water or shallow groundwater gathering in significant excavations has the potential to be significantly polluted due to contact with excavated surfaces and aggregates. Discharge of intercepted contaminated groundwater during passive or active dewatering has the potential to pollute the wider water environment if not disposed of correctly.

9.193 Silt and suspended sediments and debris entering watercourses would have the potential to adversely modify stream morphologies, smother habitats and harm aquatic flora and fauna.

Chemical Pollution of Surface Water and Groundwater

9.194 Temporary storage and use onsite use of chemicals, fuels and oils associated with construction activities, and use of wet concrete and other cementitious material, may result in potentially harmful substances entering the water environment. Possible pathways to hydrological receptors may include; accidental spillages, improper transport and refuelling, or inappropriate storage and disposal procedures, by gradual leakage or single failure of storage tanks or refuelling mechanisms. Temporary presence of alum-based flocculants (used to remove suspended solids from surface water) has the potential to enter surface waters if unregulated.

9.195 During the operational phase of the proposed development, the permanent presence of oils and lubricants associated with turbine maintenance has a similar potential to enter and pollution the water environment.

9.196 Wastewater effluent from temporary construction phase welfare facilities and permanent substation building welfare facilities has the potential to enter surface water or shallow groundwater.

9.197 During the operational phase of the proposed development, accidental fire at the BESS facility on site may potentially risk contamination to land and water from release and fallout of gases and particulates.

9.198 As a consequence, chemical pollutants from construction activities, storage of materials, or from coliforms from wastewater entering watercourses have the potential to adversely affect water quality, with associated effects to potable supplies, fish and aquatic ecology.

Design Evolution: Constraints and Avoidance Measures

9.199 The magnitude and significance of those effects determined as being likely to be a consequence of the proposed development can be substantially reduced or eliminated through a proactive design approach to avoid identified baseline receptors, with particular emphasis in relation to fishery habitats.

9.200 This section identifies the avoidance measures imposed and outlines the resulting magnitude and significance of residual effects. Additional mitigation is then specified to further reduce or eliminate remaining residual effects.

9.201 Detail of the design evolution highlighting considerations made with regards to hydrology and water quality management is presented in **Chapter 3: Design Evolution & Alternatives**.

9.202 The proposed development layout has evolved so that the design avoids conflict with the water and geology environment, as demonstrated in the following sections.

Water Features

9.203 As a precautionary measure and in accordance with the guidance previously advocated by NIEA Natural Environment Division, buffer (exclusion) zones to valuable water features are adopted as constraints to built development, and for incorporation as a construction buffer in relation to permissible land uses in proximity to watercourses.

9.204 Impact avoidance and design of mitigation have been developed in accordance with legislation and best practice guidance outlined in **Table 9.1** and paragraphs **9.32** and **9.33**, respectively. Mitigation for all water features aims to preserve existing water quality ratings as a minimum.

9.205 Establishment of intact vegetated buffer zones between infrastructure and water features allows:

- Protection of water quality by filtering runoff within riparian vegetation before it enters the watercourse;
- Space for natural fluvial processes such as channel shape and planform adjustment which help restore and maintain the natural dynamic balance of river systems and associated habitats;
- Establishment of vegetation to stabilise banks and reduce soil erosion;
- Access for the maintenance and inspection of watercourses and for dealing with any residual risk of pollution incidents; and
- Habitat for plants and animals to form part of a habitat network.

9.206 The sensitivity of the water feature and the associated degree of protection it is therefore afforded, is primarily dependent on;

- Environmental designations on the water feature or downstream environment;
- Fisheries or ecological potential in the water feature or in the downstream environment;
- Water feature morphology (natural substrate or artificial channel, soil/ground type);
- Water feature size, capacity to convey water and hydrological potential (flows) – proportionate to the size of the catchment drained by the water feature;
- Nature and topography of the surrounding land, i.e., wet, poorly drained soils and steep slopes (>10°) would require greater protection;
- Sensitivity of the water feature to particular types of pollution, i.e., silts / nutrient enrichment / chemical pollution.

9.207 The rationale adopted in relation to water feature buffers is informed by NIEA Natural Environment Division guidance, which has typically ,in response to similar development, advised no infill, disturbance, construction activity or storage of materials within 50 m of natural watercourses. NIEA has indicated that justification for buffer zones applied is the responsibility on the Applicant, while any rationale for reducing the scale of the buffer zone must be demonstrated requiring the submission of detailed information using a number of additional factors e.g. soil typology, topography, size of watercourse and climatic conditions.

9.208 NIEA, in Practice Guide to EIA and Planning Considerations, outlines buffer zones for water features as per the below table;

Table 9.14: NIEA Buffer Zones for Water Features

Width of Watercourse	Width of Buffer Strip
Surface Watercourse	10 m (minimum detailed in GGP 5)
Water Feature (surface watercourse, spring, well, borehole used for Drinking Water – public or private)	250 m
Water Feature (surface watercourse, spring, well, borehole not used for water supply – but could provide preferential flow pathway)	50 m
Designated Wetland	250 m

9.209 Additional industry guidance relevant and similar in nature to the construction and operational activities for the proposed development has been reviewed and taken into account:

- Guidance for Pollution Prevention (GPPs): GGP5-Works and Maintenance in or near water;
- Pollution Prevention Guidance (PPGs);

- Best practice in relation to forestry works (in particular on upland and peat sites) recommends riparian buffer reflecting stream size, with buffers from 5 –20 m;
- Best practice in management of sediments and runoff from exposed ground in relation to agriculture recommends buffers of up to 10 m in order to protect surface waters from pollution by suspended solids, and nutrient enrichment by organic/inorganic fertilisers.

9.210 Water features considered significant for the purposes of the proposed development are shown on **Figure 9.1** and drainage drawings within **Appendix 9.1: Surface Water Management Plan.**

9.211 Significance has been determined following desktop studies and verified by site walkovers, with all streamlines subject to catchment and flow analysis by GIS -flow-raster accumulation analysis.

Significant watercourses

9.212 Significant watercourses identified and requiring application of a buffer to the proposed turbines and infrastructure are largely as per OS close scale vector mapping and were subject to ground truthing on Site.

9.213 A 50 m buffer has been applied to the significant watercourses identified in the baseline assessment, i.e., significant where catchment within Site is >0.3 km^2. The 'significant' watercourses located within the Site are shown on **(Figure 9.1)**

9.214 An example of the significant watercourses on the Site is shown on the following **Plate 9-13**.

Plate 9-13: Significant Watercourse Examples

Location	Mid-catchment (within site boundary) of Upper Glencloy River
Grid Ref.	325968, 414630
Photo Ref.	IMG_9168.jpg
	

Minor Watercourses

9.215 Minor watercourses were given buffers of 10 m based on SEPA and NatureScot (previously SNH) guidance and represent tributary channels on the Site where the catchment area was less than 0.3 km^2. Many are the sources / upper reaches of the more identifiable downstream channels and appear as grass-covered depressions in the land. They are distinct and easily identifiable on aerial imagery but often harder to differentiate from the surrounding land at ground level during dry conditions. Others are more defined channels cut into peat.

9.216 Minor watercourses will either be protected on their present alignment, or where works or diversions are required, then this shall be as enabling work adhering to strict procedures for working in or near water (described later in this assessment) with the proposed alignment then protected from the development.

9.217 Examples of minor watercourses / upper catchment sources on the Site are shown on the following **Plate 9-10**.

Plate 9-14: Minor Watercourse Examples

Location	Tributary of 'Glencloy River – Tributary 4'	Tributary of Ticloy Water
Grid Ref.	326083, 415593	324909, 413367
Photo Ref.	IMG_9326.jpg	IMG_9004.jpg
		

Other Drainage Features

9.218 All other minor drainage features (mapped or otherwise) comprising; dry or partially dry agricultural ditches, ephemeral drains, dry track drainage, grips, peat cuttings or other drainage features are considered insignificant in the context of site hydrology and habitat potential.

9.219 Such features would be managed during and following construction by means of temporary blocking (with prior settlement features upstream of and outwith the drainage channel), using filtration check dams or similar, in order to prevent residual indirect potential pollution downstream caused by connectivity to downstream waterways.

Adopted Watercourse Buffers

9.220 The significance of watercourses is shown on **Figure 9.1: Site Hydrology.** Conservative minimum hydrological buffer zones are adopted and implemented as shown in **Table 9.15**. The buffer widths adopted exceed those recommended in industry guidance; the allowance provided gives due consideration to the nature of peat soil conditions on the Site, antecedent weather, moisture and base flow and a significantly increased factor of safety in all instances given the significance of fishery interests within downstream catchments.

Table 9.15: Minimum Adopted Hydrological Buffer Zones

Water Features	Minimum Width of Buffer Strip
Significant Watercourses (catchment >0.3 km^2)	50 m
Minor Watercourses (catchment <0.3 km^2)	10 m
Other Drainage Features	Managed on-site by diversion / temporary blocking in accordance with GGPs and PPGs.

9.221 Buffers are indicated on Surface Water Management drawings included at **Appendix 9.1**.

9.222 New infrastructure designed to lie outwith stated hydrological buffer zones include those elements of the works associated with significant earthworks and greatest potential for spillage or leakage of chemical pollutants, i.e.:

- All turbine bases, crane pads and associated working areas;
- Temporary and permanent spoil storage areas;
- Enabling works compound, substation and construction compound, fuel and chemical storage areas and any other platforms;
- Spoil movements and earthworks (placement of donor turves and contour ploughing) associated with proposed habitat enhancement and ecological mitigation.

9.223 New permanent access tracks are to lie outside of buffer zones; with the exception of unavoidable crossings of water features. Careful consideration has been given to the routing of access tracks in order to avoid / limit crossing of watercourses.

9.224 For areas of proposed road widening / passing places on existing roads surrounding the proposed development, potential risk to water will be managed by complying with GPP5 and the principles for construction in or adjacent to water outlined in the site SWMP (**Appendix 9.1**).

9.225 Temporary track infrastructure (such as temporary widening and turning heads) that may encroach into buffers shall be managed through the use of additional surface water management measures, discussed in **paragraphs 9.266** through **9.269**.

Abstractions

9.226 The proposed infrastructure layout within the Site is such that no development (tracks, turbines or other significant infrastructure) is sited within 250m of any known or potential potable water abstraction identified in the previous screening assessment. No further constraint is required.

Floodplains

9.227 All development, other than tracks at watercourse crossings, are located beyond the extents of the 1 % AEP indicative fluvial floodplain based on refined site-specific river modelling and flood mapping.

9.228 Pluvial flood extents noted along watercourses on-site (shown on **Figure 9.1: Site Hydrology**) generally coincide with the headwaters of watercourses. Surface water flooding coinciding with watercourses is more appropriately assessed as fluvial and would not pose an additional constraint.

9.229 Infrastructure is designed to ensure that conveyance of watercourse and surface water flooding is not impeded by means of providing drainage culverts / under track crossings where necessary.

9.230 Electrical infrastructure that would be susceptible to damage by floodwater is designed such that it does not have potential to be affected by fluvial (watercourse) or surface water flooding.

9.231 Areas of isolated surface water flooding generally coincide with source areas of on-site water features or isolated low points. Site drainage and culverts shall allow passage of local surface flooding as considered within **Appendix 9.1: Surface Water Management Plan**, **Appendix 9.2 Flood Risk & Drainage Assessment**, and accompanying drainage management drawings.

Designed Measures

9.232 Normal design measures associated with development of the type proposed are not considered "mitigation" in EIA terms but are important in their effect of controlling or reducing the potential effect of the proposal on the receiving environment. Such measures are outlined in the following sections.

Site Drainage Management and SuDS Design

9.233 The proposed development will adopt a surface water management plan / site drainage design using the principles of Sustainable Drainage, promoting the principles of onsite retention of flows and use of buffers and other silt removal techniques. All drainage related mitigation measures proposed will be encompassed by a robust and proven Sustainable Drainage System (SuDS) design which will be used to control drainage and silt management on the site.

9.234 Onsite drainage design will minimise modification and disruption of the existing natural hydrology by:

- Maintaining existing overland flow routes and channels. Existing natural flow paths lateral to access roads will be maintained through the use of piped crossings under road alignments at natural depressions and at regular intermediate intervals. The spacing of cross drains will be specified at detailed design stage;

- Avoiding transporting rainfall runoff in long linear drainage swales by providing regular channel "breakouts", whereby water is encouraged to flow overland, thus maintaining existing natural hydrological patterns;
- Reducing surface water flow rates and volumes by attenuating runoff from tracks and hard standings "at source" by providing check-dams in swales, whereby the flow velocity and rate of discharge is artificially reduced to mimic natural properties;
- Providing settlement ponds at turbine hard standing areas and other main surface water discharge locations, where runoff from significant new impermeable areas is treated and attenuated before being released overland;
- All swales, crossings and other hydraulic features will be engineered to ensure that dimensions are suitable to convey predicted flows and so prevent build-up of surface water and / or flooding.

9.235 Drainage design will reduce chemical, silt and other suspended pollutant transport by providing a "treatment train" of two to three stages of pollutant removal to all surface water runoff, nominally by:

- Ensuring that drainage swales are designed to convey flows at a low velocity by using a wide, flat bottomed drain;
- Providing settlement and filtration features in all linear drainage swales (check dams, filtration dams) to reduce flow velocity and encourage settlement;
- Encouraging appropriate vegetation growth in the base of all linear drainage to provide additional filtration to flows;
- Providing settlement ponds at turbine hard standing areas and other key discharge locations in order to provide treatment to contaminated runoff prior to discharge;
- Discharging surface water runoff over undisturbed vegetated ground, hence allowing any remaining silts and other pollutants to drop out of flows before entering the watercourse (having the effect of polishing the runoff);
- Preventing the discharge of surface water runoff flows directly to existing watercourses or drainage. All discharges shall seek to be via SuDS and buffer zones which will act as a filter strip, allowing deposition of suspended solids and other pollutants;
- Providing settlement features in water channels downstream of areas of peat infilling and ditch blocking area proposed as part of habitat management and enhancement planning. Refer to **Appendix 6.6** for full Habitat Management Plan (HMP) measures. Areas of ditch blocking are shown on Surface Water Managememt drawings included in **Appendix 9.1: Surface Water Management Plan.**

9.236 Consideration specific to the proposed infrastructure elements are documented in the detailed site-specific drainage management / SuDS design – see **Appendix 9.1: Surface Water Management Plan** and accompanying drainage drawings.

Watercourse Crossings

9.237 As noted previously, the number of watercourse and drainage crossings has been minimised through the principle of avoidance at the layout design stage. Proposals submitted in conjunction with this assessment indicate:

- Six crossings of significant watercourses.
- Fourteen crossings of minor watercourses.

9.238 Culverts will be designed to accommodate track crossings and minimise length of affected channel in order to comply with Revised PPS15 policy FLD4.

9.239 Hydraulic design of crossings will be undertaken as per the guidance and requirements provided in CIRIA C689 "Culvert Design and Operation Guide" (or other standard as may be required by DfI Rivers in post-consent consultation), with primary parameters likely to include:

- Width of the culvert will be greater than the width of the active drainage channel;
- Alignment of the culvert will suit the alignment of the drainage channel, i.e. preserve the existing direction of flow;
- The slope of the culvert will not exceed the slope of the bed of the existing drainage channel.
- Detailed design of crossings will assume a hydraulic capacity requirement of 1% Annual Equivalent Probability flow including factor for climate change as required by DfI Rivers Technical Flood Risk Guidance in relation to Allowances for Climate Change in Northern Ireland as a conservative measure. Detailed hydraulic design of culverts and similar structures post permission is normal and accepted practice for wind farms in Northern Ireland.
- Fisheries shall be protected (where applicable) by adopting the guidance stated in Guidelines for Fisheries Protection during Development Works as published by Loughs Agency.

9.240 Culvert form will be informed by the site-specific fisheries assessment (**Chapter 8: Fisheries**). In instances where fish passage is a requirement (which is limited to Ticloy Water (x2), Upper Glencloy River (x1), Glencloy River – Tributary 2 (x1), and Glencloy River – Tributary 3 (x1)) culverts will be designed to ensure that the channel bed and banks remain intact in order to preserve fisheries habitats and allow continued fish passage; i.e. the structure will be a bottomless culvert. Elsewhere culverts shall be of a closed conduit type.

9.241 Typical design drawings for a bottomless culvert and closed culvert have been provided as part of the planning application and are included as part of the Drainage Management Drawings within **Appendix 9.1: Surface Water Management Plan.**

9.242 Consultation and approval will be sought from all relevant parties as required by the DAERA Surface Waters Alteration Handbook (November 2017), including and DfI Rivers in particular, at the pre-construction detailed design stage for all works in and affecting watercourses and drains, as per the requirements of Schedule 6 of the Drainage (Northern Ireland) Order 1973 and subsequent amendments.

9.243 While detailed design of minor watercourse crossings (comprising simple closed culverts) can satisfactorily be deferred post-consent of any planning application, a design of crossings over significant watercourses has been undertaken to inform the **Flood Risk & Drainage Assessment (Technical Appendix 9.2)** as the crossings would otherwise have potential to impede a floodplain.

9.244 The resultant structures comprise clear span crossings of the significant watercourses, which have been demonstrated to ensure that the effect on flood conveyance is satisfactorily managed and would have no significant adverse effect on flood levels and flood extent within the Site and no adverse effect elsewhere. Preliminary DfI Rivers approval has been sought for the significant watercourse crossings.

Radon

9.245 The Site is within an area of elevated radon potential, where 1–3 % buildings are above the action level. Radon protection measures are advised to be implemented for the permanent sub-station and control building or as may be directed by the local Building Control office suitable to the nature of the proposed enclosed space.

BESS

9.246 The battery energy storage systems (BESS) comprise 4 no. lithium-ion battery energy storage containers. The storage containers are designed such that the batteries are within sealed units to ensure that a single cell thermal runaway will not propagate and result in multiple cell thermal runaways. This has been tested and confirmed in the UL9540A test (refer to Appendix 1.3). Therefore, the amount of potential pollutants will be limited to the gas vented from one cell but will be contained within the sealed unit limiting any potential impact to the wider environment (i.e., via fallout to land or surface waters and thereafter to groundwater).

Effect of the Development

9.247 Magnitude and likelihood of the potential environmental effects have been determined based on criteria outlined within **paragraphs 9.44** to **9.50** taking into account the effect of avoidance measures and normal designed-in measures proposed and described in preceding sections.

9.248 The associated impact significance of these effects on the receptors affected (following the implementation of avoidance and design measures proposed) has been determined in accordance with the rationale described previously and the results are presented in summary **Table 9.16**.

Table 9.16: Potential Magnitude and Significance of Impacts to Receptors – Including effect of Avoidance & Design

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
Soils / Drift Deposits (Local / Low)	Ground Movement / Instability	Low	Negligible	Unlikely	Not Significant	The Peat Slide Risk Assessment has concluded that peat slide risk is not significant.
On-site significant watercourses – Ticloy Water and Glencloy River (National / High)	Changes in runoff and flow patterns	Negligible	Low	Rare	Not Significant	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt "soft" rural SuDS features to ensure response to rainfall is not exacerbated. Design of crossings of significant watercourses at six locations within channels on-site when adopting best practice design standards as stated result in no significant localised effect in terms of restricted capacity that would cause any change to flood risk.
	Silt / suspended solid pollution of surface waters	High	High	Likely	Major	Temporary short-term construction activities within watercourses would be likely to cause a significant but temporary fundamental change in water quality in watercourses on the Site.
	Chemical pollution of surface waters	High	High	Likely	Major	Spillage of oils, chemicals, or cementitious material associated with temporary construction and arising due to improper site management would be likely to cause a fundamental but temporary change in water quality in watercourses on the Site.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
On-site Minor Drainage (Local / Low)	Changes in runoff and flow patterns	Low	Negligible	Unlikely	Not Significant	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt "soft" rural SuDS features to ensure response to rainfall is not exacerbated. Design of crossings of minor watercourses at fourteen locations within channels on-site when adopting best practice design standards as stated result in no significant localised effect in terms of restricted capacity that would cause any change to flood risk.
	Silt / suspended solid pollution of surface waters	Medium	Low	Likely	Minor	Temporary short-term construction activities within watercourses would be likely to cause a significant but temporary fundamental change in water quality in watercourses on the Site.
	Chemical pollution of surface waters	Medium	Low	Likely	Minor	Spillage of oils, chemicals, or cementitious material associated with temporary construction and arising due to improper site management would be likely to cause a fundamental but temporary change in water quality in watercourses on the Site.
Glencloy River & Braid River (off-site) (National / High)	Changes in runoff and flow patterns	Low	Moderate	Unlikely	Minor	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt "soft" rural SuDS features to ensure response to rainfall is not exacerbated. The Site as a proportion of the waterbody catchment is not significant.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
	Silt / suspended solid pollution of surface waters	Medium	High	Unlikely	Moderate	Riparian buffer zones, avoidance, and control of reduced quality runoff from the temporary and permanent works would cause runoff from the Site to have no effect exceeding normal seasonal or pre-existing fluctuations. Temporary short-term construction activities within upstream watercourses would be likely to cause a detectable but temporary change in water quality in the immediate downstream environment.
	Chemical pollution of the watercourse	High	High	Likely	Major	Spillage of oils, chemicals, or cementitious material associated with temporary construction, particularly at works adjacent to or within watercourses, and arising due to improper site management would be likely to cause a fundamental but temporary change in water quality in the downstream environment.
Bedrock Groundwater / Aquifers (Local / Low)	Alteration of Groundwater	Low	Negligible	Unlikely	Not Significant	No significant excavations within the bedrock are expected. Significant dewatering with the potential for affecting groundwater levels is not anticipated.
	Chemical pollution of groundwater	Low	Negligible	Likely	Minor	Bedrock is expected to be shallow in several areas, with limited thickness of Superficial Deposits however depth to groundwater is anticipated to be significant and dominated by fracture flow.
Private water supplies (Local / Low)	Disruption to quantity or quality of supply	Negligible	Negligible	Unlikely	Not Significant	No infrastructure is proposed within 250m of any known or potential abstraction location and as such no supply would be affected.
Hydro Power Abstractions (Local / Low)	Disruption to quantity of supply	Negligible	Negligible	Unlikely	Not Significant	Design of watercourse crossings and surface water management ensures that existing flow paths are maintained and there will be no loss of water to downstream abstractions.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
Tracks, turbines and associated buildings. (Local / Low)	Risk to occupants and infrastructure due to identified potential risk of flooding.	Low	Negligible	Unlikely	Not Significant	The proposed development has been designed to avoid areas potentially susceptible to fluvial flooding and pluvial ponding.
	Risk to occupants due to presence of Radon	Low	Negligible	Unlikely	Not Significant	Proposed buildings will be designed to incorporate appropriate protection measures as may be required.
Watercourses, Groundwater and Land / Soils – (Varies up to National / High)	Risk of contamination due to accidental fire at BESS facility.	Negligible	Low	Rare	Not Significant	Battery storage containers are sealed to ensure that any potential single cell thermal runaway is contained. Therefore, the amount of potential pollutants will be limited to the gas vented from one cell but will be contained within the sealed unit limiting any potential impact to the wider environment.

Additional Mitigation Measures – Construction Phase

9.249 Additional mitigating measures, over and above the avoidance and buffer zones and measures to manage surface water previously detailed, are intended to reduce or prevent the residual significant hazards which may not be fully mitigated by the design evolution and avoidance.

Water Quality Monitoring

9.250 A water quality monitoring program will be implemented to monitor effects on the surface water quality regime during the infrastructure construction, operational and decommissioning phases of the proposed development, in order to;

- Demonstrate that the mitigation measures and surface water management is performing as designed;
- Provide validation that the in-place mitigation measures are not having an adverse effect upon the environment;
- Indicate the need for additional mitigation measures to prevent, reduce or remove any effects on the water environment, such as additional temporary settlement or filtration structures or short-term flocculant dosing to suit observed site conditions.

9.251 The monitoring would be informed by existing water quality baseline data presented in **paragraphs 9.149** through **9.152** of this assessment and baseline monitoring rounds undertaken prior to the commencement of the construction phase.

9.252 It is intended that the water monitoring extent, duration and frequency will be agreed with the Department for Infrastructure or the relevant regulating body (nominally NIEA:WMU) post consent and will nominally consist of physicochemical and biological monitoring. The extent, duration and frequency of the monitoring will be proportionate to the level of activity during each phase of the proposed development and the associated perceived risks.

Pollution Prevention

Pollution Prevention Plan

9.253 A detailed Pollution Prevention Plan (PPP) will be implemented and monitored by the site manager as part of a full Construction & Decommissioning Method Statement (CDMS) for the project, to be submitted post-consent following detailed site investigations and agreed with the local planning authority. Although this will be of particular importance during construction, it will apply to potentially polluting activities during all phases of the proposed development.

9.254 The detailed PPP will be produced following consultation and agreement with NIEA, and all appropriate personnel working on the Site will be trained in its use. As a minimum, the PPP will comply with Guidance for Pollution Prevention (GPP) and Pollution Prevention Guidelines (in particular GPP 21: Pollution Incident Response

Planning) and best practice as advocated by CIRIA. The PPP will identify site-specific measures and incorporate a Pollution Incident Plan, which will include emergency contact details, details of spill kits on the Site and instructions on actions in case of spillage / emergency.

9.255 Measures to be incorporated within the PPP are identified in the following sections.

Pollution Prevention Measures

9.256 During all phases the site manager will ensure that mitigation measures as identified within this assessment are fully implemented and that activities are carried out in such a manner as to prevent or reduce effects. The following construction and decommissioning phase-specific measures will be implemented. The following sections should be read in conjunction with the construction management information provided within **Chapter 1: Introduction and Proposed Development.**

9.257 To ensure best practice on site and to help avoid pollution release to watercourses and groundwater, the following NIEA Guidance for Pollution Prevention (GPP) and Pollution Prevention Guidance (PPGs) will be adhered to:

- GPP1 Understanding Your Environmental Responsibilities - Good Environmental Practices
- GPP2 Above Ground Oil Storage Tanks
- GPP 4 Treatment and disposal of Wastewater where there is no connection to the public foul sewer
- GPP 5 Works and Maintenance in or near Water
- GPP 8 Safe Storage and Disposal of Used Oils
- GPP 20 Dewatering Underground Ducts and Chambers
- GPP 21 Pollution Incident Response Planning
- GPP 22 Dealing with Spills
- GPP 26 Safe Storage of Drums and Intermediate Bulk Containers.
- PPG 3 Use and Design of Oil Separators in Surface Water Drainage Systems
- PPG 6 Working at Construction and Demolition Sites
- PPG 7 Safe Storage – The Safe Operation of Refuelling Facilities

9.258 Key requirement for control of chemical pollution risk are identified in the above guidance and will include the following:

Storage

9.259 All equipment, materials and chemicals on the Site will be stored away from any watercourse (i.e., outwith previously stated buffer zones). Chemical, fuel and oil stores will be sited on impervious bases in accordance with GPP2 and within a secured bund of 110% of the storage capacity, within the temporary storage compound

Vehicles and Refuelling

9.260 Standing machinery will have drip trays placed underneath to prevent oil and fuel leaks causing pollution. Refuelling of vehicles and machinery will be carried out on an impermeable surface in designated areas, well away from any watercourse or drainage ditches (i.e., outwith previously stated buffer zones) and will adhere to best practice as detailed in PPG 7.

Maintenance

9.261 Onsite maintenance to construction plant will be avoided in all practicable instances, unless vehicles have broken down necessitating maintenance at the point of breakdown. Suitable measures in accordance with a Pollution Prevention Plan (PPP) will be put in place prior to commencement of maintenance in this instance.

Cement and concrete batching

9.262 Preference shall be given to construction techniques that do not require use of cementitious materials where suitable practicable alternatives exist. When concrete / cement is used, concrete batching will not be permitted on site. Wet concrete operations will not be carried out within watercourses or adjacent to watercourses. Measures to prevent discharge of alkaline wastewaters or contaminated storm water to watercourses will be outlined in a detailed PPP for the Site to be approved by NIEA before commencement of works. Wastewater spillage will be minimised by using settling tanks and recycling water.

Mess and welfare facilities

9.263 Mess and welfare facilities will be required during construction and decommissioning and will be located at the construction compound. Foul effluent disposal shall be via chemical facilities with periodic tankered removal by a licensed waste haulier for licensed offsite disposal (i.e. there shall be no emission on site).

Construction Best Practice

Construction in the vicinity of Watercourses

9.264 The following procedures apply to the general construction activities either within the watercourses or in defined watercourse buffer zones:

- Due consideration will be given to the prevailing ground and weather conditions when programming the execution of the works in order to ensure that in-channel works are undertaken during periods of predicted low flow and low rainfall in order to minimise contact with water.
- Ensure that roadside drains do not discharge directly into watercourses, but rather through a riparian buffer area of intact vegetation as denoted on design drawings.

Construction of Watercourse Crossings

9.265 Construction of watercourse crossings will be programmed to coincide with periods of predicted low flow in the affected channel (determined by rainfall and would generally coincide with summer months). Construction will be strictly as per the design for each identified watercourse crossing and will fully implement all SuDS and additional mitigating measures proposed at the detailed design stage. For purposes of outline design, the proposed mitigation will include:

- Installation of silt fences parallel to the watercourse channel in the vicinity of the proposed crossing;
- Installation of small cut-off drains to prevent natural surface runoff entering area of construction activity;
- Installation of filtration or other silt entraining features within the watercourse channel immediately downstream of the works location;
- Use of damming and over pumping to allow a dry working environment where deemed appropriate.

Temporary SuDS

9.266 Temporary drainage and silt management features (SuDS) will be constructed prior to earthworks (including preliminary or enabling works) proceeding to construct any linear works (tracks / hardstanding areas / cable routes), turbine bases, and other infrastructure. Drainage will be provided to temporary works and reinstated to suit the final footprint of the completed development.

9.267 Temporary drainage measures in particular will be employed in enabling works to facilitate widening of existing tracks.

9.268 Temporary measures may include:

- Temporary silt fences erected in areas where risk of pollution to watercourses has been identified e.g. watercourse crossing locations and areas where tracks or other infrastructure lie within watercourse buffer zones.
- Placing temporary filtration silt fences within drainage channels where siltation is observed.
- Installing temporary constructed settlement features such as sumps or settlement ponds / lagoons where required.
- Upslope cut-off drainage channels approximately parallel to the proposed track alignment installed in advance of any excavated cuttings for the track or turbine hardstanding areas.
- Watercourses, drains, natural flow paths and cut-off drain outlet locations should be identified and charted, in order to ensure that piped crossings can be installed in advance of or adjacent to the track construction.

- Settlement ponds should be constructed in advance of commencing excavations for foundations and at any other locations identified as required at detailed design stage.
- Trackside drainage swales should be installed in parallel with track construction. Note that this may require that drainage swales are reformed on an ongoing basis as temporary track alignments are modified to their eventual finished design level.

9.269 Suitable prevention measures should be in place at all times to prevent the conveyance of silts to receiving watercourses.

Electrical Cable Laying

9.270 Due consideration will be given to the prevailing ground conditions and season when programming the execution of cable trench excavations in order to ensure works are undertaken during periods with low rainfall and elevated shallow groundwater levels in order to reduce the likelihood of runoff entering the excavations.

9.271 Excavation of cable trenches will be carried out over short distances, with frequent backfilling of trenches to minimise opportunity for the ingress of water into open trenches, temporary silt traps will be provided in longer trench runs and on steeper slopes and spoil will be stored in line with a spoil management plan, which will be produced as part of the CDMS at the pre-construction stage.

Excavations and Spoil Management

9.272 Soil and subsoil excavation and movement will be undertaken in accordance with best practice guidelines such as Good Practice Guide for Handling Soils (MAFF, 2000) in order to minimise potential for silt laden runoff from spoil and excavations. Areas of stockpiled spoil including stored peat:

- will not be permitted within previously identified watercourse buffer zones; and
- will not be permitted to obstruct the flow of overland surface water with specific drainage to spoil mounds to be provided.

9.273 Material produced from excavations on the Site will be reused where reasonably practicable in the reinstatement of the Site. Excavated materials will be separated into rock material, subsoil, reusable peat and vegetated sod material and will be stored in the designated temporary stockpile zones, under the supervision of a geotechnical expert. These materials will be reused where possible to re-grade slopes, and to re-vegetate and stabilise the sides of access tracks and hard standing areas.

9.274 Spoil drainage will be designed on a bespoke basis for spoil storage areas to allow controlled dewatering and prevent washout of suspended solids to the receiving water environment. As part of the detailed CDMS a spoil management strategy will be developed by the appointed competent contractor for the development. Outline designs for drainage arrangements for temporary spoil areas are shown on the

Drainage Management Drawings within **Appendix 9.1: Water Framework Directive Assessment.**

Ditch Blocking and Earthworks for Habitat Enhancement

9.275 It is proposed that localised ditch blocking be carried out for the purposes of habitat enhancement / restoration. Details are provided in the Outline Habitat Management Plan (OHMP) in Appendix 6.6.

9.276 Ditch blocking downgradient of areas of earthworks will have an additional beneficial effect by providing settlement to reduced quality runoff from lands upgradient.

Dewatering of Excavations

9.277 The majority of the turbine base foundations will be on bedrock or other hard strata above bedrock (to be confirmed by detailed site investigation prior to detailed design); therefore, deep excavations within bedrock and the associated bedrock aquifer are not anticipated and dewatering below the bedrock aquifer groundwater table is therefore not anticipated.

9.278 Shallow groundwater (e.g., in areas of glacial sand and gravel) or rainfall runoff collected in excavations will be discharged via settlement ponds or filter strips prior to entry to the receiving water environment.

9.279 Any settlement lagoons or filter strips associated with dewatering will be regularly inspected, particularly after periods of heavy rainfall and prior to periods of forecast heavy rainfall. Maintenance (to clear blockages or remove silt) will be carried out in periods of dry weather where practicable. Maintenance requirements are further considered in **Appendix 9.1: Surface Water Management Plan.**

Dust Management

9.280 Loose track material generated during the use of access tracks and the construction compound will be prevented from reaching watercourses by maintenance to surface water drainage systems installed at aggregate based hard standing areas. In dry weather dust suppression methods such as by dust suppression bowser will be employed.

Borrow Pits

9.281 For the avoidance of doubt, no borrow pits outside the development footprint are proposed at the Site, therefore associated pollution risks associated with rock extraction activities are not a consideration.

Maintenance of Pollution Prevention Measures

9.282 All SuDS and additional pollution prevention measures installed will be subject to a regular maintenance regime for the life of the construction phase in order to maintain functionality of all features. This will comprise:

- Unblocking of drains;
- Maintenance of access road and other hard standing surfaces;
- Replacement of filtration features;
- Removal of silt build-up from settlement and filtration features.

Mitigating Measures - Operational Phase

9.283 Mitigation of the effects of the wind farm development will comprise the following:

- Ensure best practice is adhered to on the Site and avoid pollution release to watercourses by incorporating NIEA Pollution Prevention Guidance notes into management policy.
- In the event that permanent welfare facilities are installed as part of control building / substation facilities, foul effluent will be disposed of through the use of sealed cesspools or chemical facilities with periodic tankered removal by a licensed waste haulier for licensed offsite disposal (i.e., there shall be no emission on the site).
- A fire management response plan will be prepared in conjunction with the battery supplier and with the local Fire Service prior to construction. This will outline containment measures and chemical fire suppressant methods which will be implemented to mitigate risk of potential contamination to land or water environment. In the event of a fire all wastes will be dealt with appropriately through the procedures agreed within the site-specific Fire Management Plan to be prepared post-consent.
- Cyclical maintenance of permanent SuDS drainage features installed during the construction phase, including unblocking of drains, maintenance of access road and other hard standing surfaces, and removal of silt build-up from settlement features. An outline maintenance programme is included in **Appendix 9.1: Appendix 9.1: Surface Water Management Plan.**

Mitigating Measures and Residual Effects

9.284 The following table details the assessed impact magnitude, likelihood and associated significance as a function of the matrix stated previously of all receptors identified as previously having an unmitigated impact significance greater than ‘not significant’.

Table 9.17: Mitigated Effects

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
On-site significant watercourses – Ticloy Water and Glencloy River (National / High)	Changes in runoff and flow patterns	Negligible	Low	Rare	Not Significant	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt “soft” rural SuDS features to ensure response to rainfall is not exacerbated. Design of crossings of significant watercourses at six locations within channels on-site when adopting best practice design standards as stated result in no significant localised effect in terms of restricted capacity that would cause any change to flood risk. The drainage strategy adopted ensures that natural catchments are mirrored and ensures that water is not lost from the catchment that would result in a loss of available water for abstraction.
	Silt / suspended solid pollution of surface waters	Negligible	Low	Rare	Not Significant	Surface water management and pollution control and in particular to work in and adjacent to watercourses, is likely to result in no permanent change and no significant temporary change in conditions exceeding natural or pre-existing conditions.
	Chemical pollution of surface waters	Negligible	Low	Rare	Not Significant	Pollution prevention measures proposed to control chemical pollution at all phases is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions. Robust water quality monitoring will permit a rapid response to any residual risk.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
On-site Minor Drainage (Local / Low)	Changes in runoff and flow patterns	Negligible	Low	Rare	Not Significant	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt “soft” rural SuDS features to ensure response to rainfall is not exacerbated. Design of crossings of minor watercourses at fourteen locations within channels on-site when adopting best practice design standards as stated result in no significant localised effect in terms of restricted capacity that would cause any change to flood risk.
	Silt / suspended solid pollution of surface waters	Negligible	Low	Rare	Not Significant	Surface water management and pollution control and in particular to work in and adjacent to watercourses, is likely to result in no permanent change and no significant temporary change in conditions exceeding natural or pre-existing conditions.
	Chemical pollution of surface waters	Negligible	Low	Rare	Not Significant	Pollution prevention measures proposed to control chemical pollution at all phases is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions. Robust water quality monitoring will permit a rapid response to any residual risk.
Glencloy River & Braid River (off-site) (National / High)	Changes in runoff and flow patterns	Negligible	Low	Rare	Not Significant	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt “soft” rural SuDS features to ensure response to rainfall is not exacerbated. The site as a proportion of the waterbody catchment is not significant.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
	Silt / suspended solid pollution of surface waters	Negligible	Low	Rare	Not Significant	Riparian buffer zones, avoidance, and control of reduced quality runoff from the temporary and permanent works would cause runoff from the site to have no effect exceeding normal seasonal or pre-existing fluctuations. Surface water management and pollution control in particular to work in and adjacent to watercourses, is likely to result in no permanent change and no significant temporary change in conditions exceeding natural or pre-existing conditions.
	Chemical pollution of the watercourse	Negligible	Low	Rare	Not Significant	Pollution prevention measures proposed to control chemical pollution at all phases is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions. Robust water quality monitoring will permit a rapid response to any residual risk.
Bedrock Groundwater / Aquifers (Local / Low)	Alteration of Groundwater	Low	Negligible	Unlikely	Not Significant	No significant excavations within the bedrock are expected. Significant dewatering with the potential for affecting groundwater levels is not anticipated.
	Chemical pollution of groundwater	Low	Negligible	Unlikely	Not Significant	Bedrock is expected to be shallow in several areas, with limited thickness of Superficial Deposits however depth to groundwater is anticipated to be significant and dominated by fracture flow. Pollution prevention measures proposed to control chemical pollution at all phases is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
Watercourses, Groundwater and Land / Soils – (Varies up to National / High)	Risk of contamination due to accidental fire at BESS facility.	Negligible	Low	Rare	Not Significant	A fire management response plan will be prepared in conjunction with the battery supplier and with the local Fire Service prior to construction. This will outline containment measures and chemical fire suppressant methods which will be implemented to mitigate risk of potential contamination to land or water environment. In the event of a fire all wastes will be dealt with appropriately through the procedures agreed within the site-specific Fire Management Plan to be prepared post-consent.

Cumulative Effects

9.285 An assessment has been undertaken of the cumulative effect on geology and the water environment of the Development in conjunction with other known wind farms and other significant developments in planning, construction or operation at the time of the application.

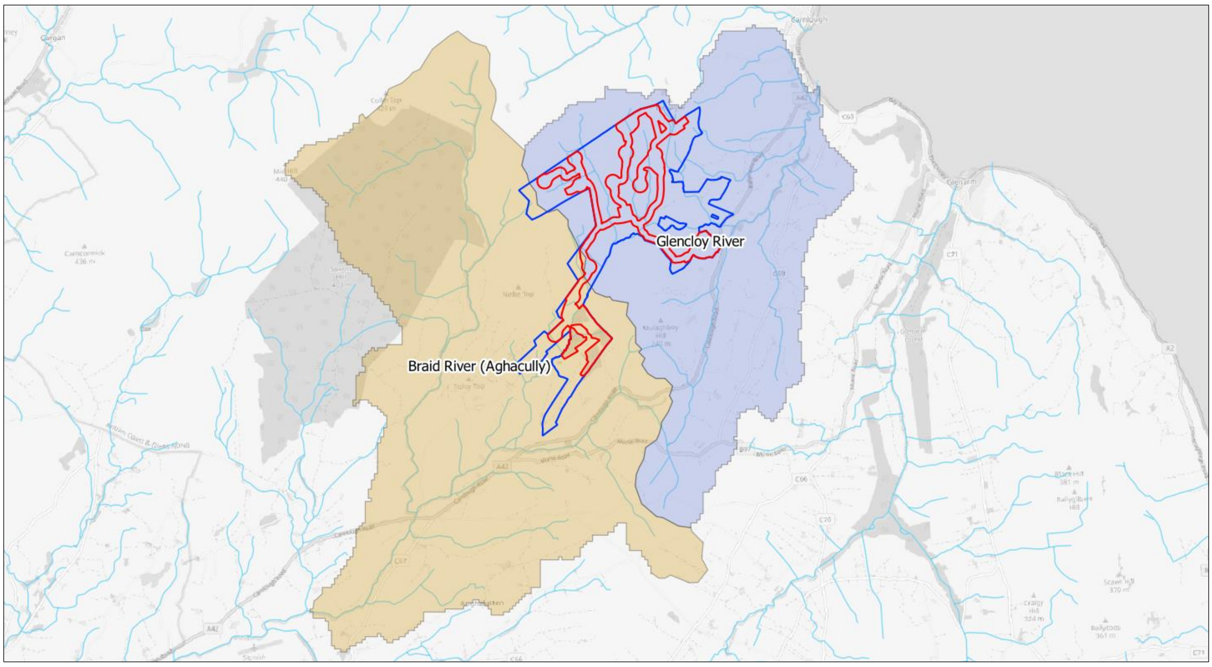
9.286 The assessment aims to determine potential for cumulative impact within the hydrological, hydrogeological and geological setting of the site caused by an accumulation of similar developments.

9.287 The hydrological and hydrogeological setting of the site for the purposes of the assessment is the downstream Glencloy River and Ticloy Water (including Braid River (Aghacully)) as identified on the DfI Rivers interactive catchment mapping website and shown on the following **Plate 9-15**.

9.288 No other significant wind farm development is planned or operational within that setting and as such potential for cumulative effect is discounted.

9.289 If considering a wider setting, then as no likely significant residual water environment or geological effects are predicted arising from the Development, there is no potential significant cumulative effect to water or the geological environment in conjunction with any other pre-existing or future development.

Plate 9-15: Hydrological Setting



Summary and Conclusions

9.290 This assessment identifies the potential geological, hydrological, and hydrogeological impacts, including surface and groundwater quality of the Development. It summarises the relevant legislation and guidance and provides appropriate baseline information, enabling the potential effects to be identified.

9.291 Aspects of the design, construction and operation of the Development that may potentially impact on the receiving geological and water environment have been identified and the pathways for impacts assessed. It has been determined that without mitigation the Development would be likely to cause adverse impacts of major significance primarily driven by the sensitivity of fisheries interests on and shortly downstream of the Site. As such, informed by the baseline assessment and pathways identified, mitigation integrated as part of outline design and proposed during construction phase includes:

- Avoidance of water features based on baseline constraints mapping;
- Design of site elements to minimise impact on the geological and water environment;
- Implementation of a comprehensive surface water management plan comprising the use of SuDS (drainage) and silt management in order to prevent pathways for pollution;
- Construction phase pollution prevention procedures in accordance with NIEA requirements and guidance.

9.292 Monitoring of the effect of the Development on the water environment and fisheries habitat will be provided by the Applicant through physicochemical and biological water quality monitoring. Implementation of the mitigation proposed eliminates or reduces the potential significance to all receptors to “not significant”.

9.293 There is no likelihood of significant cumulative impacts over and above any pre-existing effect caused by existing or consented wind development.

10

Noise

Glossary

A-weighting

A frequency-response function providing good correlation with the sensitivity of the human ear.

Broadband Noise

Noise which covers a wide range of frequencies (see Frequency).

Decibel dB(A)

The decibel (dB) is a logarithmic unit used in acoustics to quantify sound levels relative to a 0 dB reference (e.g. a sound pressure level of $2*10^{-5}$ Pa). The 'A' signifies A-weighting.

Equivalent Continuous Sound Level (L_{eq})

The equivalent continuous sound level is a notional steady noise level, which over a given time would provide the same energy as the intermittent noise.

Frequency

Refers to how quickly the air vibrates, or how close the sound waves are to each other and is measured in cycles per second, or Hertz (Hz). The lowest frequency audible to humans is 20 Hz and the highest is 20,000 Hz. The human ear is most sensitive to the 1 kHz, 2 kHz and 4 kHz octave bands and much less sensitive at lower audible frequencies.

Frequency Spectrum

Description of the sound pressure level of a source as a function of frequency.

Percentile Sound Level (L_{90})

Sound pressure level exceeded for 90% of the time for any given time interval. For example, $L_{(A)90,10min}$ means the A-weighted level that is exceeded for 90% of a ten minute interval. This indicates the noise levels during quieter periods, or the background noise level. It represents the lower estimate of the prevailing noise level and is useful for excluding such effects as aircraft or dogs barking on background noise levels.

Noise Emission

The noise energy emitted by a source (e.g. a wind turbine).

Noise Immission

The sound pressure level detected at a given location (e.g. nearest dwelling).

Octave Band

Range of frequencies between one frequency ($f_0*2^{-1/2}$) and a second frequency ($f_0*2^{+1/2}$). The quoted centre frequency of the octave band is f_0.

Sound Power Level

Sound power level is the acoustic power radiated from a sound source and is independent of the surroundings. It is a logarithmic measure in comparison to a reference level (10^{-12} watts).

Sound Pressure Level

A logarithmic measure of the effective sound pressure of a sound relative to a reference value which is for minimum audible field conditions ($20*10^{-6}$Pa).

Third Octave Band

The range of frequencies between one frequency ($f_0*2^{-1/6}$) and a second frequency equal to ($f_0*2^{+1/6}$). The quoted centre frequency of the third octave band is f_0.

Tonal Noise

A noise that contains a noticeable or discrete, continuous note and includes noises such as hums, hisses, screeches.

10 Acoustic Assessment

Introduction

10.1 This chapter contains an assessment of the acoustic impact of the proposed Unshinagh Wind Farm (hereafter referred to as the proposed development). The report assesses wind farm operational noise and construction noise at the nearest residential properties.

10.2 This chapter is supported by the following:

- Figure 10.1 – Predicted Noise Footprint due to Proposed Wind Farm;
- Figure 10.2 – Predicted Cumulative Noise Footprint;
- Technical Appendix 10.1 - Assessment of Energy Storage Facility;
- Technical Appendix 10.2 – Scope of Assessment;
- Technical Appendix 10.3 – Calculating Standardised Wind Speed;
- Technical Appendix 10.4 – Propagation Height & Valley Effect;
- Technical Appendix 10.5 – Background Noise Survey Photos;
- Technical Appendix 10.6 – Instrumentation Records;
- Technical Appendix 10.7 – Charts;
- Technical Appendix 10.8 – Suggested Planning Conditions; and
- Glossary.

10.3 Figures and Technical Appendices are referenced in the text where relevant.

Statement of Authority

10.4 This assessment has been undertaken by RES, with at least one in-house Member of the Institute of Acoustics involved in its production. RES has undertaken acoustic impact assessments in every single one of its UK wind farm development applications since 2000. RES has also carried out noise assessments and reported to several local planning authorities on operational wind energy projects, including taking measurements on newly constructed wind farms to ensure compliance with planning conditions.

10.5 Additionally, RES has been project co-ordinator for several Joule[1] projects, leading European research into wind turbine noise, was involved in producing the guideline 'The Assessment and Rating of Noise from Wind Farms'[2] for the DTI in 1996, acted as peer reviewer for the 'Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'[3], and contributed to the RenewableUK work on Amplitude Modulation[4]. Publications include:

- 'An Investigation of Blade Swish from Wind Turbines', P Dunbabin, Proceedings of the 1996 International Congress on Noise Control Engineering (Internoise '96), 30 July – 2 August 1996, Book 1, pp 463 – 469;

[1] DGXII European Commission funded projects in the field of Research and Technological Development in non-nuclear energy

[2] 'The Assessment and Rating of Noise from Wind Farms', The Working Group on Noise from Wind Turbines, ETSU Report for the DTI, ETSU-R-97, September 1996. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/49869/ETSU_Full_copy__Searchable_.pdf

[3] 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise', Institute of Acoustics, May 2013. Available at: https://www.ioa.org.uk/publications/wind-turbine-noise

[4] 'Wind Turbine Amplitude Modulation: Research to Improve Understanding as to its Cause and Effects', RenewableUK, December 2013. Available at: http://usir.salford.ac.uk/id/eprint/33475/

- 'An Automated System for Wind Turbine Tonal Assessment', R Ruffle, Proceedings of the 1996 International Congress on Noise Control Engineering (Internoise '96), 30 July – 2 August 1996, Book 6, pp 2997 – 3002;
- 'Wind Turbine Measurements for Noise Source Identification', ETSU W/13/003914/00.REP, 1999, Dr P Dunbabin, RES et al;
- 'A Critical Appraisal of Wind Farm Noise Propagation', ETSU W/13/00385/REP, 2000 Dr J Bass, RES;
- 'Aerodynamic Noise Reduction for Variable Speed Turbines', ETSU/W/45/00504/REP, 2000, Dr P Dunbabin, RES;
- 'Fundamental research in amplitude modulation - a project by RenewableUK', Dr J Bass et al, Fourth International Meeting on Wind Turbine Noise, Rome, April 2011;
- 'Investigation of the 'Den Brook' Amplitude Modulation methodology for wind turbine noise', Dr J Bass, Acoustics Bulletin Vol 36 No 6 November/December 2011;
- 'How does noise influence the design of a wind farm?', Dr M Cassidy, Fifth International Conference on Wind Turbine Noise, Denver, 2013;
- 'Propagation of Noise from Wind Farms According to the Good Practice Guide', A Birchby, Sixth International Conference on Wind Turbine Noise, Glasgow, 2015;
- 'Addressing the Issue of Amplitude Modulation', Dr M Cassidy, Sixth International Conference on Wind Turbine Noise, Glasgow, 2015;
- 'A Method for Rating Amplitude Modulation in Wind Turbine Noise', Institute of Acoustics Noise Working Group, August 2016; and
- 'Pre-construction Site Prediction Tool for Wind Farm AM – Do We Now Know Enough?', A Birchby, Seventh International Conference on Wind Turbine Noise, Rotterdam, 2017.

Wind Turbine Noise

10.6 In the context of other sources of environmental noise, the noise levels produced by wind turbines are generally low and have greater dependence upon wind speed. The combination of these two factors implies that a degree of masking would often be provided by background noise.

10.7 As described by the Department of the Environment in Best Practice Guidance to Planning Policy Statement 18[5]:

"There are two quite distinct types of noise source within a wind turbine. The mechanical noise produced by the gearbox, generator and other parts of the drive train; and the aerodynamic noise produced by the passage of the blades through the air. Since the early 1990s there has been a significant reduction in the mechanical noise generated by wind turbines and it is now usually less than, or of a similar level to, the aerodynamic noise. Aerodynamic noise from wind turbines is generally unobtrusive – it is broad-band in nature and in this respect is similar to, for example, the noise of wind in trees."

[5] 'Best Practice Guidance to Planning Policy Statement 18: Renewable Energy', PPS18, August 2009

Construction Noise

10.8 The sources of construction noise, which are temporary, would vary both in location and duration as the different elements of the wind farm are constructed and would arise primarily through the operation of large items of plant.

10.9 Noise would also arise due to the temporary increase in construction traffic near the site. This level would also depend on the particular construction phase of the proposed development.

Scope of Assessment

10.10 Noise can have an effect on the environment and on the quality of life enjoyed by individuals and communities. The effect of noise, both in the construction and operational phase, is therefore a material consideration in the determination of planning applications.

Operational Noise

10.11 The main focus of the assessment of operational noise presented here is based on the most relevant type of noise emission for modern wind turbines: aerodynamic noise, which is broadband in nature. Mechanical noise, which can be tonal in nature, is also considered albeit less relevant to modern wind turbines. Implicitly incorporated within this assessment is the normal character of the noise associated with wind turbines (commonly referred to as 'blade swish') and consideration of a range of noise frequencies, including low frequencies.

10.12 An acoustic assessment considering the operation of the proposed Energy Storage Facility can be found in **Technical Appendix 10.1**.

10.13 Low frequency content of the noise from wind farms shall be considered through the use of octave band specific noise emission and propagation modelling, however it is considered that specific and targeted assessment on low frequency content of noise emissions from the proposed wind farm is unjustified. Details for scoping out low frequency noise from the acoustic assessment, as well as infrasound, sleep disturbance, vibration, amplitude modulation and wind turbine syndrome can be found in **Technical Appendix 10.2**.

10.14 A summary of the findings of a comprehensive study into wind turbine noise and associated health effects can be found in **Technical Appendix 10.2**.

Construction Noise

10.15 The acoustic impact assessment of construction noise from the wind farm presented here is based on RES's experience of constructing wind farms and calculated for the operation of the primary large items of construction equipment. Additionally, consideration is given to the increased noise levels due to increased traffic flows during the construction phase to and from the site.

10.16 Whilst noise would also arise during decommissioning of the proposed development (through turbine deconstruction and breaking of the exposed part of the concrete bases) this is not discussed separately as noise levels resulting from it are expected to be lower than those during construction due to the number and type of activities involved. The impact of decommissioning can therefore be considered in light of the conclusions of the construction noise assessment.

Legislative Framework & Guidance

Operational Noise

10.17 Within Northern Ireland, noise from wind farms is defined within the planning context by Planning Policy Statement 18: Renewable Energy[6]. Best Practice Guidance to Planning Policy Statement 18: Renewable Energy[5] refers to the use of the Department of Trade and Industry's 'The Assessment and Rating of Noise from Wind Farms' (ETSU-R-97). In relation to noise from wind farms the Planning Policy states:

"The report, 'The Assessment and Rating of Noise from Wind Farms' (ETSU-R-97), describes a framework for the measurement of wind farm noise and gives indicative noise levels calculated to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development."

10.18 It is therefore considered that the use of ETSU-R-97, as a criterion for assessment of wind farm noise, fulfils the requirements of Planning Policy Statement 18.

10.19 The methodology described in ETSU-R-97 was developed by a working group comprised of a cross-section of interested persons including, amongst others, environmental health officers, wind farm operators and independent acoustic experts.

10.20 ETSU-R-97 makes it clear from the outset that any noise restrictions placed on a wind farm must balance the environmental impact of the wind farm against the national and global benefits that arise through the development of renewable energy resources. The principle of balancing development needs against protection of amenity may be considered common to any type of noise control guidance.

10.21 The basic aim of ETSU-R-97, in arriving at the recommendations contained within the report, is the intention to provide:

"Indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development or adding unduly to the costs and administrative burdens on wind farm developers or local authorities."

10.22 An article published in the Institute of Acoustics Bulletin (IoA Bulletin) Vol. 34 No. 2, March/April 2009[7], recommends a methodology for addressing issues not made explicit by, or outside the scope of, ETSU-R-97, such as in relation to wind shear or noise propagation modelling. Whilst this article does not represent formal legislation or guidance it was authored by a group of independent acousticians experienced in wind farm noise issues who have undertaken work on behalf of wind farm developers, local planning authorities and third parties and as such is a good indicator of best practice techniques. The assessment presented herein adopts the recommendations made within this article.

10.23 A Good Practice Guide (IoA GPG) to the application of ETSU-R-97 for the assessment and rating of wind turbine noise[3], issued by the Institute of Acoustics in May 2013 and

[6] 'Planning Policy Statement 18: Renewable Energy', PPS18, August 2009

[7] 'Prediction and Assessment of Wind Turbine Noise', Bowdler et al, Acoustics Bulletin Vol 34 No 2 March/April 2009

endorsed by the Northern Ireland Executive, along with the governments in England, Scotland and Wales, provides guidance on all aspects of the use of ETSU-R-97 and reaffirms the recommendations of the Acoustics Bulletin article with regard to propagation modelling and wind shear. The assessment presented herein adopts the recommendations of the Good Practice Guide.

10.24 Supplementary guidance notes were published by the Institute of Acoustics in July and September 2014, and these provide further details on specific areas of the IoA GPG[8]. The assessment presented herein adopts the recommendations made within these supplementary guidance notes.

10.25 ETSU-R-97 has been applied at the vast majority of wind farms currently operating in the UK and provides a robust basis for assessing the noise impact of a wind farm when used in accordance with the IoA GPG. It is the only relevant guidance referenced in Northern Ireland planning policy for rating and assessing operational wind farm noise. Based on planning policy and guidance, as outlined above, a wind farm which can operate within noise limits derived according to ETSU-R-97 shall be considered acceptable. This approach has been agreed with Mid & East Antrim Borough Council.

Construction Noise

10.26 In Northern Ireland, advice on construction noise assessment is referred to in 'The Control of Noise (Codes of Practice for Construction and Open Sites) Order (Northern Ireland) 2002'[9]. This legislation points to BS 5228: Part 1:1997 for guidance on appropriate methods for minimising noise from construction and open sites in Northern Ireland.

10.27 Since the 1997 version of BS 5228 has been superseded by BS 5228-1:2009 'Code of practice for noise and vibration control on construction and open sites - Part 1: Noise'[10] this has been identified as being the appropriate source of guidance on appropriate methods for minimising noise from construction activities, and is adopted herein.

10.28 The Pollution Control and Local Government (NI) Order 1978 provides information on the need for ensuring that best practicable means are employed to minimise noise[11].

Consultation

10.29 Details of the consultation undertaken are outlined in **Table 10.1**.

[8] 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise - Supplementary Guidance Notes', Institute of Acoustics, July & September 2014. Available at https://www.ioa.org.uk/publications/wind-turbine-noise

[9] 'The Control of Noise (Codes of Practice for Construction and Open Sites) Order (Northern Ireland) 2002', The Department of the Environment, November 2002

[10] 'Code of Practice for Noise and vibration control on construction and open sites - Part 1: Noise', British Standards Institution, BS 5228-1:2009

[11] 'Pollution Control and Local Government (NI) Order 1978', published by Her Majesty's Stationary Office, 1978

Table 10.1: Acoustic Assessment Consultation

Consultees	Date of Consultation	Nature and Purpose of Consultation
Mid & East Antrim Borough Council	31/03/21	Report "Planned Acoustic Assessment at the Proposed Unshinagh Wind Farm" (ref. 04291-2285662-01) sent to Environmental Health Officer (EHO).
Mid & East Antrim Borough Council	01/04/21	Response from EHO to say they are content with three of the proposed survey locations but that there are other properties near H29, namely H33, that aren't in the vicinity of a working farmyard and may result in lower backgrounds.
Mid & East Antrim Borough Council	13/04/21	Email to EHO to say that RES will seek permission to survey at H33 and ask if they would like to attend the survey setup.
Mid & East Antrim Borough Council	13/04/21	Email from EHO to say that they would like to attend the survey setup.
Mid & East Antrim Borough Council	12/05/21	Report "Noise Survey Locations for the Acoustic Assessment of the Proposed Unshinagh Wind Farm" (ref. 04291-2464839-01) sent to EHO.
Mid & East Antrim Borough Council	12/05/21	Email from EHO confirming receipt and no comments.

Methodology

Operational Noise

10.30 To ensure adequate assessment of the potential impacts of the operational noise from the proposed wind farm the following steps have been taken, in accordance with relevant guidance detailed above:

- The baseline noise conditions at each of the nearest residential properties to the wind farm are established by way of representative background noise surveys;
- The noise levels at the nearest residential properties from the operation of the proposed development are predicted using a sound propagation model considering: the locations of the wind turbines; the intervening terrain; and the likely noise emission characteristics of the wind turbines;
- With due regard to relevant guidance or regulations the acoustic assessment criteria are derived; and
- The evaluation of the acoustic impact is undertaken by comparing the predicted noise levels with the assessment criteria.

Establishing Baseline Conditions

10.31 Similar to other assessments of noise impacts (most notably BS 4142[12],which ETSU-R-97 identifies as forming the basis of its recommendations), the ETSU-R-97 methodology requires the comparison of predicted noise levels due to turbine emissions (which vary with hub height wind speed) with noise limits based upon the noise levels already existing under those same conditions (i.e. the baseline conditions).

[12] 'Method for Rating Industrial Noise affecting Mixed Residential and Industrial Areas', British Standards Institution, 1997

10.32 Since background noise levels depend upon wind speed, as indeed do wind turbine noise emissions, it is important when making reference measurements to put them in that context. Thus, the assessment of background noise levels requires the measurement of not only noise levels, but concurrent wind conditions, covering a representative range of wind speeds. These wind measurements are made at the wind turbine site rather than at the residential properties, since it is this wind speed that would subsequently govern the wind farm's noise generation. Often the residential properties themselves will be sheltered from the wind and may consequently have relatively low background noise levels.

10.33 To establish the baseline conditions, sound level meters and associated apparatus are set-up to record the required acoustic information at a selection of the nearest residential properties geographically spread around the proposed wind farm site and which are likely to be representative of other residential properties in the locale.

10.34 Wind speed and direction are recorded as 10 minute averages for the same period as for the noise measurements, and are synchronised with the acoustic data to allow correlations to be established. The wind speed that is adopted for use is the same wind speed as that which drives the turbine noise levels.

10.35 The adoption of this wind speed was recommended within the article published in the IoA Bulletin and the subsequent IoA GPG. The methodology used to calculate standardised 10 m wind speed is described in **Technical Appendix 10.3**.

10.36 Prior to establishing the baseline conditions the acoustic data is filtered as follows:

- For each background noise measurement location, the measured noise data is divided into two sets, as specified by ETSU-R-97 and shown in **Table 10.2**:

Table 10.2: Definition of Time of Day Periods

Time of Day	Definition
Quiet daytime	18:00 - 23:00 every day 13:00 - 18:00 Saturday 07:00 - 18:00 Sunday
Night-time	23:00 - 07:00 every day

- Rainfall affected data is systematically removed from the acoustic data set. To facilitate this, a rain gauge is deployed at the wind farm site to record 10 minute rainfall data and identify potentially affected noise data. Both the 10 minute period containing the bucket tip and the preceding 10 minute period are removed from the dataset as recommended in the IoA GPG to account for the time it takes for the rain gauge tipping bucket to fill.
- Periods of measured background noise data thought to be affected by extraneous, i.e. non-typical, noise sources are identified and removed from the data set. Whilst some 'extraneous' data may actually be real, it tends to bias any trend lines upwards so its removal is adopted as a conservative measure.
- In practice this means close inspection of the measured background noise levels, comparison with concurrent data measured at nearby locations and consideration of both directional and temporal variation.

Modelling Noise Propagation

10.37 Whilst there are several sound propagation models available, the ISO 9613 Part 2 model has been used[13], this being identified as most appropriate for use in such rural sites[14]. The specific interpretation of the ISO 9613 Part 2 propagation methodology recommended in the aforementioned IoA Bulletin and the subsequent IoA GPG has been employed.

10.38 To make noise predictions it is assumed that:

- the turbines are identical;
- the turbines radiate noise at the power specified in this report;
- each turbine can be modelled as a point source at hub-height;
- each residential property is assigned a reference height to simulate the presence of an observer.

10.39 The sound propagation model takes account of attenuation due to geometric spreading and atmospheric absorption. The assumed temperature and relative humidity are 10 ˚C and 70 % respectively, as recommended in the IoA Bulletin and IoA GPG. Ground effects are also taken into account by the propagation model with a ground factor of 0.5 and a receiver height of 4 m used as recommended in the IoA Bulletin and IoA GPG.

10.40 The barrier attenuations predicted by ISO 9613 Part 2 have been shown to be significantly greater than those measured in practice under downwind conditions[14]. Therefore, barrier attenuation according to the ISO 9613 Part 2 method has been discounted. In lieu of this, where there is no direct line of sight between the residential property in question and any part of the wind turbine, 2 dB attenuation has been assumed as recommended in the IoA Bulletin and the IoA GPG.

10.41 Additionally, verification studies have also shown that ISO 9613 Part 2 tends to slightly underestimate noise levels at nearby dwellings in certain exceptional cases, notably in a valley type environment where the ground drops off between source and receiver. In these instances an addition of 3 dB(A) has been applied to the resulting overall A-weighted noise level as recommended by the IoA GPG. Further detail is provided in **Vol 4 Technical Appendix 10.4**.

10.42 To generate the ground cross sections between each turbine and each dwelling necessary for reliable propagation modelling, ground contours at 5 m intervals for the area of interest have been generated from 50 m grid resolution digital terrain data.

10.43 The predicted noise levels are calculated as L_{Aeq} noise levels and changed to the L_{A90} descriptor (to allow comparisons to be made) by subtraction of -2 dB, as specified by ETSU-R-97.

10.44 It has been shown by measurement-based verification studies that the ISO 9613 Part 2 model tends to slightly overestimate noise levels at nearby dwellings[14]. Examples of additional conservative assumptions modelled are:

- properties are assumed to be downwind of all noise sources simultaneously and at all times. In reality, this is not the case and additional attenuation would be expected when a property is upwind or crosswind of the proposed wind turbines;

[13] 'Acoustics - Attenuation of Sound During Propagation Outdoors, Part 2: General Method of Calculation', International Organisation for Standardisation, ISO 9613-2:1996

[14] 'A Critical Appraisal of Wind Farm Noise Propagation', ETSU Report W/13/00385/REP, January 2000

- although, in reality, the ground is predominantly porous (acoustically absorptive) it has been modelled as 'mixed', i.e. a combination of hard and porous, corresponding to a ground absorption coefficient of 0.5 as recommended by the IoA Bulletin and IoA GPG;
- receiver heights are modelled at 4 m above local ground level, which equates roughly to first floor window level, as recommended by the IoA Bulletin and IoA GPG. This results in a predicted noise level anything up to 2 dB(A) higher than at the typical human ear height of 1.2-1.8 m;
- trees and other non-terrain shielding effects have not been considered;
- an allowance for measurement uncertainty has been included in the sound power levels for the presented turbine.

Operational Noise Impact Criteria

10.45 Noise is measured in decibels (dB) which is a measure of the sound pressure level, i.e. the magnitude of the pressure variations in the air. Measurements of environmental noise are usually made in dB(A) which includes a correction for the sensitivity of the human ear.

10.46 ETSU-R-97 seeks to protect the internal and external amenity of wind farm neighbours by defining acceptable limits for operational noise from wind turbines. The test applied to operational noise is whether or not the noise levels produced by the combined operation of the wind turbines lie below noise limits derived in accordance with ETSU-R-97 at nearby residential properties.

Whilst ETSU-R-97 presents a comprehensive and detailed assessment methodology for wind farm noise, it also provides a simplified methodology:

"if the noise is limited to an $L_{A90,10min}$ of 35dB(A) up to wind speeds of 10 m/s at 10 m height, then these conditions alone would offer sufficient protection of amenity, and background noise surveys would be unnecessary".

10.47 In the detailed methodology, ETSU-R-97 states that different limits should be applied during daytime and night-time periods. The daytime limits, derived from the background noise levels measured during quiet daytime periods, are intended to preserve outdoor amenity, while the night-time limits are intended to prevent sleep disturbance. The general principle is that the noise limits should be based on existing background noise levels, except for very low background noise levels, in which case a fixed limit may be applied. The suggested limits are given in **Table 10.3** below, where L_B is the background $L_{A90,10min}$ and is a function of wind speed. During daytime periods and at low background noise levels, a lower fixed limit of 35–40 dB(A) is applicable. The exact value is dependent upon a number of factors: the number of nearby dwellings, the effect of the noise limits on energy produced, and the duration and level of exposure.

Table 10.3: Permissible Noise Level Criteria

Time of Day	Permissible Noise Level
Daytime	• 35-40 dB(A) for L_B less than 30-35 dB(A) • L_B + 5 dB, for L_B greater than 30-35 dB(A)
Night-time	• 43 dB(A) for L_B less than 38 dB(A) • L_B + 5 dB, for L_B greater than 38 dB(A)

10.48 Note that a higher noise level is permissible during the night than during the day as it is assumed that residents would be indoors. The night-time criterion is derived from sleep disturbance criterion referred to in ETSU-R-97, with an allowance of 10 dB for attenuation through an open window.

10.49 The wind speeds at which the acoustic impact is considered are less than or equal to 12 ms^{-1} at a height of 10 m and are likely to be the acoustically critical wind speeds. Above these wind speeds, as stated in ETSU-R-97, reliable measurements of background and turbine noise are difficult to make. However, if a wind farm meets the noise criteria at the wind speeds presented, it is most unlikely that it would cause any greater loss of amenity at higher wind speeds due to increasing background noise levels masking wind farm generated noise.

10.50 It is important to note that, since reactions to noise are subjective, it is not possible to guarantee that a given development would not result in any adverse comment with regard to noise as the response to any given noise will vary from person to person. Consequently, standards and guidance that relate to environmental noise are typically presented in terms of criteria that would be expected to be considered acceptable by the majority of the population.

Construction Noise

10.51 To ensure adequate assessment of the potential impacts of the construction noise from the proposed wind farm the following steps have been taken:

- Baseline noise criteria are established from the appropriate guidance BS 5228-1:2009;
- Noise levels due to on-site construction activities are predicted at nearby residential properties in accordance with the BS 5228-1:2009 standard;
- Predicted noise levels due to construction traffic at the same residential properties are made using the BS 5228-1:2009 standard; and
- The combined effect of on-site construction activities with construction traffic is compared with the target level specified by BS 5228-1:2009.

Baseline Conditions

Operational Noise

10.52 The proposed development is located approximately 2km south-west of Carnlough. The surrounding area is predominantly rural in nature and used for grazing sheep and cattle with an A-class road running to the east of the site. The general noise character is typical of a rural environment with noise from farm machinery, sheep, cattle, and birds, with the occasional overhead aircraft. There is also a contribution of noise from the A-class road near the site.

10.53 Background noise measurements were undertaken at four residential property locations in accordance with ETSU-R-97 as detailed in **Table 10.4**.

Table 10.4 - Background Noise Survey Details

House ID	Measurement Period		
	Start	End	Duration (days)
H6	26/04/2021	11/06/2021	47
H16	26/04/2021	11/06/2021	47
H23	26/04/2021	11/06/2021	47
H33	26/04/2021	11/06/2021	47

10.54 The background noise monitoring equipment was housed in weather-proof enclosures and powered by lead-acid batteries. The microphones were placed at a height of approximately 1.2 m above ground and equipped with all-weather wind shields which also provide an element of water resistance.

10.55 The proprietary wind shields used are designed to reduce the effects of wind-generated noise at the microphone and accord with the recommendations of the IoA GPG in that they are the appropriate size and, in combination with the microphone, are certified by the manufacturer as meeting Type 1 / Class 1 precision standards.

10.56 Noise levels are monitored continuously, and summary statistics stored every 10 minutes in the internal memory of each meter. The relevant statistic measured is the $L_{A90,10min}$ (The A-weighted sound pressure level exceeded for 90 % of the 10 minute interval).

10.57 The sound level meters were placed away from reflecting walls and vegetation. Photos of the equipment, in situ, may be seen in **Technical Appendix 10.5**. The apparatus were calibrated before and after the survey period and the maximum drift detected was 0.2dB, which is within the required range recommended in the IoA GPG. All instrumentation has been subject to laboratory calibration traceable to national standards within the last 24 months, as recommended in the IoA GPG. Details are provided in **Technical Appendix 10.6**.

10.58 **Chart 10.1** (see **Technical Appendix 10.7** for all charts) shows the measured wind rose over the background noise survey period, as measured by the LiDAR located on-site.

10.59 LIDAR (Light Detection and Ranging) is a remote sensing device that measures conditions in the atmosphere by using pulses from a LASER by applying the principle of the Doppler Effect, detecting the movement of air in the atmospheric boundary layer to measure wind speed and direction. LIDAR provides measurements at several heights, and this enables wind speed data to be obtained that describe the wind profile across a range of heights.

10.60 LIDAR has been successfully tested, by independent third parties using suitable test sites, against conventional anemometry[15,16]. From the technical reports, these tests have demonstrated that, over a range of relevant heights, the accuracy of the LIDAR is comparable to that of the conventional anemometry.

10.61 For illustrative purposes, **Chart 10.2** shows the measured wind rose over an extended period (30/07/20 – 22/07/21) from the LiDAR located on the proposed wind farm site. As

[15] "Evaluation of WINDCUBE", Albers et al, Deutsche WindGuard Consulting GmbH, Report PP 08007, 16 March 2008

[16] "Verification test for three WindCubeTM WLS7 LiDARs at the Høvsøre test site", Gottschall et al, DTU Report Risø-R-1732, May 2010

previously discussed, the noise prediction model employed is likely to overestimate the real noise immission levels for locations not downwind of the turbines. **Chart 10.2** therefore may aid the reader as to the likelihood of over-estimation due to this factor.

10.62 The noise data has been cross-referenced with rainfall data measured at residential property H6 using a rain gauge. The rain gauge became blocked during the survey so Met Office Radar data has been used between 20/05/21 - 28/05/21. Any noise data identified as having been affected by rainfall has been removed from the analysis as shown in **Charts 10.3 to 10.10.**

10.63 Short-term periods of increased noise levels considered to be atypical have been removed from the dataset. The excluded data is shown in **Charts 10.3 to 10.10.**

10.64 There is no data for survey location H33 from 14/05/21 to 27/05/21 because of a power failure.

10.65 **Charts 10.3 to 10.6** show $L_{A90,10min}$ correlated against wind speed for quiet daytime periods at each survey location. In each case, a 'best fit' line has been fitted to the data and the noise limits added. The equation of the regression polynomial has been provided in the charts.

10.66 **Charts 10.7 to 10.10** show $L_{A90,10min}$ correlated against the wind speed for night-time periods at each survey location. In each case, a 'best fit' line has been fitted to the data and the noise limits added. The equation of the regression polynomial has been provided in the charts.

10.67 **Table 10.5** and **Table 10.6** detail the $L_{A90,10min}$ background noise levels calculated from the derived 'best fit' lines, as described above:

Table 10.5 - Quiet Daytime Noise Levels (dB(A) re 20 μPa)

House ID	Standardised 10 m Wind Speed (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H6	25.0	26.0	26.6	27.1	27.8	28.6	30.0	32.0	34.8	38.6	43.6	43.6
H16	29.5	29.7	30.1	30.7	31.6	32.8	34.3	36.2	38.5	41.2	44.4	44.4
H23	29.0	29.3	30.0	31.0	32.4	34.2	36.3	38.9	41.8	45.0	48.7	48.7
H33	32.8	33.3	33.6	33.9	34.2	34.8	35.7	37.0	38.9	41.6	45.0	45.0

Table 10.6 - Night-time Noise Levels (dB(A) re 20 μPa)

House ID	Standardised 10 m Wind Speed (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H6	20.8	20.8	21.0	21.6	22.5	23.9	25.5	27.6	29.9	32.7	35.8	35.8
H16	25.6	25.6	25.6	26.0	27.0	28.5	30.5	32.9	35.7	38.6	41.7	41.7
H23	27.1	27.1	27.1	27.7	29.1	31.0	33.4	36.2	39.2	42.4	45.6	45.6
H33	26.5	26.5	26.8	27.6	28.9	30.6	32.7	35.0	37.4	40.0	40.0	40.0

Construction Noise

10.68 For the on-site construction noise assessment, Annex E of BS 5228-1:2009 provides guidance on setting environmental noise targets. Several methods of assessing the significance of noise levels are presented in Annex E and the most applicable to the construction of the proposed development is the ABC method. The ABC method sets threshold noise levels for specific periods based on the ambient noise levels.

Potential Impacts

Potential Operational Impacts

Noise Propagation Modelling

10.69 The locations of the proposed turbines are provided in **Table 10.7** and shown in **Figure 10.1**.

Table 10.7: Location of Proposed Turbines

Turbine	Co-ordinates	
	X (m)	Y (m)
T1	326489	416258
T2	326152	416531
T3	326190	415813
T4	325672	416289
T5	325948	415318
T6	325717	415843
T7	324884	415754
T8	325118	413988
T9	324852	413503
T10	325196	412984
T11	324561	412887
T12	324969	415323
T13	324391	415381
T14	325503	415369

10.70 The locations of the nearest residential properties to the turbines have been determined by inspection of relevant maps and through site visits. More residential properties may have been identified but have not been considered critical to this acoustic assessment or may be adequately represented by another residential property. The locations considered are listed in **Table 10.8** and are also shown in **Figure 10.1**. Of these, H36 and H37 are treated as unoccupied and so not considered further.

10.71 The distances from each residential property to the nearest turbine are given in **Table 10.8**. It can be seen that the minimum house-to-turbine separation is 1000 m.

Table 10.8: Location of Residential Properties and Distances to Nearest Proposed Turbine

House ID	House Name	Co-ordinates		Distance (m)	Nearest Turbine
		X (m)	Y (m)		
H1	10 SLANE ROAD	324855	411669	1253	T11
H2	14 SLANE ROAD	325022	411755	1222	T11
H3	16 SLANE ROAD	325089	411791	1198	T10
H4	20 SLANE ROAD	325113	411853	1134	T10
H5	22 SLANE ROAD	325142	411868	1117	T10
H6	50 KILLYCARN ROAD	323688	411880	1333	T11
H7	54 KILLYCARN ROAD	323827	412064	1103	T11

House ID	House Name	Co-ordinates		Distance (m)	Nearest Turbine
		X (m)	Y (m)		
H8	44 KILLYCARN ROAD	323510	412097	1315	T11
H9	68 SLANE ROAD	326194	412894	1002	T10
H10	57 SLANE ROAD	326493	412942	1298	T10
H11	64 SLANE ROAD	326830	413484	1709	T10
H12	64A SLANE ROAD	326688	413519	1585	T10
H13	64B SLANE ROAD	326575	413545	1489	T10
H14	66 SLANE ROAD	326851	413604	1767	T10
H15	70 SLANE ROAD	326962	413803	1823	T5
H16	72A SLANE ROAD	326958	413839	1791	T5
H17	72 SLANE ROAD	326948	413945	1699	T5
H18	85 SLANE ROAD	327147	414071	1730	T5
H19	153 BALLYMENA ROAD	327180	414504	1477	T5
H20	149 BALLYMENA ROAD	327207	414575	1462	T5
H21	147A BALLYMENA	327226	414631	1451	T5
H22	147 BALLYMENA ROAD	327188	414797	1345	T5
H23	4 GARTFORD LANE	326933	415144	1000	T3
H24	128 BALLYMENA ROAD	327745	415531	1451	T1
H25	124 BALLYMENA ROAD	327755	415573	1439	T1
H26	121 BALLYMENA ROAD	327870	415792	1458	T1
H27	121A BALLYMENA	327698	415836	1281	T1
H28	25 BALLYMENA ROAD	327966	416532	1502	T1
H29	7 GARTFORD LANE	327654	416663	1233	T1
H30	5 GARTFORD LANE	327574	416723	1180	T1
H31	25 DRUMOURNE ROAD	327476	416927	1192	T1
H32	23 DRUMOURNE ROAD	327632	417062	1397	T1
H33	20 DRUMOURNE ROAD	327305	417341	1356	T1
H34	H34	327265	415440	1128	T1
H35	H35	327415	415880	1000	T1
H36	H36	327325	416370	843	T1
H37	H37	323714	411918	1287	T11
H38	H38	324178	411139	1789	T11
H39	H39	324377	411411	1487	T11
H40	H40	324381	411456	1442	T11
H42	H42	323966	411112	1872	T11
H43	H43	323789	411238	1821	T11
H44	H44	324755	411517	1384	T11
H45	H45	326574	412855	1384	T10
H46	H46	327564	416194	1077	T1

10.72 Although not finalised, the candidate turbine type for the proposed development is the Vestas V136 4.2MW turbine. This report uses the acoustic data from the manufacturer's performance specification from this machine for all analysis[17]. The manufacturer has identified these values as warranted such that some margin may have already been incorporated. However, should the levels be tested it may be that the level of uncertainty in the test measurement would also need to be accounted for. Accordingly, as a conservative measure within the assessment presented here, a further 2 dB has been added to the warranted turbine noise levels to allow for this as recommended by the IoA GPG. Details used in this analysis are as follows:

- a hub height of 112 m;
- a rotor diameter of 136 m;
- sound power levels, L_{WA}, for standardised 10 m height wind speeds (v_{10}) as shown in **Table 10.9**;
- octave band sound power level data, at the wind speeds where it is available, as shown in **Table 10.10**;
- tonal emission characteristics such that no clearly audible tones are present at any wind speed.

Table 10.9 - A-Weighted Sound Power Levels (dB(A) re 1 pW) for the Vestas V136 4.2MW Wind Turbine

Standardised 10m Height Wind Speed, v_{10} (ms^{-1})	Warranted	Plus Uncertainty
1	91.8	93.8
2	91.8	93.8
3	91.8	93.8
4	95.5	97.5
5	100.5	102.5
6	103.6	105.6
7	103.9	105.9
8	103.9	105.9
9	103.9	105.9
10	103.9	105.9
11	103.9	105.9
12	103.9	105.9

[17] 'Performance Specification V136-4.0/4.2 MW 50/60 Hz', Vestas, Document ID: 0067-7065 V06, 2018-05-02

Table 10.10 - Octave Band A-Weighted Sound Power Levels (dB(A) re 1 pW) at Standardised 10m Height Wind Speeds for the Vestas V136 4.2MW Wind Turbine

Octave Band (Hz)	8 ms^{-1}
63	87.0
125	94.6
250	99.2
500	101.0
1000	99.9
2000	95.9
4000	89.0
8000	79.2
OVERALL	105.9

Predictions of Noise Levels at Residential Properties

10.73 **Table 10.11** shows the predicted noise immission levels at the nearest residential properties at each wind speed considered, calculated from the operation of the proposed wind farm. The property with the highest predicted noise immission level of 38.1 dB(A) is H23.

10.74 **Figure 10.1** shows an isobel (i.e. noise contour) plot for the site at a 10 m height wind speed of 8 ms^{-1}. Such plots are useful for evaluating the noise 'footprint' of a given development.

Table 10.11: Predicted Noise Levels At Nearby Residential Properties, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H1	21.2	21.2	21.2	24.9	29.9	33.0	33.3	33.3	33.3	33.3	33.3	33.3
H2	21.9	21.9	21.9	25.6	30.6	33.7	34.0	34.0	34.0	34.0	34.0	34.0
H3	22.1	22.1	22.1	25.8	30.8	33.9	34.2	34.2	34.2	34.2	34.2	34.2
H4	22.5	22.5	22.5	26.2	31.2	34.3	34.6	34.6	34.6	34.6	34.6	34.6
H5	22.6	22.6	22.6	26.3	31.3	34.4	34.7	34.7	34.7	34.7	34.7	34.7
H6	19.9	19.9	19.9	23.6	28.6	31.7	32.0	32.0	32.0	32.0	32.0	32.0
H7	21.5	21.5	21.5	25.2	30.2	33.3	33.6	33.6	33.6	33.6	33.6	33.6
H8	20.1	20.1	20.1	23.8	28.8	31.9	32.2	32.2	32.2	32.2	32.2	32.2
H9	23.6	23.6	23.6	27.3	32.3	35.4	35.7	35.7	35.7	35.7	35.7	35.7
H10	21.7	21.7	21.7	25.4	30.4	33.5	33.8	33.8	33.8	33.8	33.8	33.8
H11	22.0	22.0	22.0	25.7	30.7	33.8	34.1	34.1	34.1	34.1	34.1	34.1
H12	22.6	22.6	22.6	26.3	31.3	34.4	34.7	34.7	34.7	34.7	34.7	34.7
H13	23.2	23.2	23.2	26.9	31.9	35.0	35.3	35.3	35.3	35.3	35.3	35.3
H14	22.2	22.2	22.2	25.9	30.9	34.0	34.3	34.3	34.3	34.3	34.3	34.3
H15	21.7	21.7	21.7	25.4	30.4	33.5	33.8	33.8	33.8	33.8	33.8	33.8
H16	21.8	21.8	21.8	25.5	30.5	33.6	33.9	33.9	33.9	33.9	33.9	33.9
H17	22.4	22.4	22.4	26.1	31.1	34.2	34.5	34.5	34.5	34.5	34.5	34.5

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H18	21.6	21.6	21.6	25.3	30.3	33.4	33.7	33.7	33.7	33.7	33.7	33.7
H19	22.1	22.1	22.1	25.8	30.8	33.9	34.2	34.2	34.2	34.2	34.2	34.2
H20	22.2	22.2	22.2	25.9	30.9	34.0	34.3	34.3	34.3	34.3	34.3	34.3
H21	22.4	22.4	22.4	26.1	31.1	34.2	34.5	34.5	34.5	34.5	34.5	34.5
H22	23.3	23.3	23.3	27.0	32.0	35.1	35.4	35.4	35.4	35.4	35.4	35.4
H23	26.0	26.0	26.0	29.7	34.7	37.8	38.1	38.1	38.1	38.1	38.1	38.1
H24	20.6	20.6	20.6	24.3	29.3	32.4	32.7	32.7	32.7	32.7	32.7	32.7
H25	20.6	20.6	20.6	24.3	29.3	32.4	32.7	32.7	32.7	32.7	32.7	32.7
H26	21.0	21.0	21.0	24.7	29.7	32.8	33.1	33.1	33.1	33.1	33.1	33.1
H27	21.3	21.3	21.3	25.0	30.0	33.1	33.4	33.4	33.4	33.4	33.4	33.4
H28	19.7	19.7	19.7	23.4	28.4	31.5	31.8	31.8	31.8	31.8	31.8	31.8
H29	21.2	21.2	21.2	24.9	29.9	33.0	33.3	33.3	33.3	33.3	33.3	33.3
H30	21.6	21.6	21.6	25.3	30.3	33.4	33.7	33.7	33.7	33.7	33.7	33.7
H31	21.2	21.2	21.2	24.9	29.9	33.0	33.3	33.3	33.3	33.3	33.3	33.3
H32	20.2	20.2	20.2	23.9	28.9	32.0	32.3	32.3	32.3	32.3	32.3	32.3
H33	19.7	19.7	19.7	23.4	28.4	31.5	31.8	31.8	31.8	31.8	31.8	31.8
H34	24.7	24.7	24.7	28.4	33.4	36.5	36.8	36.8	36.8	36.8	36.8	36.8
H35	24.0	24.0	24.0	27.7	32.7	35.8	36.1	36.1	36.1	36.1	36.1	36.1
H38	17.4	17.4	17.4	21.1	26.1	29.2	29.5	29.5	29.5	29.5	29.5	29.5
H39	19.2	19.2	19.2	22.9	27.9	31.0	31.3	31.3	31.3	31.3	31.3	31.3
H40	19.5	19.5	19.5	23.2	28.2	31.3	31.6	31.6	31.6	31.6	31.6	31.6
H42	17.0	17.0	17.0	20.7	25.7	28.8	29.1	29.1	29.1	29.1	29.1	29.1
H43	17.2	17.2	17.2	20.9	25.9	29.0	29.3	29.3	29.3	29.3	29.3	29.3
H44	20.2	20.2	20.2	23.9	28.9	32.0	32.3	32.3	32.3	32.3	32.3	32.3
H45	21.5	21.5	21.5	25.2	30.2	33.3	33.6	33.6	33.6	33.6	33.6	33.6
H46	21.4	21.4	21.4	25.1	30.1	33.2	33.5	33.5	33.5	33.5	33.5	33.5

10.75 Noise levels at 37 of the 43 nearest residential properties are below 35 dB(A), indicating that the noise immission levels would be regarded as acceptable and the residents' amenity as receiving 'sufficient protection' without further assessment requiring to be undertaken.

10.76 There are six properties that have predicted noise levels greater than this simplified noise criteria as indicated in **Table 10.11**. Therefore the 'full' acoustic assessment need only be considered at these. However, as background noise measurements were carried out at H6, H16 & H33 these properties have also been considered in the full acoustic assessment so as to provide a fuller description of the acoustic impact of the proposed wind farm. H5 is also presented as this is the property with the smallest margin between the predicted noise level and the daytime limit.

Acoustic Acceptance Criteria

10.77 As stated previously, during daytime periods and at low background noise levels, a lower fixed limit of 35-40 dB(A) is applicable with the exact value dependent upon a number of factors: the number of noise affected residential properties; the potential impact on the power output of the wind farm and the likely duration and level of exposure. RES has adopted a daytime lower limit of 35 dB(A) for the assessment of the proposed development as a conservative measure.

Table 10.12: Permissible Noise Level Criteria in Vicinity of Proposed Development

Time of Day	Permissible Noise Level
Daytime	• 35 dB(A) for L_B less than 30 dB(A) • L_B + 5 dB, for L_B greater than 30 dB(A)
Night-time	• 43 dB(A) for L_B less than 38 dB(A) • L_B + 5 dB, for L_B greater than 38 dB(A)

Calculation of Acceptable Noise Limits from Baseline Conditions

10.78 The 'best-fit' lines of **Technical Appendix 10.7 Charts 10.3-10.10** have been used to calculate the acceptable noise limits at the background noise measurement locations. **Table 10.13** shows the daytime noise limits and **Table 10.14** the night time noise limits.

Table 10.13 - Recommended Daytime Noise Limits (dB(A) re 20 µPa)

House ID	Standardised 10 m Wind Speed (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H6	35.0	35.0	35.0	35.0	35.0	35.0	35.0	37.0	39.8	43.6	48.6	48.6
H16	35.0	35.0	35.1	35.7	36.6	37.8	39.3	41.2	43.5	46.2	49.4	49.4
H23	35.0	35.0	35.0	36.0	37.4	39.2	41.3	43.9	46.8	50.0	53.7	53.7
H33	37.8	38.3	38.6	38.9	39.2	39.8	40.7	42.0	43.9	46.6	50.0	50.0

Table 10.14 - Recommended Night-time Noise Limits (dB(A) re 20 µPa)

House ID	Standardised 10 m Wind Speed (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H6	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
H16	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.6	46.7	46.7
H23	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.2	47.4	50.6	50.6
H33	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.0	45.0	45.0

10.79 The recommendations of ETSU-R-97 state that where there are groups of properties that are likely to have a similar background noise environment, it is appropriate to use data from one representative location as the basis for assessment at the other properties. The survey results inferred to be representative for each property is shown in **Table 10.15**. The specific choice of noise survey chosen has been made considering the distance to the nearest survey location and the likelihood of experiencing a broadly similar exposure as the survey.

Table 10.15 - Assumed Representative Background Noise Survey Locations

House ID	Survey Location
H1	H6
H2	H6
H3	H6
H4	H6
H5	H6
H6	H6
H7	H6
H8	H6
H9	H16
H10	H16
H11	H16
H12	H16
H13	H16
H14	H16
H15	H16
H16	H16
H17	H16
H18	H16
H19	H16
H20	H23
H21	H23
H22	H23
H23	H23
H24	H23
H25	H23
H26	H23
H27	H23
H28	H33
H29	H33
H30	H33
H31	H33
H32	H33
H33	H33
H34	H23
H35	H23
H38	H6
H39	H6
H40	H6
H42	H6

House ID	Survey Location
H43	H6
H44	H6
H45	H16
H46	H33

10.80 As recommended in ETSU-R-97, the absolute lower noise limits may be increased up to 45 dB(A) if the occupant has a financial involvement in the wind farm. However, whilst some of the nearby properties may qualify for such an increase, these limits have not been adopted in the presented results.

Acoustic Assessment

10.81 **Table 10.16** shows a comparison of the predicted noise levels with the recommended daytime noise limits for each residential property where the full assessment procedure is being applied. The term L_p is used to denote the predicted noise level due to the operation of the proposed wind farm. The predicted noise levels at 1 ms^{-1} and 2 ms^{-1} have been assumed as equal to 3 ms^{-1} as a conservative measure as noise levels at these wind speeds would typically be less. The term ΔL is used to denote the difference between the predicted wind farm noise level and the recommended limit. A negative value indicates that the predicted noise level is within the limit. **Table 10.17** shows a comparison with the recommended night-time noise limits.

10.82 Noise levels at all locations are within both the daytime and night-time noise limits at all wind speeds considered. The minimum margin of predicted noise levels below the daytime noise limits is -0.3 dB(A). The minimum margin during night-time periods is -4.9 dB(A).

Table 10.16 - Comparison of Predicted Noise Levels and Daytime Limits - (dB(A) re 20 μPa)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1			2			3			4		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H5	22.6	35.0	-12.4	22.6	35.0	-12.4	22.6	35.0	-12.4	26.3	35.0	-8.7
H6	19.9	35.0	-15.1	19.9	35.0	-15.1	19.9	35.0	-15.1	23.6	35.0	-11.4
H9	23.6	35.0	-11.4	23.6	35.0	-11.4	23.6	35.1	-11.5	27.3	35.7	-8.4
H13	23.2	35.0	-11.8	23.2	35.0	-11.8	23.2	35.1	-11.9	26.9	35.7	-8.8
H16	21.8	35.0	-13.2	21.8	35.0	-13.2	21.8	35.1	-13.3	25.5	35.7	-10.2
H22	23.3	35.0	-11.7	23.3	35.0	-11.7	23.3	35.0	-11.7	27.0	36.0	-9.0
H23	26.0	35.0	-9.0	26.0	35.0	-9.0	26.0	35.0	-9.0	29.7	36.0	-6.3
H33	19.7	37.8	-18.1	19.7	38.3	-18.6	19.7	38.6	-18.9	23.4	38.9	-15.5
H34	24.7	35.0	-10.3	24.7	35.0	-10.3	24.7	35.0	-10.3	28.4	36.0	-7.6
H35	24.0	35.0	-11.0	24.0	35.0	-11.0	24.0	35.0	-11.0	27.7	36.0	-8.3

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	5			6			7			8		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H5	31.3	35.0	-3.7	34.4	35.0	-0.6	34.7	35.0	-0.3	34.7	37.0	-2.3
H6	28.6	35.0	-6.4	31.7	35.0	-3.3	32.0	35.0	-3.0	32.0	37.0	-5.0
H9	32.3	36.6	-4.3	35.4	37.8	-2.4	35.7	39.3	-3.6	35.7	41.2	-5.5
H13	31.9	36.6	-4.7	35.0	37.8	-2.8	35.3	39.3	-4.0	35.3	41.2	-5.9
H16	30.5	36.6	-6.1	33.6	37.8	-4.2	33.9	39.3	-5.4	33.9	41.2	-7.3
H22	32.0	37.4	-5.4	35.1	39.2	-4.1	35.4	41.3	-5.9	35.4	43.9	-8.5
H23	34.7	37.4	-2.7	37.8	39.2	-1.4	38.1	41.3	-3.2	38.1	43.9	-5.8
H33	28.4	39.2	-10.8	31.5	39.8	-8.3	31.8	40.7	-8.9	31.8	42.0	-10.2
H34	33.4	37.4	-4.0	36.5	39.2	-2.7	36.8	41.3	-4.5	36.8	43.9	-7.1
H35	32.7	37.4	-4.7	35.8	39.2	-3.4	36.1	41.3	-5.2	36.1	43.9	-7.8

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	9			10			11			12		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H5	34.7	39.8	-5.1	34.7	43.6	-8.9	34.7	48.6	-13.9	34.7	48.6	-13.9
H6	32.0	39.8	-7.8	32.0	43.6	-11.6	32.0	48.6	-16.6	32.0	48.6	-16.6
H9	35.7	43.5	-7.8	35.7	46.2	-10.5	35.7	49.4	-13.7	35.7	49.4	-13.7
H13	35.3	43.5	-8.2	35.3	46.2	-10.9	35.3	49.4	-14.1	35.3	49.4	-14.1
H16	33.9	43.5	-9.6	33.9	46.2	-12.3	33.9	49.4	-15.5	33.9	49.4	-15.5
H22	35.4	46.8	-11.4	35.4	50.0	-14.6	35.4	53.7	-18.3	35.4	53.7	-18.3
H23	38.1	46.8	-8.7	38.1	50.0	-11.9	38.1	53.7	-15.6	38.1	53.7	-15.6
H33	31.8	43.9	-12.1	31.8	46.6	-14.8	31.8	50.0	-18.2	31.8	50.0	-18.2
H34	36.8	46.8	-10.0	36.8	50.0	-13.2	36.8	53.7	-16.9	36.8	53.7	-16.9
H35	36.1	46.8	-10.7	36.1	50.0	-13.9	36.1	53.7	-17.6	36.1	53.7	-17.6

Table 10.17 - Comparison of Predicted Noise Levels & Night Time Limits - (dB(A) re 20 μPa)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1			2			3			4		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H5	22.6	43.0	-20.4	22.6	43.0	-20.4	22.6	43.0	-20.4	26.3	43.0	-16.7
H6	19.9	43.0	-23.1	19.9	43.0	-23.1	19.9	43.0	-23.1	23.6	43.0	-19.4
H9	23.6	43.0	-19.4	23.6	43.0	-19.4	23.6	43.0	-19.4	27.3	43.0	-15.7
H13	23.2	43.0	-19.8	23.2	43.0	-19.8	23.2	43.0	-19.8	26.9	43.0	-16.1
H16	21.8	43.0	-21.2	21.8	43.0	-21.2	21.8	43.0	-21.2	25.5	43.0	-17.5
H22	23.3	43.0	-19.7	23.3	43.0	-19.7	23.3	43.0	-19.7	27.0	43.0	-16.0
H23	26.0	43.0	-17.0	26.0	43.0	-17.0	26.0	43.0	-17.0	29.7	43.0	-13.3
H33	19.7	43.0	-23.3	19.7	43.0	-23.3	19.7	43.0	-23.3	23.4	43.0	-19.6
H34	24.7	43.0	-18.3	24.7	43.0	-18.3	24.7	43.0	-18.3	28.4	43.0	-14.6
H35	24.0	43.0	-19.0	24.0	43.0	-19.0	24.0	43.0	-19.0	27.7	43.0	-15.3

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	5			6			7			8		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H5	31.3	43.0	-11.7	34.4	43.0	-8.6	34.7	43.0	-8.3	34.7	43.0	-8.3
H6	28.6	43.0	-14.4	31.7	43.0	-11.3	32.0	43.0	-11.0	32.0	43.0	-11.0
H9	32.3	43.0	-10.7	35.4	43.0	-7.6	35.7	43.0	-7.3	35.7	43.0	-7.3
H13	31.9	43.0	-11.1	35.0	43.0	-8.0	35.3	43.0	-7.7	35.3	43.0	-7.7
H16	30.5	43.0	-12.5	33.6	43.0	-9.4	33.9	43.0	-9.1	33.9	43.0	-9.1
H22	32.0	43.0	-11.0	35.1	43.0	-7.9	35.4	43.0	-7.6	35.4	43.0	-7.6
H23	34.7	43.0	-8.3	37.8	43.0	-5.2	38.1	43.0	-4.9	38.1	43.0	-4.9
H33	28.4	43.0	-14.6	31.5	43.0	-11.5	31.8	43.0	-11.2	31.8	43.0	-11.2
H34	33.4	43.0	-9.6	36.5	43.0	-6.5	36.8	43.0	-6.2	36.8	43.0	-6.2
H35	32.7	43.0	-10.3	35.8	43.0	-7.2	36.1	43.0	-6.9	36.1	43.0	-6.9

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	9			10			11			12		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H5	34.7	43.0	-8.3	34.7	43.0	-8.3	34.7	43.0	-8.3	34.7	43.0	-8.3
H6	32.0	43.0	-11.0	32.0	43.0	-11.0	32.0	43.0	-11.0	32.0	43.0	-11.0
H9	35.7	43.0	-7.3	35.7	43.6	-7.9	35.7	46.7	-11.0	35.7	46.7	-11.0
H13	35.3	43.0	-7.7	35.3	43.6	-8.3	35.3	46.7	-11.4	35.3	46.7	-11.4
H16	33.9	43.0	-9.1	33.9	43.6	-9.7	33.9	46.7	-12.8	33.9	46.7	-12.8
H22	35.4	44.2	-8.8	35.4	47.4	-12.0	35.4	50.6	-15.2	35.4	50.6	-15.2
H23	38.1	44.2	-6.1	38.1	47.4	-9.3	38.1	50.6	-12.5	38.1	50.6	-12.5
H33	31.8	43.0	-11.2	31.8	45.0	-13.2	31.8	45.0	-13.2	31.8	45.0	-13.2
H34	36.8	44.2	-7.4	36.8	47.4	-10.6	36.8	50.6	-13.8	36.8	50.6	-13.8
H35	36.1	44.2	-8.1	36.1	47.4	-11.3	36.1	50.6	-14.5	36.1	50.6	-14.5

Potential Construction Impacts

Construction Noise Assessment

10.83 Primary activities creating noise during the construction period are from: the construction of the turbine bases; the erection of the turbines; the excavation of trenches for cables; and the construction of associated hard standings, access tracks and the construction compound. Noise from vehicles on local roads and access tracks would also arise due to the delivery of turbine components and construction materials, notably aggregates, concrete and steel reinforcement.

10.84 It should be noted that the exact methodology and timing of construction activities cannot be predicted at this time, this assessment is therefore based on assumptions representing a worst-case approach.

Construction Noise Predictions

10.85 The plant assumed for each construction activity is shown in **Table 10.18**. The number of items indicates how many of each plant are required for the specified activity, and the duration of activity is a percentage of a given 12 hour day period needed for that plant to operate. Overall sound power levels are based upon the data in Annex C of BS 5228-1:2009.

Table 10.18: Construction Phases and Sound Power Levels

Activities	Plant	Sound Power (L_{WA})	No. Items	Activity Duration (%)	Effective Sound Power (L_{WA})
Construction Compound	Tracked excavator	113	2	100	119
	Dump truck	113	2	100	
	Tipper lorry	107	2	50	
	Vibratory roller	102	1	75	
	Lorry	108	1	75	
Construct Site Tracks	Tracked excavator	113	3	83	123
	Dump truck	113	2	83	
	Tipper lorry	107	2	83	
	Vibratory roller	102	1	83	
	Excavator mounted rock	121	1	83	
Construct Substations	Tracked excavator	113	2	42	113
	Concrete mixer truck	108	2	17	
	Lorry	108	1	42	
	Telescopic Handler	99	1	83	
Construct crane hard-standings	Tracked excavator	113	2	83	119
	Dump truck	113	2	83	
	Tipper lorry	107	2	83	
	Vibratory roller	102	1	83	
	Tracked excavator	113	2	83	124

Activities	Plant	Sound Power (L_{WA})	No. Items	Activity Duration (%)	Effective Sound Power (L_{WA})
Construct Turbine Foundations	Dump truck	113	4	83	
	Concrete mixer truck	108	6	50	
	Mobile telescopic crane	110	1	50	
	Concrete pump	106	2	50	
	Water pump	93	1	100	
	Compressor	103	3	83	
	Vibratory roller	102	1	83	
	Poker vibrator	106	5	83	
	Excavator mounted rock	121	1	83	
Excavate and Lay Site Cables	Tracked excavator	113	2	83	123
	Dump truck	113	2	83	
	Tractor (Towing Equipment)	108	1	83	
	Tractor (Towing Trailer)	107	1	83	
	Vibratory plate	108	1	83	
	Excavator mounted rock	121	1	83	
Erect Turbine	Mobile telescopic crane	110	3	83	122
	Lorry	108	10	83	
	Diesel generator	102	8	83	
	Torque guns	111	4	83	
	Wheeled loader	108	4	83	
	Telescopic handler	99	3	83	
Reinstate Crane Bases	Tracked excavator	113	2	83	118
	Dump truck	113	2	83	
Lay Cable to Substations	Tracked excavator	113	2	83	123
	Dump truck	113	2	83	
	Tractor (Towing Equipment)	108	1	83	
	Tractor (Towing Trailer)	107	1	83	
	Vibratory plate	108	1	83	
	Excavator mounted rock	121	1	83	
Forestry Felling	Harvester	108	2	83	110
Construct New Water Crossing	Tracked Excavator	113	2	83	119
	Dump Truck	113	2	83	
	Tipper lorry	107	4	83	
	Mobiletelescopic crane	109	1	17	
	Vibratory Roller	102	1	83	
	Telescopic Handler	99	1	83	
	Water pump	93	3	83	

10.86 Predictions of construction noise levels have been carried out using the methods prescribed in Annex F of BS 5228-1:2009[18]. The worst case scenario, where each construction activity takes place at the nearest proposed location to the residential property being assessed, is considered. The locations of the construction activities are taken from the infrastructure drawing. The results of these predictions, made at eight representative residential properties, are shown in **Table 10.19**.

10.87 In all cases average noise levels over the construction period would be lower as the worst case is presented for when the activities are closest to the residential property.

Table 10.19: Predicted Sound Pressure Level due to Construction Noise (dB L_{Aeq})

Activity	H5	H7	H9	H19	H23	H25	H35	H40
Construct site compounds	36.6	35.7	40.4	42.6	44.2	39.3	40.1	34.9
Construct site tracks	49.9	50.0	50.9	74.4	55.3	48.0	51.9	47.3
Construct Substations	30.6	29.7	34.4	36.9	38.6	33.5	34.4	28.8
Construct crane hard-standings	45.5	45.6	46.6	42.8	46.6	43.0	46.6	43.0
Construct Turbine Foundations	50.9	51.0	52.0	48.2	52.0	48.4	52.0	48.4
Excavate and Lay Site Cables	49.5	49.6	50.6	46.8	50.6	47.0	50.6	47.0
Erect Turbine	48.7	48.8	49.8	46.0	49.8	46.2	49.8	46.2
Reinstate Crane Bases	44.9	45.0	46.0	42.2	46.0	42.4	46.0	42.4
Lay Cable to Substations	49.5	49.6	50.6	46.8	50.6	47.0	50.6	47.0
Forestry Felling	48.5	38.3	41.7	29.7	28.8	26.0	26.0	38.3
Construct New Water Crossing	44.3	43.9	44.9	49.3	47.4	43.4	46.8	41.9

Construction Traffic

10.88 Due to the delivery of construction material and wind farm components, vehicle movements either into or away from the site shall increase levels of traffic flow on public roads in the area. Traffic regularly accessing the site is shown in **Chapter 11: Access Traffic and Transport** and is assumed to be characterised by the sound power levels of Dump Trucks, Lorries and Concrete Mixers as a worst case. It is estimated that a total of 140 two-way vehicle movements per day would be required during the most intense period of construction activity although this would only be the case for a maximum of 14 days during foundation pouring.

10.89 Construction traffic noise has been quantified using the method described in BS 5228:2009 Part 1. Using the distances from residential properties to the centre of the relevant carriageway where site traffic would be, the noise levels predicted are presented in **Table 10.20**. The maximum sound pressure level due to traffic flows during the most

[18] A 50% mixed ground attenuation has been used throughout to conservatively account for the arable nature of ground conditions in the vicinity of the proposed development

intensive period of activity is predicted to be 71.2 dB L_{Aeq}. The property where this occurs is adjacent to the proposed delivery route and, as such, corresponds to the worst case.

Table 10.20: Traffic Noise Predictions by Activity (dB L_{Aeq})

House ID	Dump truck	Lorry	Concrete mixer truck
H5	56.0	47.4	50.9
H7	49.5	40.9	44.5
H9	50.4	41.8	45.3
H19	60.1	51.5	55.0
H23	52.3	43.7	47.2
H25	69.6	61.0	64.5
H35	53.6	45.0	48.5
H40	54.8	46.2	49.8

10.90 The increase in noise level due to the presence of construction traffic on nearby roads has been quantified using the methodology set out in CRTN[19]. The maximum predicted increase in daytime average traffic noise level, during the most intense period of construction, is 1.6 dB(A). Given that a 3 dB(A) change is commonly regarded as the smallest subjectively perceptible difference in noise level, the predicted short-term change in traffic noise levels are considered negligible and not significant.

General Construction Noise in Conjunction with Traffic Noise

10.91 Worst case construction noise levels may arise when the following simultaneous activities occur: construction of nearest site tracks; construction of nearest water-crossing; construction of nearest crane hard-standings; and construction of nearest turbine foundations. Therefore cumulative predictions of these construction activities and the additional noise contribution from construction traffic have been calculated and are shown in **Table 10.21**.

10.92 It should be noted that the predictions exclude the screening effects of local topography therefore actual levels of noise experienced at nearby residential properties could be lower.

Table 10.21: Predicted Noise Due to Combined Traffic Noise and Turbine Construction (dB L_{Aeq})

House ID	Construction Plant Noise	Traffic Noise	Combined Noise
H5	54.5	57.6	59.3
H7	54.6	51.1	56.2
H9	55.5	52.0	57.1
H19	74.4	61.7	74.4
H23	57.8	53.9	59.3
H25	52.4	71.2	71.2
H35	56.1	55.2	58.7
H40	52.0	56.4	57.7

[19] Calculation of Road Traffic Noise (CRTN), HMSO Department of Transport, 1988.

Assessment of Construction Noise

10.93 In accordance with the ABC method of Annex E of BS 5228-1:2009, due to the relatively low levels of ambient noise in the vicinity of the proposed development, a Category A assessment is appropriate. This category sets significant effect threshold L_{Aeq} criteria of: 65 dB(A) during weekdays (0700-1900) and Saturdays (0700-1300); 55 dB(A) for weekdays (1900-2300), Saturdays (1300-2300) and Sundays (0700-2300); and 45 dB(A) for night-time (2300-0700) periods.

10.94 **Table 10.21** shows that predicted noise levels from the combined effect of increased traffic flows and activities associated with the peak of construction activities are below the 65 dB(A) daytime threshold specified by BS 5228-1:2009 at six of the assessed residential properties.

10.95 Construction noise levels of greater than 65 dB(A) are predicted to occur at H19 due to the construction of the site entrance along with the site tracks within 240 m of the property. The site entrance is expected to take ten days to construct with the site tracks within 240 m of the property taking an additional seven days.

10.96 Construction noise levels of greater than 65 dB(A) are predicted to occur at H25 during foundation pouring when the most intense period of construction traffic is expected. These levels of traffic noise are expected to occur for 14 days. For the purposes of this assessment it is assumed that all of the deliveries during this period will be coming from the east. This is considered the most likely scenario at this stage but this is not finalised so deliveries could also be coming from the west. The same traffic noise levels would be expected at other properties that are adjacent to the delivery route.

10.97 Construction, with the possible exception of turbine erection and commissioning or periods of emergency work, is not scheduled to take place during the evenings, on Saturdays after 13:00 or on Sundays when the 55 dB(A) threshold applies.

10.98 Construction work is not scheduled to take place during the night when a 45 dB(A) threshold applies with the potential exceptions of turbine erection and commissioning, concrete deliveries and pouring or periods of emergency work. Predicted noise levels of 49.8 dB(A) due to turbine erection imply that this activity should be avoided at night as far as possible. Predicted traffic noise levels imply that concrete deliveries and pouring prior to 07:00 should also be avoided if possible.

10.99 The predictions made represent the worst-case combination of most intensive traffic activity with simultaneous construction activity at the nearest possible location to each residential property.

Mitigation

Operational Noise

10.100 One of the key constraints and considerations in designing the layout of the turbines was the minimisation of potential noise impacts at the nearest residential receptors. As such the turbine layout was designed to ensure that there is an adequate separation distance between any of the proposed turbines and the nearest residential property.

10.101 Due to this consideration of the noise impacts in the design of the wind farm, embedding mitigation measures in the turbine layout, no applied mitigation measures are required for the operation of the proposed turbines as noise levels due to the proposed development are below noise limits derived in accordance with ETSU-R-97.

10.102 It is worth noting that the operation of many modern turbines may be altered by changing the pitch of the wind turbine blades resulting in a trade-off between power production and noise reduction. Operating turbines in such a noise-reduced mode would provide a potential mechanism for reducing the level of noise experienced at nearby residential properties but the acoustic assessment of the proposed development, undertaken in accordance with best practice guidance that is considered robust, demonstrates that this is not required.

10.103 If planning permission is granted for the proposed development, planning conditions can be proposed to provide a degree of protection to nearby residents in the form of limits relating to noise level and tonality.

10.104 **Technical Appendix 10.8** contains a set of conditions that RES considers appropriate.

Construction Noise

10.105 For all activities, measures would be taken to reduce noise levels with due regard to practicality and cost as per the concept of 'best practicable means' as defined in Pollution Control and Local Government (NI) Order 1978.

10.106 BS 5228-1:2009 states that the 'attitude of the contractor' is important in minimising the likelihood of complaints and therefore consultation with the local authority should occur along with steps to inform residents of intended activity. Non-acoustic factors, which influence the overall level of complaints such as mud on roads and dust generation, would also be controlled through construction practices adopted on the site.

10.107 Furthermore, the following noise mitigation options could be implemented where appropriate:

- Consideration would be given to noise emissions when selecting plant and equipment to be used on site;
- All equipment should be maintained in good working order and fitted with the appropriate silencers, mufflers or acoustic covers where applicable;
- Stationary noise sources would be sited as far away as reasonably possible from residential properties; and
- The movement of vehicles to and from the site would be controlled and employees instructed to ensure compliance with the noise control measures adopted.

10.108 Site operations would be limited to 0700-1900 Monday to Friday and 0800-1300 Saturday although exceptions to this may be made during turbine erection and commissioning, concrete deliveries and pouring or for periods of emergency work.

10.109 The temporary exceedance of the 65 dB(A) daytime target level due to the construction of the site entrance and beginning of the site tracks can be mitigated by the use of acoustic barriers if necessary.

10.110 There are many strategies to reduce construction noise by the limitation of activities that would result in predicted noise levels being lower than the specified target. Any such measures should be considered adequate and the mitigation adopted should not be limited to the measures proposed.

Residual Effects

Operational

10.111 The acoustic assessment demonstrates that predicted noise levels at all residential properties do not exceed the derived noise limits across all wind speeds. This should not be interpreted to mean that wind farm operational noise would be inaudible (or masked by background noise) under all conditions, but that the levels of noise are acceptable under ETSU-R-97 and associated guidance.

Construction

10.112 Temporary construction noise levels above the 65 dB(A) daytime criteria level at H19 due to construction of the site entrance and nearby site tracks. Traffic noise levels of greater than 65 dB(A) are also predicted at properties adjacent to the HGV delivery route. At all other times predicted noise from worst case combination of increased traffic and site construction noise would not exceed relevant criteria should work proceed as scheduled although exceptions may occur if turbine erection and commissioning, concrete deliveries and pouring or periods of emergency work need to take place outside of the planned construction times.

Cumulative Effects

Cumulative Operational Noise Assessment

10.113 An assessment of the cumulative acoustic impact of the proposed development in conjunction with seven nearby single turbine schemes has been undertaken in accordance with the guidance on wind farm noise assessment; ETSU-R-97 and the IoA GPG.

10.114 ETSU-R-97 states:

> *"It is clearly unreasonable to suggest that, because a wind farm has been constructed in the vicinity in the past which resulted in increased noise levels at some properties, the residents of those properties are now able to tolerate higher noise levels still. The existing wind farm should not be considered as part of the prevailing background noise."*

10.115 The locations of the turbines making up the proposed development, along with the other turbines considered in the cumulative assessment, are shown in **Figure 10.2**. The planning references for the single turbine schemes are as detailed in **Table 10.22**.

Table 10.22: Single Turbine Planning Details

Turbine ID	Planning Reference
A1	G/2012/0219/F
B1	G/2014/0227/F
C1	G/2013/0377/F
D1	LA02/2021/0604/F
E1	LA02/2021/0606/F
F1	F/2012/0184/F
G1	G/2011/0550/F

10.116 The residential properties considered in the cumulative assessment are those detailed in **Table 10.8.** The distances to the nearest turbine included in the cumulative assessment are given in **Table 10.23**.

Table 10.23: Distances from Residential Properties to Nearest Cumulative Turbine

House ID	Distance (m)	Nearest Turbine
H1	879	C1
H2	819	B1
H3	759	B1
H4	692	B1
H5	668	B1
H6	486	C1
H7	587	C1
H8	767	C1
H9	744	A1
H10	1043	A1
H11	1580	A1
H12	1482	A1
H13	1410	A1
H14	1664	A1
H15	1823	T5
H16	1791	T5
H17	1699	T5
H18	1730	T5
H19	1477	T5
H20	1462	T5
H21	1451	T5
H22	1345	T5
H23	1000	T3
H24	1451	T1
H25	1439	T1
H26	1458	T1

House ID	Distance (m)	Nearest Turbine
H27	1281	T1
H28	1502	T1
H29	1233	T1
H30	1180	T1
H31	1192	T1
H32	1397	T1
H33	1356	T1
H34	1128	T1
H35	1000	T1
H38	407	C1
H39	395	C1
H40	392	C1
H42	390	C1
H43	332	C1
H44	763	C1
H45	1100	A1
H46	1077	T1

Turbines prefixed "T" are the turbines belonging to the proposed development
Turbines prefixed "A-G" are nearby single turbine sites whose planning references can be found in Table 22

Cumulative Assessment Methodology

10.117 ETSU-R-97 recommends that the derived noise limits applicable at nearby residential properties shall relate to the cumulative effects of noise from all wind turbines that may affect a particular location.

10.118 The methodology is therefore to:

- Predict noise immission levels at the nearest residential properties due to the proposed development, along with the other turbines to be considered in the cumulative assessment;
- Calculate the predicted cumulative noise levels by combining the predicted noise levels from all of the projects that are being considered; and
- Compare the cumulative predicted noise levels to criteria specified by relevant guidance, ETSU-R-97, to determine whether the cumulative predicted noise levels comply with ETSU-R-97 criteria.

10.119 The methodology outlined above is in accordance with the appropriate guidance on cumulative wind farm noise assessment as described in ETSU-R-97 and the IoA GPG.

Predictions of Noise Levels at Residential Properties

10.120 Details of the single turbine schemes considered are as follows:

- Turbine types and hub heights as detailed in **Table 10.24**;
- sound power levels as shown in **Table 10.25**; and
- octave band sound power level data as shown in **Table 10.26**.

Table 10.24: Single Turbine Planning Details

Turbine ID	Turbine Type	Hub Height (m)
A1	Vergnet GEV 32/275	32.3
B1	Norwin N29 225kW	30.0
C1	Micon M750	40.0
D1	Vestas V29	30.0
E1	Vestas V29	30.0
F1	Gaia 11kW	20.0
G1	Aircon 10kW	15.0

Table 10.25: A-Weighted Sound Power Levels (dB(A) re 1 pW) plus Uncertainty for Single Turbines

v_{10} (ms^{-1})	A1	B1	C1	D1	E1	F1	G1
1	86.3	94.5	95.3	98.1	98.1	82.8	80.0
2	86.3	94.5	95.3	98.1	98.1	82.8	80.0
3	86.3	94.5	95.3	98.1	98.1	82.8	80.0
4	92.9	94.5	95.3	98.1	98.1	82.8	80.0
5	94.6	95.6	95.3	98.5	98.5	83.8	80.8
6	95.4	96.7	96.0	98.9	98.9	84.9	81.6
7	103.4	97.8	96.8	99.3	99.3	85.9	82.4
8	104.4	98.9	97.6	99.7	99.7	86.9	83.2
9	104.6	100.1	98.3	100.1	100.1	87.8	84.0
10	104.2	101.2	99.0	100.5	100.5	88.8	84.8
11	104.0	102.3	99.8	100.9	100.9	89.8	85.6
12	104.0	103.5	100.5	101.3	101.3	90.8	86.4

Table 10.26: Octave Band A-Weighted Sound Power Levels (dB(A) re 1 pW) at 8 ms^{-1} for Single Turbines

Octave Band (Hz)	A1	B1	C1	D1	E1	F1	G1
63	83.8	73.4	77.5	78.4	78.4	68.0	61.9
125	91.8	82.5	86.6	85.7	85.7	74.0	68.3
250	96.8	88.3	92.6	90.5	90.5	80.2	70.8
500	99.8	93.6	93.9	95.3	95.3	78.6	71.8
1000	98.8	95.1	88.5	94.3	94.3	81.4	77.5
2000	94.8	91.0	84.0	91.6	91.6	79.9	80.7
4000	89.8	78.3	75.7	83.6	83.6	75.8	62.2
8000	78.8	67.1	63.6	73.0	73.0	67.6	49.8
OVERALL	104.4	98.9	97.6	99.7	99.7	86.9	83.2

10.121 The existing and consented single turbine schemes are conditioned to the noise limits specified in their Decision Notices. These noise limits are used to calculate the worst case predicted noise levels using the 'Controlling Property' method outlined in the IoA GPG as follows:

- Predictions are made using the acoustic emission data specified in the acoustic assessment for the single turbine scheme;
- Comparison is made between the predicted noise levels and the limits from the planning conditions in order to identify the property with the smallest margin i.e. the controlling property; and
- The predictions are scaled by the minimum margin between the predictions and the conditioned noise limits at the controlling property. This yields predicted noise levels which do not exceed the conditioned noise limits at any property and are equal to the conditioned noise limit at the controlling property.

10.122 The predicted noise levels at the residential properties considered in the assessment due to the operation of the sites considered in the cumulative assessment are detailed in **Table 10.27**.

10.123 The methodology used to calculate the cumulative predicted noise levels makes the assumption that the properties in question are downwind of all of the considered wind farms simultaneously which is not the case in practice. The cumulative predicted noise levels are conservative due to the reductions in noise that would be expected when a property is situated crosswind or upwind of a noise source.

10.124 When making predictions of the cumulative noise level at a given residential property and wind speed, should any of the single turbine sites have predicted noise levels of greater than 10 dB less than the proposed development, the single turbine in question is not included in the total as in acoustic practice it is generally accepted that where there is such a difference between the noise levels from two sources, there is no cumulative impact and the smaller source can be ignored.

Table 10.27: Cumulative Predicted Noise Levels at Nearby Residential Properties, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H1	26.2	26.2	26.2	28.7	31.6	34.1	35.3	35.7	36.0	36.2	36.2	36.2
H2	26.3	26.3	26.3	29.1	32.1	34.4	36.0	36.5	36.7	36.9	37.1	37.0
H3	26.7	26.7	26.7	29.4	32.3	34.6	36.1	36.6	37.1	37.3	37.5	37.4
H4	27.2	27.2	27.2	29.9	33.1	35.2	36.7	37.2	37.5	37.9	38.0	38.0
H5	27.4	27.4	27.4	30.1	33.0	35.3	36.9	37.4	37.7	38.1	38.2	38.0
H6	29.3	29.3	29.3	30.7	32.6	34.5	35.0	35.6	36.0	36.4	36.1	36.4
H7	28.2	28.2	28.2	29.9	32.5	34.8	35.2	35.7	36.0	36.3	36.2	36.2
H8	28.2	28.2	28.2	29.7	31.9	34.0	34.8	35.2	35.7	36.1	35.8	36.0
H9	27.6	27.6	27.6	30.7	34.1	36.6	38.7	39.4	39.7	39.7	39.8	39.7
H10	24.5	24.5	24.5	27.6	30.8	33.5	34.8	35.5	35.6	35.6	35.7	35.6
H11	23.9	23.9	23.9	26.5	30.7	33.8	34.1	34.1	34.1	34.1	34.1	34.1
H12	24.5	24.5	24.5	26.8	31.3	34.4	34.7	34.7	34.7	34.7	34.7	34.7
H13	24.7	24.7	24.7	26.9	31.9	35.0	35.3	35.8	35.8	35.8	35.7	35.7
H14	24.2	24.2	24.2	25.9	30.9	34.0	34.3	34.3	34.3	34.3	34.3	34.3

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H15	22.8	22.8	22.8	25.4	30.4	33.5	33.8	33.8	33.8	33.8	33.8	33.8
H16	22.8	22.8	22.8	25.5	30.5	33.6	33.9	33.9	33.9	33.9	33.9	33.9
H17	23.2	23.2	23.2	26.1	31.1	34.2	34.5	34.5	34.5	34.5	34.5	34.5
H18	22.5	22.5	22.5	25.3	30.3	33.4	33.7	33.7	33.7	33.7	33.7	33.7
H19	22.1	22.1	22.1	25.8	30.8	33.9	34.2	34.2	34.2	34.2	34.2	34.2
H20	22.2	22.2	22.2	25.9	30.9	34.0	34.3	34.3	34.3	34.3	34.3	34.3
H21	22.4	22.4	22.4	26.1	31.1	34.2	34.5	34.5	34.5	34.5	34.5	34.5
H22	23.3	23.3	23.3	27.0	32.0	35.1	35.4	35.4	35.4	35.4	35.4	35.4
H23	26.0	26.0	26.0	29.7	34.7	37.8	38.1	38.1	38.1	38.1	38.1	38.1
H24	20.6	20.6	20.6	24.3	29.3	32.4	32.7	32.7	32.7	32.7	32.7	32.7
H25	20.6	20.6	20.6	24.3	29.3	32.4	32.7	32.7	32.7	32.7	32.7	32.7
H26	21.0	21.0	21.0	24.7	29.7	32.8	33.1	33.1	33.1	33.1	33.1	33.1
H27	21.3	21.3	21.3	25.0	30.0	33.1	33.4	33.4	33.4	33.4	33.4	33.4
H28	19.7	19.7	19.7	23.4	28.4	31.5	31.8	31.8	31.8	31.8	31.8	31.8
H29	21.2	21.2	21.2	24.9	29.9	33.0	33.3	33.3	33.3	33.3	33.3	33.3
H30	21.6	21.6	21.6	25.3	30.3	33.4	33.7	33.7	33.7	33.7	33.7	33.7
H31	21.2	21.2	21.2	24.9	29.9	33.0	33.3	33.3	33.3	33.3	33.3	33.3
H32	20.2	20.2	20.2	23.9	28.9	32.0	32.3	32.3	32.3	32.3	32.3	32.3
H33	19.7	19.7	19.7	23.4	28.4	31.5	31.8	31.8	31.8	31.8	31.8	31.8
H34	24.7	24.7	24.7	28.4	33.4	36.5	36.8	36.8	36.8	36.8	36.8	36.8
H35	24.0	24.0	24.0	27.7	32.7	35.8	36.1	36.1	36.1	36.1	36.1	36.1
H38	30.6	30.6	30.6	31.7	33.0	34.4	35.0	35.6	36.3	36.9	36.3	36.8
H39	31.1	31.1	31.1	32.2	33.8	35.2	35.8	36.5	37.1	37.6	37.1	37.5
H40	31.2	31.2	31.2	32.3	33.9	35.4	35.9	36.7	37.3	37.8	37.2	37.7
H42	31.0	31.0	31.0	32.0	33.2	34.6	35.1	35.8	36.5	37.1	36.4	36.9
H43	32.4	32.4	32.4	33.4	34.5	35.7	36.3	37.0	37.7	38.3	37.5	38.1
H44	26.4	26.4	26.4	28.5	31.1	33.5	34.5	34.9	35.3	35.5	35.4	35.5
H45	25.3	25.3	25.3	28.0	31.0	33.8	35.1	35.5	35.7	35.8	36.0	35.9
H46	21.4	21.4	21.4	25.1	30.1	33.2	33.5	33.5	33.5	33.5	33.5	33.5

10.125 Noise levels at 21 of the 43 nearest residential properties are below 35 dB(A) level, indicating that the noise immission levels would be regarded as acceptable and the residents' amenity as receiving 'sufficient protection' without further assessment requiring to be undertaken.

10.126 There are 22 properties that have predicted noise levels greater than this simplified noise criteria as indicated in **Table 10.27**. Therefore the 'full' acoustic assessment has been considered at these along with the survey locations.

Derived Acoustic Acceptance Criteria

10.127 Due to the greater generation capacity and therefore increased planning merit of the cumulative development, and in accordance with the guidance provided by ETSU-R-97 and the IoA GPG, a 37.5 dB(A) daytime lower limit has been adopted. Justification for this limit is as follows:

- Number of noise affected residential properties: 22 of the considered residential properties are predicted to experience cumulative noise levels of greater than 35 dB(A), a relatively small number given the scale of the cumulative development which would generate significant social, economic and environmental benefits, suggesting a limit in the middle of the range would be appropriate;
- Potential impact on the power output of the wind farm: The rated power of the proposed development would be 58.8 MW should the turbine type considered in the acoustic assessment be installed. This represents an average-large site in comparison with other wind farm developments in Northern Ireland when combined with the power output of the single turbines, suggesting that a lower limit in the middle of the range would be appropriate. Restricting the lower limit to 35 dB(A) could limit the number and size of turbines installed or result in noise management being required, thereby impacting the amount of energy generated by such a scheme; and
- The likely duration and level of exposure: The amount of the time that noise levels of greater than 35 dB(A) are predicted is limited to periods of sufficiently high wind speed. Furthermore, the noise levels experienced would be less in practice as it has been assumed that properties can be downwind of all wind turbines simultaneously which would not be the case in reality. It would therefore be suggested that a daytime lower limit in the middle of the range is applied.

10.128 As detailed in paragraph 10.79, the background noise survey locations inferred to be representative for each property are shown in **Table 10.15**.

10.129 As recommended in ETSU-R-97, the absolute lower noise limits may be increased up to 45 dB(A) if the occupant has a financial involvement in the wind farm. However, whilst some of the nearby residential properties may qualify for such an increase, these limits have not been adopted in the presented results.

10.130 The derived noise limits for daytime and night-time periods, for each residential property, can be found in **Table 10.28** and **Table 10.29**.

Cumulative Acoustic Assessment

10.131 A comparison of the cumulative predicted noise levels with the recommended daytime noise limits for the nearby residential properties is shown in **Table 10.28**. The term L_p is used to denote the cumulative predicted noise level. The cumulative predicted noise levels at 1 ms^{-1} and 2 ms^{-1} have been assumed as equal to 3 ms^{-1} as a conservative measure. The term ΔL is used to denote the difference between the cumulative predicted cumulative noise level and the recommended limit. A negative value indicates that the cumulative predicted noise level is within the limit. **Table 10.29** shows a comparison with the recommended night-time noise limits.

10.132 Cumulative noise levels at all residential properties are within both the daytime and night-time noise limits at all wind speeds considered. The minimum margin during daytime periods is -0.1 dB(A) at H5. The minimum margin during night-time periods is -3.3 dB(A) at H9.

10.133 At the residential properties where the minimum margins occur, the predicted noise levels due to the wind farms considered in the cumulative assessment, along with the noise limits, are shown graphically in **Charts 10.12** & **10.13** in **Technical Appendix 10.7**.

10.134 **Figure 10.2** shows a cumulative noise contour plot for the proposed development and the other projects considered in the cumulative assessment calculated using the ISO 9613 Part 2 propagation model. The plot is provided to illustrate the cumulative noise 'footprint' and should be considered indicative only. Where properties are located such that they cannot be downwind of all turbines simultaneously, the predictions made using a downwind propagation model such as ISO 9613-2 are conservative given that reductions in noise would be expected when a property is crosswind or upwind of a noise source.

Table 10.28: Comparison of Cumulative Predicted Noise Levels and Daytime Noise Limits, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1			2			3			4		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H1	26.2	37.5	-11.3	26.2	37.5	-11.3	26.2	37.5	-11.3	28.7	37.5	-8.8
H2	26.3	37.5	-11.2	26.3	37.5	-11.2	26.3	37.5	-11.2	29.1	37.5	-8.4
H3	26.7	37.5	-10.8	26.7	37.5	-10.8	26.7	37.5	-10.8	29.4	37.5	-8.1
H4	27.2	37.5	-10.3	27.2	37.5	-10.3	27.2	37.5	-10.3	29.9	37.5	-7.6
H5	27.4	37.5	-10.1	27.4	37.5	-10.1	27.4	37.5	-10.1	30.1	37.5	-7.4
H6	29.3	37.5	-8.2	29.3	37.5	-8.2	29.3	37.5	-8.2	30.7	37.5	-6.8
H7	28.2	37.5	-9.3	28.2	37.5	-9.3	28.2	37.5	-9.3	29.9	37.5	-7.6
H8	28.2	37.5	-9.3	28.2	37.5	-9.3	28.2	37.5	-9.3	29.7	37.5	-7.8
H9	27.6	37.5	-9.9	27.6	37.5	-9.9	27.6	37.5	-9.9	30.7	37.5	-6.8
H10	24.5	37.5	-13.0	24.5	37.5	-13.0	24.5	37.5	-13.0	27.6	37.5	-9.9
H13	24.7	37.5	-12.8	24.7	37.5	-12.8	24.7	37.5	-12.8	26.9	37.5	-10.6
H16	22.8	37.5	-14.7	22.8	37.5	-14.7	22.8	37.5	-14.7	25.5	37.5	-12.0
H22	23.3	37.5	-14.2	23.3	37.5	-14.2	23.3	37.5	-14.2	27.0	37.5	-10.5
H23	26.0	37.5	-11.5	26.0	37.5	-11.5	26.0	37.5	-11.5	29.7	37.5	-7.8
H33	19.7	37.8	-18.1	19.7	38.3	-18.6	19.7	38.6	-18.9	23.4	38.9	-15.5
H34	24.7	37.5	-12.8	24.7	37.5	-12.8	24.7	37.5	-12.8	28.4	37.5	-9.1
H35	24.0	37.5	-13.5	24.0	37.5	-13.5	24.0	37.5	-13.5	27.7	37.5	-9.8
H38	30.6	37.5	-6.9	30.6	37.5	-6.9	30.6	37.5	-6.9	31.7	37.5	-5.8
H39	31.1	37.5	-6.4	31.1	37.5	-6.4	31.1	37.5	-6.4	32.2	37.5	-5.3
H40	31.2	37.5	-6.3	31.2	37.5	-6.3	31.2	37.5	-6.3	32.3	37.5	-5.2
H42	31.0	37.5	-6.5	31.0	37.5	-6.5	31.0	37.5	-6.5	32.0	37.5	-5.5
H43	32.4	37.5	-5.1	32.4	37.5	-5.1	32.4	37.5	-5.1	33.4	37.5	-4.1
H44	26.4	37.5	-11.1	26.4	37.5	-11.1	26.4	37.5	-11.1	28.5	37.5	-9.0
H45	25.3	37.5	-12.2	25.3	37.5	-12.2	25.3	37.5	-12.2	28.0	37.5	-9.5

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	5			6			7			8		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H1	31.6	37.5	-5.9	34.1	37.5	-3.4	35.3	37.5	-2.2	35.7	37.5	-1.8
H2	32.1	37.5	-5.4	34.4	37.5	-3.1	36.0	37.5	-1.5	36.5	37.5	-1.0
H3	32.3	37.5	-5.2	34.6	37.5	-2.9	36.1	37.5	-1.4	36.6	37.5	-0.9
H4	33.1	37.5	-4.4	35.2	37.5	-2.3	36.7	37.5	-0.8	37.2	37.5	-0.3
H5	33.0	37.5	-4.5	35.3	37.5	-2.2	36.9	37.5	-0.6	37.4	37.5	-0.1
H6	32.6	37.5	-4.9	34.5	37.5	-3.0	35.0	37.5	-2.5	35.6	37.5	-1.9
H7	32.5	37.5	-5.0	34.8	37.5	-2.7	35.2	37.5	-2.3	35.7	37.5	-1.8
H8	31.9	37.5	-5.6	34.0	37.5	-3.5	34.8	37.5	-2.7	35.2	37.5	-2.3
H9	34.1	37.5	-3.4	36.6	37.8	-1.2	38.7	39.3	-0.6	39.4	41.2	-1.8
H10	30.8	37.5	-6.7	33.5	37.8	-4.3	34.8	39.3	-4.5	35.5	41.2	-5.7
H13	31.9	37.5	-5.6	35.0	37.8	-2.8	35.3	39.3	-4.0	35.8	41.2	-5.4
H16	30.5	37.5	-7.0	33.6	37.8	-4.2	33.9	39.3	-5.4	33.9	41.2	-7.3
H22	32.0	37.5	-5.5	35.1	39.2	-4.1	35.4	41.3	-5.9	35.4	43.9	-8.5
H23	34.7	37.5	-2.8	37.8	39.2	-1.4	38.1	41.3	-3.2	38.1	43.9	-5.8
H33	28.4	39.2	-10.8	31.5	39.8	-8.3	31.8	40.7	-8.9	31.8	42.0	-10.2
H34	33.4	37.5	-4.1	36.5	39.2	-2.7	36.8	41.3	-4.5	36.8	43.9	-7.1
H35	32.7	37.5	-4.8	35.8	39.2	-3.4	36.1	41.3	-5.2	36.1	43.9	-7.8
H38	33.0	37.5	-4.5	34.4	37.5	-3.1	35.0	37.5	-2.5	35.6	37.5	-1.9
H39	33.8	37.5	-3.7	35.2	37.5	-2.3	35.8	37.5	-1.7	36.5	37.5	-1.0
H40	33.9	37.5	-3.6	35.4	37.5	-2.1	35.9	37.5	-1.6	36.7	37.5	-0.8
H42	33.2	37.5	-4.3	34.6	37.5	-2.9	35.1	37.5	-2.4	35.8	37.5	-1.7
H43	34.5	37.5	-3.0	35.7	37.5	-1.8	36.3	37.5	-1.2	37.0	37.5	-0.5
H44	31.1	37.5	-6.4	33.5	37.5	-4.0	34.5	37.5	-3.0	34.9	37.5	-2.6
H45	31.0	37.5	-6.5	33.8	37.8	-4.0	35.1	39.3	-4.2	35.5	41.2	-5.7

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	9			10			11			12		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H1	36.0	39.8	-3.8	36.2	43.6	-7.4	36.2	48.6	-12.4	36.2	48.6	-12.4
H2	36.7	39.8	-3.1	36.9	43.6	-6.7	37.1	48.6	-11.5	37.0	48.6	-11.6
H3	37.1	39.8	-2.7	37.3	43.6	-6.3	37.5	48.6	-11.1	37.4	48.6	-11.2
H4	37.5	39.8	-2.3	37.9	43.6	-5.7	38.0	48.6	-10.6	38.0	48.6	-10.6
H5	37.7	39.8	-2.1	38.1	43.6	-5.5	38.2	48.6	-10.4	38.0	48.6	-10.6
H6	36.0	39.8	-3.8	36.4	43.6	-7.2	36.1	48.6	-12.5	36.4	48.6	-12.2
H7	36.0	39.8	-3.8	36.3	43.6	-7.3	36.2	48.6	-12.4	36.2	48.6	-12.4
H8	35.7	39.8	-4.1	36.1	43.6	-7.5	35.8	48.6	-12.8	36.0	48.6	-12.6
H9	39.7	43.5	-3.8	39.7	46.2	-6.5	39.8	49.4	-9.6	39.7	49.4	-9.7
H10	35.6	43.5	-7.9	35.6	46.2	-10.6	35.7	49.4	-13.7	35.6	49.4	-13.8
H13	35.8	43.5	-7.7	35.8	46.2	-10.4	35.7	49.4	-13.7	35.7	49.4	-13.7
H16	33.9	43.5	-9.6	33.9	46.2	-12.3	33.9	49.4	-15.5	33.9	49.4	-15.5
H22	35.4	46.8	-11.4	35.4	50.0	-14.6	35.4	53.7	-18.3	35.4	53.7	-18.3
H23	38.1	46.8	-8.7	38.1	50.0	-11.9	38.1	53.7	-15.6	38.1	53.7	-15.6
H33	31.8	43.9	-12.1	31.8	46.6	-14.8	31.8	50.0	-18.2	31.8	50.0	-18.2
H34	36.8	46.8	-10.0	36.8	50.0	-13.2	36.8	53.7	-16.9	36.8	53.7	-16.9
H35	36.1	46.8	-10.7	36.1	50.0	-13.9	36.1	53.7	-17.6	36.1	53.7	-17.6
H38	36.3	39.8	-3.5	36.9	43.6	-6.7	36.3	48.6	-12.3	36.8	48.6	-11.8
H39	37.1	39.8	-2.7	37.6	43.6	-6.0	37.1	48.6	-11.5	37.5	48.6	-11.1
H40	37.3	39.8	-2.5	37.8	43.6	-5.8	37.2	48.6	-11.4	37.7	48.6	-10.9
H42	36.5	39.8	-3.3	37.1	43.6	-6.5	36.4	48.6	-12.2	36.9	48.6	-11.7
H43	37.7	39.8	-2.1	38.3	43.6	-5.3	37.5	48.6	-11.1	38.1	48.6	-10.5
H44	35.3	39.8	-4.5	35.5	43.6	-8.1	35.4	48.6	-13.2	35.5	48.6	-13.1
H45	35.7	43.5	-7.8	35.8	46.2	-10.4	36.0	49.4	-13.4	35.9	49.4	-13.5

Table 10.29: Comparison of Cumulative Predicted Noise Levels and Night Time Limits, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1			2			3			4		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H1	26.2	43.0	-16.8	26.2	43.0	-16.8	26.2	43.0	-16.8	28.7	43.0	-14.3
H2	26.3	43.0	-16.7	26.3	43.0	-16.7	26.3	43.0	-16.7	29.1	43.0	-13.9
H3	26.7	43.0	-16.3	26.7	43.0	-16.3	26.7	43.0	-16.3	29.4	43.0	-13.6
H4	27.2	43.0	-15.8	27.2	43.0	-15.8	27.2	43.0	-15.8	29.9	43.0	-13.1
H5	27.4	43.0	-15.6	27.4	43.0	-15.6	27.4	43.0	-15.6	30.1	43.0	-12.9
H6	29.3	43.0	-13.7	29.3	43.0	-13.7	29.3	43.0	-13.7	30.7	43.0	-12.3
H7	28.2	43.0	-14.8	28.2	43.0	-14.8	28.2	43.0	-14.8	29.9	43.0	-13.1
H8	28.2	43.0	-14.8	28.2	43.0	-14.8	28.2	43.0	-14.8	29.7	43.0	-13.3
H9	27.6	43.0	-15.4	27.6	43.0	-15.4	27.6	43.0	-15.4	30.7	43.0	-12.3
H10	24.5	43.0	-18.5	24.5	43.0	-18.5	24.5	43.0	-18.5	27.6	43.0	-15.4
H13	24.7	43.0	-18.3	24.7	43.0	-18.3	24.7	43.0	-18.3	26.9	43.0	-16.1
H16	22.8	43.0	-20.2	22.8	43.0	-20.2	22.8	43.0	-20.2	25.5	43.0	-17.5
H22	23.3	43.0	-19.7	23.3	43.0	-19.7	23.3	43.0	-19.7	27.0	43.0	-16.0
H23	26.0	43.0	-17.0	26.0	43.0	-17.0	26.0	43.0	-17.0	29.7	43.0	-13.3
H33	19.7	43.0	-23.3	19.7	43.0	-23.3	19.7	43.0	-23.3	23.4	43.0	-19.6
H34	24.7	43.0	-18.3	24.7	43.0	-18.3	24.7	43.0	-18.3	28.4	43.0	-14.6
H35	24.0	43.0	-19.0	24.0	43.0	-19.0	24.0	43.0	-19.0	27.7	43.0	-15.3
H38	30.6	43.0	-12.4	30.6	43.0	-12.4	30.6	43.0	-12.4	31.7	43.0	-11.3
H39	31.1	43.0	-11.9	31.1	43.0	-11.9	31.1	43.0	-11.9	32.2	43.0	-10.8
H40	31.2	43.0	-11.8	31.2	43.0	-11.8	31.2	43.0	-11.8	32.3	43.0	-10.7
H42	31.0	43.0	-12.0	31.0	43.0	-12.0	31.0	43.0	-12.0	32.0	43.0	-11.0
H43	32.4	43.0	-10.6	32.4	43.0	-10.6	32.4	43.0	-10.6	33.4	43.0	-9.6
H44	26.4	43.0	-16.6	26.4	43.0	-16.6	26.4	43.0	-16.6	28.5	43.0	-14.5
H45	25.3	43.0	-17.7	25.3	43.0	-17.7	25.3	43.0	-17.7	28.0	43.0	-15.0

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	5			6			7			8		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H1	31.6	43.0	-11.4	34.1	43.0	-8.9	35.3	43.0	-7.7	35.7	43.0	-7.3
H2	32.1	43.0	-10.9	34.4	43.0	-8.6	36.0	43.0	-7.0	36.5	43.0	-6.5
H3	32.3	43.0	-10.7	34.6	43.0	-8.4	36.1	43.0	-6.9	36.6	43.0	-6.4
H4	33.1	43.0	-9.9	35.2	43.0	-7.8	36.7	43.0	-6.3	37.2	43.0	-5.8
H5	33.0	43.0	-10.0	35.3	43.0	-7.7	36.9	43.0	-6.1	37.4	43.0	-5.6
H6	32.6	43.0	-10.4	34.5	43.0	-8.5	35.0	43.0	-8.0	35.6	43.0	-7.4
H7	32.5	43.0	-10.5	34.8	43.0	-8.2	35.2	43.0	-7.8	35.7	43.0	-7.3
H8	31.9	43.0	-11.1	34.0	43.0	-9.0	34.8	43.0	-8.2	35.2	43.0	-7.8
H9	34.1	43.0	-8.9	36.6	43.0	-6.4	38.7	43.0	-4.3	39.4	43.0	-3.6
H10	30.8	43.0	-12.2	33.5	43.0	-9.5	34.8	43.0	-8.2	35.5	43.0	-7.5
H13	31.9	43.0	-11.1	35.0	43.0	-8.0	35.3	43.0	-7.7	35.8	43.0	-7.2
H16	30.5	43.0	-12.5	33.6	43.0	-9.4	33.9	43.0	-9.1	33.9	43.0	-9.1
H22	32.0	43.0	-11.0	35.1	43.0	-7.9	35.4	43.0	-7.6	35.4	43.0	-7.6
H23	34.7	43.0	-8.3	37.8	43.0	-5.2	38.1	43.0	-4.9	38.1	43.0	-4.9
H33	28.4	43.0	-14.6	31.5	43.0	-11.5	31.8	43.0	-11.2	31.8	43.0	-11.2
H34	33.4	43.0	-9.6	36.5	43.0	-6.5	36.8	43.0	-6.2	36.8	43.0	-6.2
H35	32.7	43.0	-10.3	35.8	43.0	-7.2	36.1	43.0	-6.9	36.1	43.0	-6.9
H38	33.0	43.0	-10.0	34.4	43.0	-8.6	35.0	43.0	-8.0	35.6	43.0	-7.4
H39	33.8	43.0	-9.2	35.2	43.0	-7.8	35.8	43.0	-7.2	36.5	43.0	-6.5
H40	33.9	43.0	-9.1	35.4	43.0	-7.6	35.9	43.0	-7.1	36.7	43.0	-6.3
H42	33.2	43.0	-9.8	34.6	43.0	-8.4	35.1	43.0	-7.9	35.8	43.0	-7.2
H43	34.5	43.0	-8.5	35.7	43.0	-7.3	36.3	43.0	-6.7	37.0	43.0	-6.0
H44	31.1	43.0	-11.9	33.5	43.0	-9.5	34.5	43.0	-8.5	34.9	43.0	-8.1
H45	31.0	43.0	-12.0	33.8	43.0	-9.2	35.1	43.0	-7.9	35.5	43.0	-7.5

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	9			10			11			12		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H1	36.0	43.0	-7.0	36.2	43.0	-6.8	36.2	43.0	-6.8	36.2	43.0	-6.8
H2	36.7	43.0	-6.3	36.9	43.0	-6.1	37.1	43.0	-5.9	37.0	43.0	-6.0
H3	37.1	43.0	-5.9	37.3	43.0	-5.7	37.5	43.0	-5.5	37.4	43.0	-5.6
H4	37.5	43.0	-5.5	37.9	43.0	-5.1	38.0	43.0	-5.0	38.0	43.0	-5.0
H5	37.7	43.0	-5.3	38.1	43.0	-4.9	38.2	43.0	-4.8	38.0	43.0	-5.0
H6	36.0	43.0	-7.0	36.4	43.0	-6.6	36.1	43.0	-6.9	36.4	43.0	-6.6
H7	36.0	43.0	-7.0	36.3	43.0	-6.7	36.2	43.0	-6.8	36.2	43.0	-6.8
H8	35.7	43.0	-7.3	36.1	43.0	-6.9	35.8	43.0	-7.2	36.0	43.0	-7.0
H9	39.7	43.0	-3.3	39.7	43.6	-3.9	39.8	46.7	-6.9	39.7	46.7	-7.0
H10	35.6	43.0	-7.4	35.6	43.6	-8.0	35.7	46.7	-11.0	35.6	46.7	-11.1
H13	35.8	43.0	-7.2	35.8	43.6	-7.8	35.7	46.7	-11.0	35.7	46.7	-11.0
H16	33.9	43.0	-9.1	33.9	43.6	-9.7	33.9	46.7	-12.8	33.9	46.7	-12.8
H22	35.4	44.2	-8.8	35.4	47.4	-12.0	35.4	50.6	-15.2	35.4	50.6	-15.2
H23	38.1	44.2	-6.1	38.1	47.4	-9.3	38.1	50.6	-12.5	38.1	50.6	-12.5
H33	31.8	43.0	-11.2	31.8	45.0	-13.2	31.8	45.0	-13.2	31.8	45.0	-13.2
H34	36.8	44.2	-7.4	36.8	47.4	-10.6	36.8	50.6	-13.8	36.8	50.6	-13.8
H35	36.1	44.2	-8.1	36.1	47.4	-11.3	36.1	50.6	-14.5	36.1	50.6	-14.5
H38	36.3	43.0	-6.7	36.9	43.0	-6.1	36.3	43.0	-6.7	36.8	43.0	-6.2
H39	37.1	43.0	-5.9	37.6	43.0	-5.4	37.1	43.0	-5.9	37.5	43.0	-5.5
H40	37.3	43.0	-5.7	37.8	43.0	-5.2	37.2	43.0	-5.8	37.7	43.0	-5.3
H42	36.5	43.0	-6.5	37.1	43.0	-5.9	36.4	43.0	-6.6	36.9	43.0	-6.1
H43	37.7	43.0	-5.3	38.3	43.0	-4.7	37.5	43.0	-5.5	38.1	43.0	-4.9
H44	35.3	43.0	-7.7	35.5	43.0	-7.5	35.4	43.0	-7.6	35.5	43.0	-7.5
H45	35.7	43.0	-7.3	35.8	43.6	-7.8	36.0	46.7	-10.7	35.9	46.7	-10.8

Cumulative Construction Noise Assessment

10.135 Any noise due to the construction of the other sites considered in the cumulative operational noise assessment is unlikely to be ongoing at the same time as the construction of the proposed development. In the event that this scenario did occur, the activities would be far enough away from each other so as not to have a cumulative impact.

Summary

10.136 The acoustic impact for the operation of the proposed development on nearby residential properties has been assessed in accordance with the guidance on wind farm noise as issued in the DTI publication “The Assessment and Rating of Noise from Wind Farms”, otherwise known as ETSU-R-97, and Institute of Acoustics Good Practice Guide (IoA GPG), as recommended for use by relevant planning policy.

10.137 To establish baseline conditions, background noise surveys were carried out at four nearby properties and the measured background noise levels used to determine appropriate noise limits, as specified by ETSU-R-97 and the IoA GPG.

10.138 Operational noise levels were predicted using a noise propagation model, the proposed wind farm layout, terrain data and assumed turbine emission data. The predicted noise levels are within noise limits derived in accordance with ETSU-R-97 at all properties at all considered wind speeds when the proposed development is considered on its own.

10.139 A construction noise assessment carried out in accordance with BS 5228-1:2009 “Noise control on construction and open sites Part 1 - Noise” found that construction noise levels are predicted to temporarily exceed construction noise criteria at nearby properties although appropriate mitigation measures have been identified.

10.140 A cumulative operational noise assessment was completed to determine the potential impact of the proposed development alongside nearby single turbine schemes. The predicted noise levels are within noise limits derived in accordance with ETSU-R-97 at all properties at all considered wind speeds.

10.141 The potential impact of the proposed development, along with the mitigation proposed and any residual impact, is summarised in **Table 10.30**.

Table 10.30: Summary of Potential Impacts, Mitigation and Residual Impacts

Potential Impact	Mitigation Proposed	Means of Implementation	Outcome/ Residual Impact
Operation			
Potential impact on residential amenity due to operational noise	Impact is deemed to be acceptable as wind farm meets noise limits specified by relevant guidance No additional mitigation measures are required due to absence of identified significant effect	Not applicable	Not significant
Construction			
Potential for noise to be created during general construction activities and by construction traffic	Due regard for 'best practicable means' (defined by Section 72 of the Control of Pollution Act 1974) A range of noise mitigation measures are proposed for the construction phase in accordance with measures outlined in BS 5228-1:2009 Site operations to be limited to 0700-1900 Monday to Friday and 0800-1300 Saturday with possible exceptions during turbine erection and commissioning, concrete delivery/pouring and periods of emergency work	Noise mitigation measures would be implemented as part of the Construction and Environmental Management Plan which would be required to be agreed as a condition of consent	Not significant

11

Traffic & Transport

11 Traffic & Transport

Introduction

11.1 This assessment considers the potential impacts on traffic and transport associated with the construction, operation and decommissioning phases of the proposed Unshinagh Wind Farm, hereinafter referred to as 'the Development'.

11.2 The site entrance for the Development is located on the A42 Ballymena Road within the townlands of Drumourne, Unshinagh Mountain, Unshinagh South, Ticloy, Slane, Cregcattan (part of Galdanagh) and Aughareamlag, Co. Antrim approximately 4km South West of the village of Carnlough Village. The Planning Application Boundary, hereinafter referred to as the 'Site' is shown in **Figure 1.1 Planning Application Boundary.**

11.3 The following have been considered in this chapter:

- Legislation and policy;
- Access routes for abnormal indivisible loads (AIL), normal construction traffic and associated road improvements;
- The type and volume of traffic generated by the Development;
- Identification of sensitive/ critical locations along the delivery route;
- Assessment of construction, operation and decommissioning traffic impacts;
- Outline of suitable mitigation measures and the evaluation of residual impacts; and
- Cumulative impacts of surrounding consented and proposed developments.

11.4 This assessment has been undertaken in-house by Renewable Energy Systems Ltd (RES) with at least one in-house Member of the Institution of Engineers Ireland and the Institution of Civil Engineers involved in its production.

11.5 This assessment is supported by the following Technical Appendices:

- **Technical Appendix 11.1: Delivery Analysis**

Legislation, Policy and Guidance

DOE- Planning Policy Statement 3- Access, Movement and Parking (2005)

11.6 Policy AMP2 of PPS3 issued by the Department of Environment (DOE) in 2005 states that:

- *"planning permission will only be granted for a development proposal involving direct access, of the intensification of the use of an existing access, onto a public road where:*
  - *a) Such access will not prejudice road safety or significantly inconvenience the flow of traffic; and*
  - *b) The proposal does not conflict with Policy AMP3 Access to Protected Routes"*

11.7 Policy AMP3 of PPS3 (Clarification) published by the DOE in October 2006 states that: *"The Department will restrict the number of new access and control the level of use of existing accesses onto Protected routes as follows:*

- *Motorways and High Standard Dual Carriageways;*
- *Other Dual Carriageways, Ring Roads, Through- Passes and By-Passes- all Locations;*
- *Other Protected Routes – Outside Settlement Limits; and*
- *Other Protected Routes – Within Settlement Limits"*

Strategic Planning Policy Statement (SPPS)

11.8 The SPPS highlights that transportation issues to be addressed in the LDP should include Protected Routes. Whilst regional policy is to restrict the number of new access and control the level of use of existing accesses onto protected routes, there are exceptions where the principle of development accords with policy elsewhere in the SPPS.

DOE – Planning Policy Statement 18: Renewable Energy (2009)

11.9 Policy RE1 of PPS18 issued by DOE in 2009 requires applications for a wind energy development to demonstrate that no part of a development will have an unacceptable impact on roads, rails or aviation safety:

- *"Where any project is likely to result in unavoidable damage during its installation, operation or decommissioning, the application will need to indicate how this will be minimised and mitigated, including details of any proposed compensatory measures… This matter will need to be agreed before planning permission is granted."*

DOE – Best Practice to Planning Policy Statement 18 'Renewable Energy' (2009)

11.10 Section 1 of the Guidance relates to wind energy and names the "Adequacy of local access road network to facilitate construction of the project and transportation of large machinery and turbine parts to site" as one of the main concerns that needs to be considered by the developer when applying for a wind farm development.

IEMA – Guidelines for the Environmental Assessment of Road Traffic (1993)

11.11 The Institute of Environmental Management and Assessment (IEMA) guidelines (hereinafter referred to as IEMA Guidelines (1993)) are the most widely used guidance document for assessing traffic impacts as part of Environmental Statements and are referred to throughout this Chapter.

11.12 The IEMA Guidelines (1993) suggest two general rules for identifying the extent of the assessment area:

- **Rule 1** – include highway links where traffic flows will increase by more than 30% (or the number of heavy good vehicles (HGVs) will increase by more than 30%).
- **Rule 2** – include any other specifically sensitive areas where the traffic flows have increased by 10% or more.

11.13 Where the change is less than the above thresholds, the impact shall be considered 'negligible'

Consultation

11.14 Consultation with stakeholders relevant to traffic, roads and infrastructure on and near the delivery routes were undertaken. The feedback from this consultation process helped to clarify the local transport strategy, identify issues of specific local importance and gather basic information on local infrastructure and structures. A summary of the consultation responses and proposed mitigation measures are included in ***Table 11.1***

Table 11.1: Consultation Responses

Consultee	Issue	Solution/ Further Steps
DfI Roads, Northern Division	Advised of proposed AIL delivery route associated with the proposed Development	DfI Roads were consulted with regards to the proposed primary AIL route, which would exit the A42 at the south west end of the Slane Road, continuing to the north east end, before entering the site at the proposed entrance located there. DfI had concerns regarding 1) running width of the Slane Road being less than 4m in some sections, 2) structural stability of the road, 3) Undulation of the road surface, and 4) passing bay provision. Following further delivery analysis and discussion with DfI Roads, the AIL route was revised to follow the A42, with the site entrance located north of the Slane road junction. Mitigation measures required on the public road network should be addressed. A Traffic & Transport Chapter is to be included within the Environmental Statement.

11.15 Please note, further consultation is required post consent with stakeholders relevant to traffic, roads and infrastructure on and near the delivery routes to finalise the preferred HGV access route strategy to the development.

Scope of the Assessment

11.16 The main transport effects will be associated with the movement of commercial Heavy Goods Vehicles (HGVs) and Abnormal Indivisible Loads (AILs) (i.e. turbine component delivery) to and from the site during the construction phase of the Development.

Once operational, it is envisaged that the volume of traffic associated with the Development would be minimal, comprising service and maintenance visits. Occasional visits may also be made to the site for more extensive maintenance/ repairs. The vehicle used for maintenance visits is likely to be a 4x4 vehicle (or similar) but there may be an occasional need for HGV deliveries, road-going cranes or AILs to access the site for heavier maintenance and repairs. However, it is considered that the effects of such operational traffic will be negligible and therefore, detailed consideration of the operational phase of the Development is not included in this assessment.

11.17 For details of the assessment of construction noise associated with deliveries, see **Chapter 10: Noise**.

11.18 The proposed access routes for AILs (turbine delivery) is illustrated in **Figure 11.1 - Turbine Delivery Route.** It is proposed that HGV deliveries of concrete and stone respectively will also utilise the A42 but could do so from either direction dependant on the source of material and subject to confirmation with Dfl Roads. The proposed HGV delivery route is illustrated in **Figure 11.2 - HGV Route.**

Abnormal Indivisible Loads (turbine component delivery) and HGV Deliveries

11.19 Specialist vehicles are required to transport components to the site. One vehicle would transport turbine blades, while another type would transport the tower sections. Swept path analyses have been undertaken for blade delivery as this is the more onerous scenario, to determine the works required to allow passage through pinch-points on the route as illustrated in **Appendix 11.1**

11.20 The proposed access route for AILs from Belfast Port has been used previously for the construction of various wind farms that have utilised the A8. From Belfast the route will travel north on the M2, onto the A26 at Dunsilly Roundabout, continuing for c. 15.7km. The route exits onto the A42, Raceview Road, continuing on the A42 east c. 19.7km to the site entrance.

11.21 The proposed return route for the delivery vehicles is similar to the proposed delivery route noted above. Once the turbine components have been delivered, the vehicles will be shortened so they are no longer than a typical articulated HGV.

11.22 Where required, approval to temporarily remove street furniture (for the minimum period as is reasonably practical), will be obtained from the appropriate bodies prior to deliveries post planning consent.

Widening Works

11.23 Widening works will be required at two locations along the abnormal load delivery route, as illustrated in ***Appendix 11.1***. Widening locations are:

- A42, The Sheddings (Detail 1, Figure 1.2)
- A42, site entrance approach

11.24 Widening works will occur in third party land take and accordingly these works are included in the Planning Application Boundary see ES **Figure 1.2**

11.25 Widening areas will be reinstated once turbine delivery has been undertaken. If road widenings require the removal of boundary features such as fences, trees or hedgerows, these will be reinstated at suitable locations. Reinstatement will also be applied to any street furniture which may be removed on a temporary basis. In the unlikely event that a replacement blade is required during the operational phase of the wind farm, the widenings will need to be reopened temporarily, after which they will be reinstated.

Normal HGV Delivery

11.26 Normal HGV load delivery routes (including stone and concrete) will utilise the A42, with sources of material to be confirmed prior to construction. No passing bays will be required as the roads are two-way with adequate passing provided.

11.27 Where agreed by Dfl Roads, circular HGV haul routes may be implemented for the construction phase of the project.

11.28 Post consent, a detailed review of all bridges/ structures along the preferred route will be undertaken and, if required structural surveys will be carried out. The requirement (if any) of any subsequent improvement will be undertaken following consultation with Dfl Roads and detailed in the Traffic Management Plan (TMP).

Site Entrance

11.29 The site entrance is located on the A42 Carnlough/Ballymena road, approximately 150m north of Doonan leap car park and approximately 65m from the Slane road junction. an, designed accordingly to accommodate AIL deliveries.

11.30 The proposed site entrance design is shown in ***Figure 1.10*** and has been designed in accordance with the requirements of Development Control Advice Note (DCAN) 15, 2nd Edition.

11.31 As specified in DCAN 15, visibility splays measuring 160m x 4.5m are provided in both directions. Following construction, the site entrance will be reinstated to reduce the extent of hardstanding back to its original pre-construction state. Stone pillars and walls removed to allow access will be reinstated as will stock proof fencing. Any trees and hedgerows removed will be replanted.

Assessment Methodology

11.32 The assessment has been undertaken in accordance with the Institute of Environmental Assessment's 'Guidelines for the Environmental Assessment of Road Traffic' (1993).

11.33 The IEA Guidelines (1993) is the only document available that sets out a methodology for assessing potentially significant environmental impacts where a proposed development is likely to give rise to changes in traffic flows.

11.34 The IEA Guidelines (1993) suggest that, in order to determine the scale and extent of the assessment and the level of impact the development will have on the surrounding network, the following two ‘rules’ should be followed:

1. Include highways links (public roads) where traffic flows are predicted to increase by 10% or more.
2. Include any other specifically sensitive areas where traffic flows are predicted to increase by 10% or more.

11.35 Where possible, the significance of each impact is considered against the criteria within the IEA Guidelines (1993). However, the IEA Guidelines (1993) State that: *“for many effects there are no simple rules or formulae which defines the thresholds of significance and there is, therefore, a need for interpretation and judgement on the part of the assessor, backed-up by data or quantified information wherever possible. Such judgements will include the assessment of the numbers of people experiencing a change in environmental impact as well as the assessment of the damage to various natural resources.”*

11.36 In the absence of established significance criteria for traffic and transport impacts, professional judgement has been used to assess whether the impacts on traffic and transport are considered to be significant, using the IEA Guidelines (1993) to identify the scale and extent of the assessment to be undertaken. The significance falls into two categories; ‘not significant’ and ‘significant’, the latter corresponding to significant impacts in accordance with IEA Guidelines (1993).

11.37 The IEA Guidelines (1993) state projected changes in traffic of less than 10% creates no discernible environmental impact, given that daily variations in background traffic flow may fluctuate by this amount, and that a 30% change in traffic flow represents a reasonable threshold for including a highway link (public road) within the assessment. The threshold for a detailed assessment therefore has been set at a 30% change in HGV traffic flow.

11.38 The following receptors have been used for this assessment:

- ACT 1, A42 South
- ACT 2, A42 North

11.39 The Traffic Count (ATC) surveys were undertaken during a period of seven consecutive days starting on 4th May 2021 as listed in ***Table 11.2***.

Table 11.2 ATC Summaries

Road Reference	24hr Average Daily Flow
ACT 2, A42 South	1469
ACT 4, A42 North	1425

Potential Significant Effects

11.40 The construction of the Development is anticipated to take approximately 12 - 18 months. Construction site working hours will be from 0700 to 1900, Monday to Friday and 0700 to 1300 on Saturdays but deliveries may occur outside these times to minimise disruption to local residents and/ or to comply with Health and Safety, quality or any specific environmental requirements. During both turbine erection and decommissioning periods site workings could be seven days a week.

11.41 The associated traffic flows will vary over that time as different elements of the Development are constructed and will depend on the chosen Contractor's preferred method of working. A Traffic Management Plan (TMP) will be prepared by the Applicant or the chosen Contractor once the construction schedule, plant requirements and the turbine model have been defined, pre-construction. This will ensure impacts to the users of the delivery route are minimised where possible. The TMP will be submitted to Dfl Roads for approval prior to the start of construction.

11.42 Traffic generation during the construction stage estimated assuming the following activities will take place:

- Delivery of components for site set-up;
- Delivery of materials for road and hard standings;
- Delivery of materials and components associated with the foundation construction;
- Delivery of components associated with turbines;
- Delivery of components and materials associated with cable installation;
- Delivery of substation components and materials;
- Other miscellaneous deliveries/ removal; and
- Construction workers commuting.

11.43 ***Table 11.3*** provides the estimated traffic generation across an assumed 12 - 18-month construction period. The assessment has been based on the assumption that all material has to be imported to site, including ready mixed concrete for the turbine foundations and all aggregate for the access tracks and areas of hardstanding, thus providing a worst case assessment.

Table 11.3 Estimated Traffic generation across an assumed 12-18 month construction period

Phase	Purpose	Delivery Vehicle	Approx. No. of deliveries for project duration	Approx. highest No. of daily deliveries	Approx. period when deliveries occur
Site Set-Up	Portacabin delivery	Low Loader	10	10	1
	Skip delivery	Low Loader	5	5	1
	Generator delivery	Low Loader	2	2	1
	Water and fuel tank delivery	Low Loader	1	1	1
	Excavator delivery	Low Loader	3	2	1-2
	Tool container delivery	Low Loader	2	2	1-2
	Roller-compactor	Low Loader	3	1	1-2
	Articulated dumper	Tipper Lorry	3	1	1-2
	Stone for site tracks	Tipper Lorry	3770	40	1-5

Phase	Purpose	Delivery Vehicle	Approx. No. of deliveries for project duration	Approx. highest No. of daily deliveries	Approx. period when deliveries occur
Site tracks & hard standings	Stone for control building & substation compound	Tipper Lorry	40	10	1-5
	Stone for construction compound	Tipper Lorry	20	20	1-5
	Stone for pathways	Tipper Lorry	30	30	1-5
	Stone for crane hardstandings	Tipper Lorry	1200	40	1-5
Foundation construction	Excavator delivery	Low loader	2	2	2-3
	Misc works	Backhoe loader	2	2	2-3
	Concrete for turbine foundations, piles & transformer plinths	Mixer truck	840	50	2-5
	Steel delivery	Flat bed	28	28	2-5
	Foundation bolts or steel insert delivery	Flat bed	14	14	4-5
	Place foundation bolt cage or steel insert	30t – 50t crane	1	1	4-5
Turbine Erection	Tower section delivery	Clamp lift trailer	56	8	7-8
	Blade delivery	Extendible trailer	42	6	7-8
	Nacelle	Low loader	14	2	7-8
	Hub and rotor	Low loader	14	2	7-8
	Drive train	Low loader	14	3	7-8
	Large crane delivery & removal	1000t – 12000t crane	2	1	7-8
	Crane associated equipment delivery & removal	Low loader	42	10	7-8
	Smaller crane delivery & removal	150t – 200t crane	2	1	7-8
Cable Installation	Cable delivery	Flat bed	14	8	5
	Sand delivery	Tipper lorry	280	20	5
	Excavator delivery	Low loader	2	1	5
	Cable laying	Tele handler	2	1	5
Substation and Control Building	Concrete delivery	Mixer truck	36	36	5
	Brick delivery	Flat bed	3	3	5
	Roofing & Cladding	Flat bed	3	3	6-7
	Switchgear	Flat bed	2	2	6-7
	Misc. electrical equipment	Flat bed	3	3	6-7
Misc.	Waste removal	Skip lorry	90	1	1-10
	Water/ fuel deliveries	Small tanker	90	1	1-10
Site Demobilisation	Portacabin removal	Low loader	6	6	10
	Skip removal	Low loader	5	5	10
	Generator removal	Low loader	2	2	10
	Water & fuel tank removal	Low loader	1	1	10
	Roller-compactor	Low loader	1	1	7-8
	Dumper truck	Low loader	1	1	10
	Excavator removal	Low loader	2	2	5-10

Phase	Purpose	Delivery Vehicle	Approx. No. of deliveries for project duration	Approx. highest No. of daily deliveries	Approx. period when deliveries occur
	Misc. works	Low loader	2	2	10
TOTAL Heavy Goods Vehicles			**6707**		
Site Staff & Deliveries	Staff	Cars & minivans	8600	65	1-10
	Miscellaneous	Vans	900	5	1-10
TOTAL Cars & Light Vehicles			**9500**		
TOTAL VEHICLES			**16207**		

11.44 ***Table 11.3*** has been derived from experience gained from previous wind farm construction phases and assumes approximately 40 stone deliveries per day.

11.45 It is estimated that the greatest concentration of construction traffic occurs on the days when concrete is delivered to the Development for the construction of turbine foundations.

11.46 Technical 'best practice' construction requirements may necessitate that the concrete for an individual turbine base foundation will have to be delivered and poured in one day to prevent 'cold' joints forming in the structure. As a result, there may be a period in which there will be an increased number of delivery vehicles, compared with the rest of the construction period, entering and leaving the Development. The total number of concrete deliveries for each turbine base may be up to 65 journeys per day.

11.47 This equates to approximately one vehicle movement every five minutes over the working day (0700 – 1900). ***Table 11.4*** illustrates the worst case percentage change of traffic flow (ie. Based on the busiest 6 days) along the proposed access route during the turbine base construction stage of the Development.

Table 11.4 Summary of Percentage Increase in Traffic on Local Roads

Road Reference	24hr Average Daily Flow	Average Recorded Daily HGV Flow as a percentage (No. of HGVs)	Percentage increase of HGVs (No. of HGVs)	Is the IEA (1993) threshold of 30% increase in HGV Traffic Flow exceeded?
ACT 2, A42 South	1469	14% (202)	69% (140)	Yes
ACT 4, A42 North	1425	13% (191)	73% (140)	Yes

11.48 It is predicted that there will be an increase in vehicle movements of between 111% and 118%. The percentage increase is high given the low volume of traffic which the roads currently accommodate. These roads are two way and therefore will not need to be widened to accommodate vehicles travelling to and from the Development entrance.

11.49 The IEA threshold of 30% us exceeded the A42 both north and south sections, therefore an assessment of potential significant impacts has been provided in ***Table 11.5***.

Table 11.5: IEA Environmental Impact

Predicted Impact	Description	Applicability to Tertiary Road Network
Severance	Severance is a perception that a road is more difficult or possibly less safe to cross. Increased severance can result in the isolation of areas of a settlement or individual properties. However, it is important to note that the impact is largely a function of traffic volumes, rather than one of vehicle composition amongst traffic.	The IEA guidelines suggest changes in traffic flow of 30% are likely to affect severance. There is low existing traffic flow and little pedestrian activity. The TMP will be undertaken with consultation of the utilised quarry and local residents. An agreement will be made to ensure that delivery times do not coincide with 'pick-up' and 'drop-off' times that may affect access to local services. With this measure the temporary impact of severance is considered to be **Not Significant**
Driver Delay	Driver delay is that experienced by non-development related road uses on the surrounding roads and particularly as a consequence of slow moving traffic associated with construction.	The IEA guidelines suggest that delays are only likely to be of significance when the traffic on the surrounding network is at, or close to, full capacity. Given that this is not the case, this is not considered to be an issue. It is acknowledged that there may be localised delays directly attributable to construction traffic due to the large increase in traffic flow on the A42. This is most likely restricted to junctions, and local road users are familiar with encountering HGVs. The delivery of turbine components will involve large, slow moving vehicles however these will be escorted and timed to cause minimal disruption. The potential impact is considered **Not Significant** given that there is a low volume of vehicles on the tertiary road network and these roads are two way. Deliveries will be timed to minimise disruption, escorted where necessary and information regarding deliveries will be made available via the TMP, prior to construction.
Pedestrian Delay	Pedestrian delay is affected by changes in traffic volume, HGV movements and traffic speed. Pedestrian delay also depends on the existing level of pedestrian activity, visibility and current infrastructure provision. There is no threshold on which pedestrian delay is assessed.	Pedestrian movement on the A42 is minimal The area therefore has a low sensitivity rating in relation to pedestrian delay and impacts will be **Not significant**

Predicted Impact	Description	Applicability to Tertiary Road Network
Pedestrian Amenity	Pedestrian amenity can be affected by traffic volumes and the distance between pedestrians on the footway and passing traffic. The IEA guidelines suggest that changes to pedestrian amenity may be considered significant where traffic is doubled or halved.	There is minimal volume of pedestrian movement on the A42 and whilst the volume of HGV sees a significant increase, given the lack of pedestrian movement this does not pose a significant risk. It is considered the impact on pedestrian's / cyclist's amenity will be **Not Significant** given that the worst case of vehicle movements will be one per five minutes on the six days associated with the turbine foundations.
Fear & Intimidation: Pedestrians	The IEA guidelines state that the degree of fear and intimidation experienced by pedestrians is affected by the volume of passing traffic, the proportion of HGV traffic and its proximity to pedestrians.	Despite the predicted temporary increase in traffic flows, the minimal volume of pedestrian movement along A42 combined with the two-way nature of these roads means this impact will be **Not Significant.**
Accidents & Safety	The IEA guidelines state that road accidents are attributable to a variety of local factors and as such do not provide a threshold to determine significance. Instead the IEA guidelines relies more on the assessor to use their own judgement.	Construction and predicted changes will be temporary and given that consultation will be undertaken with local residents, and traffic generation is low, there is unlikely to be an impact upon road safety and accident levels. Furthermore, all abnormal loads will be escorted, and the movement of these vehicles will be programmed to avoid busy periods thus reducing the potential impacts further. It is considered the overall impact on accidents and safety is **Not Significant** given that the worst case of vehicle movements will be one per five minutes on the six days associated with the turbine foundations.

Cumulative Impacts

11.50 There are two consented and proposed projects within 10km of the Development. These are Ballykeel (consented) and Carnalbanagh (proposed) Wind Farms, located 5.5km south of T14 and 6.7km west of T12 respectively. This could theoretically result in cumulative traffic impacts, however these would likely be limited to the primary road network surrounding the A8. Whilst the developments intend to partially utilise the same turbine delivery route to access the A8, in the unlikely event that the construction periods were to coincide, vehicle movements would not likely exceed the 30% threshold. As part of the TMP, consideration of any cumulative effects arising from the construction of other wind farms will be reviewed in detail and mitigated accordingly.

Table 11.6: Wind Farms in the Vicinity of the Development

Name	Status	Number of Turbines	Distance from Proposed Site Boundary
Ballykeel	Consented	7	5.5km south of T14
Carnalbanagh	Proposed	7	6.7km west of T12

Mitigation

11.51 A Traffic Management Plan (TMP) will be prepared by the Applicant in accordance with the requirements of Department of Infrastructure NI, the local PSNI, and if required, any other relevant stakeholders. Features of the TMP will include:

- Details of the access route, conformation of any points along the access route that require street furniture removal, details of traffic numbers, delivery timings, and signage and escort requirements
- A delivery schedule for normal and abnormal loads to minimise disruption as far as reasonably practicable
- Details of how any movements will comply with legislation regarding the movement of abnormal loads e.g. notice procedures and notice periods
- Details on the use of escorts where required. Where long vehicles and abnormal loads would have to use the wrong side of the carriageway or need to swing into the path of oncoming vehicles a lead warning vehicle would be used. One escort vehicle would drive ahead and pull oncoming traffic into identified passing places. An escort vehicle would travel directly in front of the convoy and pull over any oncoming traffic that comes onto the road after the first escort vehicle has passed. A further convoy escort vehicle would follow the convoy
- Information about marking of vehicles as long/abnormal loads

11.52 Information will be given on how warning signs will be used. These will be used to advise other road users of 'Caution Slow Plant Turning Ahead' and will be placed at intervals from both directions along the main road approaching the site entrance during the construction phase. The TMP will also detail additional measures to ensure impacts from traffic movements are minimised where possible, for example provision of road sweepers and/or wheel wash facilities.

11.53 If required, the wheel wash facilities will include a waterless drive over wheel wash for lorries. This will be provided at the site entrance to prevent mud and dust being brought out from the Site onto the public highway and anything being brought onto Site from public highway. Although experience has shown the majority of mud is shaken off wheels on site before the vehicle reaches the public road, the site entrance and adjacent public highway will also be monitored and cleaned if necessary.

11.54 The TMP will include details about Video Surveying and Road Repairs. A video survey of the pre-construction condition of all public roads will be recorded around the site entrances and access routes (but including the site entrance and access roads), to provide a baseline record of the state of the roads prior to construction work commencing. This will enable any repairs and maintenance work required to the relevant road due to any damage caused by the passing of heavy vehicles associated with the wind farm construction to be identified following the construction phase. The roads will be returned, at minimum, to the baseline condition at the end of the construction phase. Any damage caused by wind farm traffic during the construction period, which would be hazardous to public traffic, will be repaired immediately. These works will be carried out under permits with DfI Roads, as appropriate.

11.55 The TMP will include plans for notifying relevant stakeholders in advance of delivery periods, including the emergency services, DfI Roads, local residents, local business, local services and schools. The local community will be informed prior to the commencement of construction and prior to the commencement of turbine deliveries by letter and through local press. The contact details of the Construction Site Manager will be made available as a contact point for enquiries. Local schools on the delivery routes will be contacted to identify school and nursery drop-off and pick up locations and times. Construction deliveries will be scheduled to avoid these busy periods as far as reasonably possible.

11.56 If cutting or removal of hedges and trees is required, then this should be done outside the bird breeding season (1st March to 31st August) unless otherwise agreed. If work is to be done during the breeding season, then there should be a survey to establish whether nesting birds are present.

Summary

11.57 The main traffic impacts are associated with the increase in HGV vehicle movements along the A42 during the construction stage of the project. These roads have low levels of existing traffic and a small number of receptors will be affected. At worst, the frequency of vehicle movements is expected to be one vehicle every five minutes during the 6 days when the construction of each wind turbine foundation would occur.

11.58 Consideration has been given to the effect of increased HGV traffic flow on Severance, Driver Delay, Pedestrian Delay, Pedestrian Amenity, Fear and Intimidation, Accidents and Safety and Cumulative Impacts. Furthermore, consideration has been given to the environmental effects of any road improvement/widening works.

11.59 A TMP will be developed and agreed with the relevant stakeholders post consent and pre-construction in order to control and mitigate impacts associated with increased vehicles movements.

11.60 Taking into account the existing vehicle movements on the affected roads, and the proposed type and frequency of vehicle numbers, it is considered that with the appropriate mitigation measures as set out above, there will be no significant impacts.

List of References, Figures and Appendices

References

Department of Environment (2009); Best Practice Guidance to Planning Policy Statement 18 – Renewable Energy, Planning and Environmental Policy Group.

Department of Environment (2005); Access, Movement and Parking Planning Policy Statement 3, PPS 3, The Planning Service.

Department of Environment (2015); Northern Area Plan 2016. Institute of Environmental Assessment (1993);

The Institute of Environmental Assessment's Guidelines for the Environmental Assessment of Road Traffic.

Figures

Appendices

12

Shadow Flicker

12 Shadow Flicker & Reflected Light

Background Information

12.1 In sunny conditions, any shadow cast by a wind turbine will mirror the movement of the rotor. When the sun is high, any shadows will be confined to the wind farm area but when the sun sinks to a lower azimuth moving shadows can be cast further afield and potentially over adjacent properties. Shadow flicker is generally not a disturbance in the open as light outdoors is reflected from all directions. The possibility of disturbance is greater for occupants of buildings when the moving shadow is cast over an open door or window; since the light source is more directional.

12.2 Whether shadow flicker is a disturbance depends upon the observer's distance from the turbine, the direction of the dwelling and the orientation of its windows and doors from the wind farm, the frequency of the flicker and the duration of the effect, either on any one occasion or averaged over a year.

12.3 In any event and irrespective of distance from the turbines, the flickering frequency will depend upon the rate of rotation and the number of blades. It has been recommended (Clarke, 1991) [1] that the critical frequency should not be above 2.5 Hz, which for a three-bladed turbine is equivalent to a rotational speed of 50 rpm. The proposed turbines at Unshinagh Wind Farm would rotate at a maximum of approximately 16 rpm, well below this threshold.

Reflected Light

12.4 A related visual effect to shadow flicker is that of reflected light. Theoretically, should light be reflected off a rotating turbine blade onto an observer then a stroboscopic effect would be experienced. In practice a number of factors limit the severity of the phenomenon and there are no known reports of reflected light being a significant problem at wind farms.

12.5 A limiting factor is that wind turbines have a semi-matt surface finish which means that they do not reflect light as strongly as materials such as glass or polished vehicle bodies.

12.6 Secondly, due to the convex surfaces found on a turbine, light will generally be reflected in a divergent manner.

12.7 Thirdly, as with shadow flicker, certain weather conditions and solar positions are required before an observer would experience this phenomenon.

12.8 It is therefore concluded that Unshinagh Wind Farm will not cause a material reduction to amenity owing to reflected light.

Policy and Guidance

12.9 The update to Shadow Flicker Evidence Base (2011) [2], published by the then Department for Energy and Climate Change (DECC), states that assessing shadow flicker effects within ten times the rotor diameter of wind turbines has been widely accepted across different European countries, and is deemed to be an appropriate area. The Best Practice Guidance to Planning Policy Statement 18 "Renewable Energy" (2009) [3] further describes that, *"…at distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low"*.

Methodology

12.10 Analysis was performed on all properties with 10 rotor diameters of any turbine.

12.11 This shadow flicker assessment is based on turbines with a 136 m rotor diameter and the planning application includes a 50 m micrositing distance for infrastructure. As such, this 50 m distance is added to the ten-rotor diameter (1360 = 10* 136) m distance to give a total distance of (1410 = 1360 + 50) m from any turbine.

12.12 Analysis was undertaken for shadow flicker at all properties within 1410 m from any wind turbine.

12.13 This analysis takes into account the motion of the Earth around the Sun, the local topography and the turbine locations and dimensions. The analysis was performed using a layout of 14 turbines, each with maximum tip heights of 180 m.

Results

12.14 With due reference to the DECC report, and an allowance for 50 m micro-siting, the potential shadow flicker is given in the Table below:

RES Property ID	Property Address	Maximum Hours of Flicker Per Year
H1	10 SLANE ROAD BALLYMENA BT42 4NA	0.0
H2	14 SLANE ROAD BALLYMENA BT42 4NA	0.0
H3	16 SLANE ROAD CARNLOUGH BT42 4NA	0.0
H4	20 SLANE ROAD CARNLOUGH BT44 0LF	0.0
H5	22 SLANE ROAD CARNLOUGH BT42 4NA	0.0
H6	50 KILLYCARN ROAD BALLYMENA BT42 4LY	0.0
H7	54 KILLYCARN ROAD BALLYMENA BT42 4LY	20.7
H8	44 KILLYCARN ROAD BALLYMENA BT42 4LY	22.7

H9	68 SLANE ROAD CARNLOUGH BT44 0LF	36.5
H10	57 SLANE ROAD CARNLOUGH BT44 0LF	10.7
H22	147 BALLYMENA ROAD CARNLOUGH BT44 0LA	34.8
H23	4 GARTFORD LANE CARNLOUGH BT44 0HU	36.7
H27	121A BALLYMENA ROAD CARNLOUGH BT44 0LA	25.6
H29	7 GARTFORD LANE CARNLOUGH BT44 0HU	18.3
H30	5 GARTFORD LANE CARNLOUGH BT44 0HU	0.0
H31	25 DRUMOURNE ROAD CARNLOUGH BT44 0HX	11.6
H32	23 DRUMOURNE ROAD CARNLOUGH BT44 0HX	8.6
H33	20 DRUMOURNE ROAD CARNLOUGH BT44 0HX	0.0
H34	BALLYMENA ROAD CARNLOUGH BT44 0LA	57.0
H35	BALLYMENA ROAD CARNLOUGH BT44 0LA	42.0
H44	SLANE ROAD BALLYMENA BT42 4NA	0.00
H45	SLANE ROAD CARNLOUGH BT44 0LF	9.85
H46	BALLYMENA ROAD CARNLOUGH BT44 0LA	0.00
H61	7 SLANE ROAD BALLYMENA BT42 4NA	0.00

12.15 The above impacts represent a worst-case scenario for the following reasons:

a. The analysis assumes that there is always sufficient lack of cloud cover, for there to be sufficient sunlight for shadows to be cast by the turbine.

b. The analysis assumes that there is always enough wind for the turbine blades to be turning.

c. The analysis assumes that the wind is always coming from the right direction for the turbine rotor to be facing towards the house, to thus cast a shadow.

d. The analysis assumes that the property has windows and/or glazed doors facing towards the turbine.

e. The analysis assumes there is no shielding, e.g. in the form of trees, between the turbine and the property.

Mitigation

12.16 The impact from shadow flicker on the 13 potentially affected houses is a worst case scenario. Only 5 houses are likely to get more than 30 hours of shadow flicker per year and it is therefore concluded that Unshinagh Wind Farm will not cause a significant reduction to residential amenity owing to shadow flicker. Mitigation will be assessed for the affected houses as necessary.

12.17 Mitigation measures can be incorporated into the operation of the Wind Farm to reduce the instance of shadow flicker. Mitigation measures include planting tree belts between the affected dwelling and the responsible turbine(s) and shutting down individual turbines during periods when shadow flicker could theoretically occur.

References

[1] Clarke A.D (1991), A case of shadow flicker/flashing: assessment and solution, Open University, Milton Keynes

[2] Brinckeroff, Parsons (2011) 'Update of UK Shadow Flicker Evidence Base', Department of Energy and Climate Change, UK Government

[3] Planning Policy Statement 18 "Renewable Energy" (including Best Practice Guidance to Planning Policy Statement 18) August 2009

13

Socioeconomics

13. Socioeconomics

Introduction

Background to the Study

13.1 RES commissioned Oxford Economics in the summer of 2021 to undertake a socioeconomic impact report of the proposed Unshinagh Wind Farm, hereinafter referred to as 'the Development', which is located within the Mid and East Antrim Borough Council area.

13.2 The Development will have a total installed capacity of up to 58.8 megawatts (MW), consisting of 14 three-bladed turbines, with a planned operational lifespan of 35 years. It is anticipated that the electricity generated will be exported to the grid.

13.3 This report presents estimates relating to the direct, indirect and induced benefits that could be generated. It also provides a brief discussion on the unquantifiable benefits associated with a development of this type and scale, and the current macroeconomic and socioeconomic environments.

About RES

13.4 RES is the world's largest independent renewable energy company. At the forefront of the industry for nearly 40 years, RES has delivered more than 21GW of renewable energy projects across the globe and supports an operational asset portfolio exceeding 7.5GW worldwide for a large client base. RES employs more than 2,000 people and is active in 10 countries working across onshore and offshore wind, solar, energy storage and transmission and distribution.

13.5 Ever since it was established in the UK in 1981, RES has been a pioneer in renewable energy, developing the UK's second ever wind farm in 1992. A significant portfolio of developed and constructed projects covers onshore and offshore wind, solar and energy storage. RES is responsible for keeping 10% of the UK's renewable energy projects operating and it provides support services—asset management and O&M—to a sizeable portfolio for leading clients in the industry.

13.6 RES has been building wind farms in Ireland since the early 1990s and from their office in Larne, Co. Antrim, they have a team of over 20 working across a range of disciplines. In Northern Ireland, RES has developed and/or constructed twenty-two onshore wind farms equating to over a quarter of Northern Ireland's onshore wind capacity and has a record of using local companies to develop, construct and operate renewable energy projects.

Structure of the Report

13.7 This section of the report is structured as follows:

- Firstly, the estimated quantifiable benefits of the construction and on-going phases of the Development are presented – concentrating on employment, gross value added (GVA)[1] and wages. An assessment of the potential fiscal and environmental benefits is also included;

- Secondly, an overview of the socioeconomic conditions, both at the regional and local level, is provided; and
- Finally, we set out our overall conclusions in respect to the Development.

Caveat

13.8 Specific information related to the Development was provided where possible by RES. The estimated benefits are based on a mix of this information, published data and reasonable assumptions.

13.9 The cost of construction could inflate or deflate depending on movements in variables such as exchange rates, demand for wind turbines and metal prices. As such the information is the best current estimate at the time of writing.

13.10 This economic impact study has been developed to form part of the environmental information to be provided to the decision maker. As such, if and when the time comes that the Development is granted full planning permission and has been built, the economic environment may look different. The analysis assumes all facilities contained in the Development are fully developed. We have considered the possibility of displacement during both the construction and operational phases of the development. It is our view that given the current and likely future performance of the local economy, there is little scope for displacement, therefore we have assumed zero levels of displacement in the modelling – see section 13.25-13.30 for further discussion.

13.11 There is no analysis within the report focusing on how the Development would impact income distribution and deprivation levels in the area. This is outside of the scope of this piece of work.

13.12 The quantifiable impacts calculated by Oxford Economics and outlined in this report come from an Economic Impact Model which uses an input-output framework, standard economic underpinnings, published data and few clearly documented reasonable working assumptions. We are aware of other reports completed by BiGGAR Economics on behalf of NIRIG (renamed to RenewableNI more recently), IWEA and RenewableUK[2] for Northern Ireland specifically, are used to check the number of construction-phase related jobs per megawatt in Northern Ireland, and have found the figures to be similar in scale to those we have estimated. While other reports completed by BiGGAR Economics on behalf of RenewableUK and the Department of Energy and Climate Change (DECC)[3] assess the direct and indirect economic impacts of the commercial onshore wind sector across the UK in the decade to 2020.

[1] Gross value added (GVA) measures the value of goods and services produced in an area, industry or sector of an economy and is equal to output minus intermediate consumption.

[2] Onshore wind: economic benefits in Northern Ireland, 2015, BiGGAR Economics, NIRIG, IWEA and RenewableUK.

[3] Onshore Wind Direct & Wider Economic Impacts, May 2012, BiGGAR Economics, DECC & RenewableUK. Date accessed on 26th August 2021 via weblink.

13.13 Our modelling does not factor in industry support mechanisms.

Glossary of Definitions

13.14 **Backward linkages**: Backward linkages refer to the channels through which money, materials or information flows between a company and its suppliers, creating a network of economic interdependence. In terms of this study, it refers to the fact that the construction phase of the Development will require the purchase and use of raw materials from sectors like building materials; steel, architectural services etc., which themselves will create supply chain jobs in the economy.

13.15 **Full-time equivalents (FTE)**: All the modelling completed by Oxford Economics and all the impacts associated with this modelling, assumes that employment is expressed in terms of FTE, which is important given the prevalence of part-time working especially in the construction sector. Accordingly, two part-time workers make up one full-time equivalent worker.

13.16 **Gross value added (GVA):** GVA measures the value of goods and services produced in an area, industry or sector of an economy and is equal to output minus intermediate consumption.

13.17 **Direct (impact)**: The direct impact is defined as the economic activity and numbers of people employed by the wind farm (both in construction and in on-going roles).

13.18 **Indirect (impact):** The indirect impact is defined as the economic activity and employment supported in the wind farm’s supply chain, as a result of their purchasing of inputs of goods and services from suppliers.

13.19 **Induced (impact):** The induced impact is defined as economic activity and employment supported by those directly or indirectly employed spending their wage income on goods and services in the wider UK economy.

13.20 **Jobs:** Any references to the employment benefits from the on-going phase once the Development becomes operational are expressed in terms of “jobs” per annum. As noted above, these jobs are full-time equivalent in nature.

13.21 **Job years:** Any references to the employment benefits from the construction phase of the Development are expressed in terms of “job years”. This is necessary given that construction phase activity normally spans more than a single year. A job year does not necessarily mean one job. Instead it refers to the amount of activity that is required. So, for example two people could be employed for six months – this would equate to one job year of work. Alternatively, one person could be employed for two years - this would equate to two job years of employment. We do not need to use the term job years when talking about the on-going phase, as these benefits are all expressed in per annum terms as discussed above.

13.22 **Nominal prices:** Nominal prices are those which reflect the current situation and are not adjusted for seasonality or inflation.

13.23 **Real prices (2018 prices):** Real prices refer to values that have been adjusted to remove the effects of inflation and are thus measured in terms of the general price level in some base reference year. They give a more accurate measure. In this case, 2018 is the base year as it is consistent with the base/reference year used within UK ONS National Accounts: the Blue Book 2020.

Quantifiable Benefits

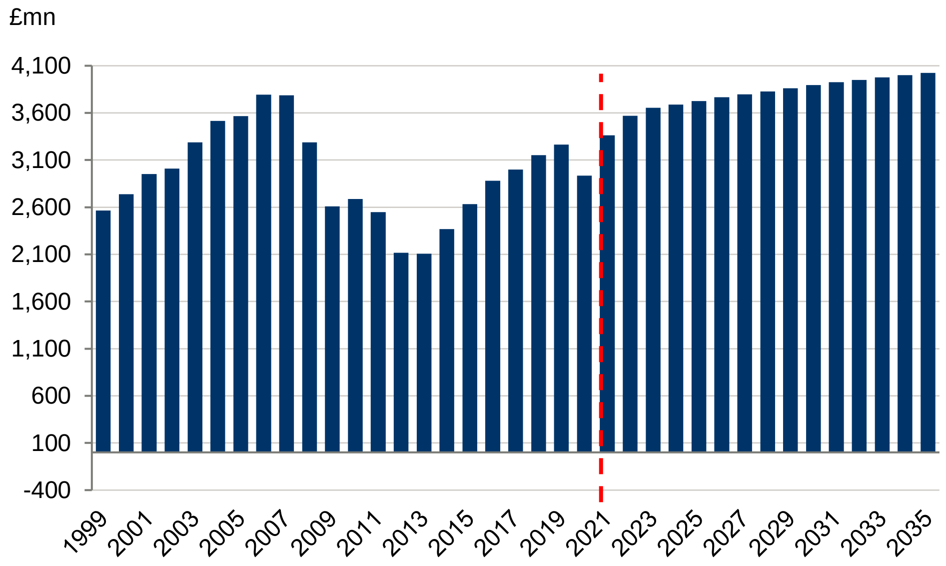
13.24 New Brexit trade arrangements that came into effect earlier this year and the continued implications from coronavirus have created several challenges for the UK economy. Indeed both impact the current and future growth trajectories at the national level, which ultimately feed down to the regional and local level. While we expect GDP growth of 7.3% this year across the UK as a whole, it comes following a sharp decline of 9.9% in 2020 and will be insufficient to see GDP levels return to 2019 levels. We forecast continued growth in 2022, with a return to pre-pandemic levels in that year. Nonetheless uncertainty surrounding the longer-term impacts of Brexit remain, as does the risk of another global / national lockdown. Therefore, there are significant downside risks to growth across the UK. Given (as we discuss later), the Mid and East Antrim Borough Council area was already experiencing a challenging economic environment, local private sector investment may be more important to help support local economic growth. **A further discussion on Brexit and the impact of Covid19 is presented in section 13.76.**

13.25 This section analyses the estimated quantifiable benefits of the construction and operational phases of the Development - concentrating on employment, GVA and wages, as well as assessing fiscal and further benefits.

13.26 A key assumption behind Oxford Economics' analysis relates to displacement. We have assumed that there will be zero displacement during both the construction and operational phases of the Development. This assumption is in part based on the analysis below and, while there are agricultural activities currently at the site, we have been informed by RES that farming will be able to continue.

13.27 Construction output and employment in Northern Ireland were heavily impacted by the 2008/09 financial recession. Figures 1 and 2 present the scale of decline and show that recovery in both output and employment terms has been slow. Construction employment levels remain almost 25 percent below those recorded in 2008, while the value of output in the sector is 11 percent lower.

Figure 1: Construction GVA in Northern Ireland (£2018 prices)



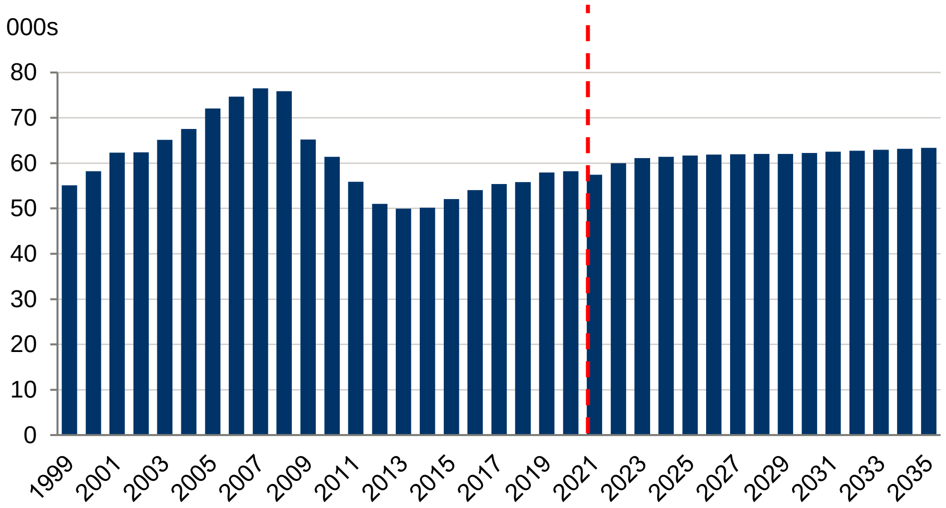
Source: ONS / Oxford Economics

13.28 Before the onset of the coronavirus pandemic, weekly (median) wages in Northern Ireland's construction sector experienced strong growth. According to ASHE statistics published by the Northern Ireland Statistics and Research Agency (NISRA), wage growth averaged 3.3 percent a year between 2015 and 2019. This rate of growth is notably higher than the region as a whole (2.5 percent). Growing demand for labour in this sector, a limited supply of construction related skills or a combination of both can explain the sector's wage inflation. In 2020 however, wages in the construction sector fell by 14.5 percent, notably weaker than the economy as a whole (1.1 percent), and while employment in the sector remained broadly stable, levels remain notably below the pre-recession peak (see Figure 2).

13.29 Therefore, we can conclude that the construction sector in Northern Ireland is likely to have enough spare capacity to accommodate the Development. As such we have applied a zero rate of displacement of current or future economic activity on the construction phase impacts.

13.30 We understand that the site for the proposed development is currently agricultural land. RES however has informed us that farmers will be able to continue to farm their land, as their full landholding is not tied up with the Development. Given the above and that the fact that the number of on-going jobs is limited in volume terms and specialised in nature, our estimates for the benefits arising from the operational phase assumes no displacement of economic or leisure activity.

Figure 2: Construction employment in Northern Ireland



Source: ONS / Oxford Economics

13.31 We are aware of the argument that increased developments of this nature could displace jobs in fossil fuel activity. We would argue that given its size, the Development would not itself, in isolation, displace any actual activity away from the various fossil fuel power stations in Northern Ireland (Kilroot, Coolkeeragh and Ballylumford[4]).

13.32 While it could be acknowledged that cumulatively and in the long-run there may be displacement from the fossil fuel industry because of the on-going drive for increased renewables as a collective, an initiative set by the UK government in the first place in which increased renewable energy is promoted in order to meet the government's target of net zero carbon emissions by 2050.

Economic impact of the Construction Phase

13.33 The benefits associated with the construction phase of the Development (jobs, wages, GVA and fiscal) are presented as a range. This range results from the implementation of two separate methods of estimating direct construction phase impacts. The first approach uses full-time job year equivalent figures provided by RES, based on previous projects they have carried out.

13.34 The second approach uses the value of investment expected to be realised in Northern Ireland. By assigning this to sectors of the economy we can estimate GVA levels, jobs and wages (using published and / or forecast data).

[4] Department for Business, Energy & Industrial Strategy: *Power stations in the United Kingdom*, May 2018. Kilroot, Coolkeeragh and Ballylumford were operational at the end of May 2018.

13.35 We then use an input-output model to estimate the indirect and induced impacts that are likely to flow from a given level of investment / activity. An input-output table provides information on how sectors purchase from one another. It also shows how households spend their income. We use UK input-output tables and adjust them to account for the local characteristics.

Method 1: Job posts approach

13.36 RES has provided job figures based on a nine-turbine project (totalling 18MW) with a construction period of 24-months. We have adjusted the job figures to account for a 14-turbine development, with a 12-month construction phase. This figure is shared across the construction and professional sector, based on the expenditure split used in Method 2 (see section 13.39).

13.37 The job figures used for modelling purposes are outlined in Table 13.1.

Table 13.1: Job years adjusted for Development

Job years	14 turbine project, 12 month construction phase
Construction	81
Professional	5
Total	**86**

Source: RES.
Note: May not add due to rounding.

Method 2: Expenditure approach

13.38 The Development is estimated to result in a capital spend of approximately £61.71 million (in nominal prices). This figure is based on information provided by RES and includes the estimated cost of turbines, Balance of Plant, local and miscellaneous spend, grid connection and professional services. Only a fraction of this investment however will be realised in Northern Ireland.

13.39 The total construction spend realisable within Northern Ireland is £23.23 million (in nominal prices)[5]. This includes the cost of grid connection and approximately five percent of the estimated £37.58 million turbine cost value, through activities such as the use of local haulage companies and crane companies.

13.40 The regional/total spend split (£24.70 million/£61.71 million) sits between estimates published in reports carried out by Deloitte and IWEA[6], and BiGGAR Economics on behalf of NIRIG (renamed to RenewableNI more recently), IWEA and RenewableUK[3]. The split between construction related spend and professional services related spend in Northern Ireland is assumed to be £23.23 million and £1.47 million respectively.

[5] For this analysis, the total construction phase spend is defined as the cost for turbines, Balance of Plant (BoP), food, fuel, plant hire, road maintenance, grid connection and miscellaneous.

[6] Jobs and Investment in Irish Wind Energy, Powering Ireland's Economy. Deloitte and IWEA. Accessed on 31st August 2021. Weblink.

For the purposes of our modelling, we have converted all this expenditure information into 2018 real prices, to keep it consistent with our model inputs and national accounts publications.[7]

13.41 The construction phase of the Development is scheduled to commence in July 2025 and last 12 months, starting operations in August 2026. The analysis therefore assumes a constant spend per quarter, leading to 46.2 percent of total spend being realised in 2025 and the remaining 53.8 percent in 2026. As such we use Oxford Economics baseline forecasts for GVA, productivity and wages to estimate the future impacts.

Direct construction phase impacts

13.42 The Development's 12-month construction phase is estimated to create or sustain between 86-151 direct job years of employment, 80-133 of which are involved with construction related activities and the remaining 5-18 job years account for professional services related activities (Table 13.2).

13.43 This direct construction phase employment would be likely to create or sustain between £2.10-£3.77 million of additional direct wages in the Northern Ireland economy. Furthermore, the investment is estimated to directly contribute between £5.09-£8.81 million to regional direct GVA.

Table 13.2: Direct benefits from the construction phase

Direct benefits	Job years	Wages (£2018m)	GVA (£2018m)
Construction related	80-133	1.95-3.22	4.88-8.07
Professional services related	5-18	0.16-0.55	0.21-0.74
Total	**86-151**	**2.10-3.77**	**5.09-8.81**

Source: Oxford Economics
Note: May not add due to rounding

Indirect and induced construction phase impacts

13.44 The supply chain (or indirect) impacts arising from the construction related activity have been estimated using the 2017 UK input-output tables (published by ONS) adjusted to take account of the structure and size of the Northern Ireland economy. In doing so we use academic guidelines like those contained in academic papers such as Flegg, A. T. and Tohmo, T. (2013) "Regional input-output tables and the FLQ formula: A case study of Finland" (Regional Studies, 47 (5). pp. 703-721).

[7] The construction phase and operational phase benefits within this section are expressed in real/constant prices with a 2018 base year – this is because 2018 is the base year used for all financial variables within Oxford Economics' suite of models – and thus the Economic Impact Model used to calculate this development's impacts. This is not to say 2018 data has been used – we have used the latest available data and the relevant forecast year in every case – 2018 simply refers to the base year for the constant price series. The construction spend figures provided by RES have been adjusted accordingly for consistency. This base year is used as it is consistent with the base/reference year used within UK ONS National Accounts: the Blue Book 2020.

13.45 Construction activity typically has strong "backward linkages" with sectors such as building materials, architectural services, legal services and insurance. These linkages tend to result in job creation elsewhere in the local economy. This makes investment in construction particularly effective in fuelling economic growth. Typically offering high economic multipliers of 2.34 and 1.29 for the UK and Northern Ireland respectively. This means that for every £1 of direct output by the sector, an additional £1.34 and £0.29 is created in the wider UK or Northern Ireland economy, respectively.

13.46 Indirect GVA impacts in Northern Ireland are therefore estimated to be approximately £1.33-£2.24 million, creating or sustaining an estimated 25-43 job years of employment, with associated wages of £0.62-£1.05 million (Table 13.3).

Table 13.3: Total benefits from the construction phase

Total (direct, indirect and induced) benefits	Job years	Wages (£2018m)	GVA (£2018m)
Direct	86-151	2.1-3.77	5.09-8.81
Indirect	25-43	0.62-1.05	1.33-2.24
Induced	28-49	0.65-1.14	1.14-1.99
Total	**139-243**	**3.37-5.96**	**7.56-13.04**

Source: Oxford Economics
Note: May not add due to rounding

13.47 As both direct and indirect wages generated through the construction phase are spent on goods and services in the wider economy—a further round of benefits will spread through the region. This helps to support activity in sectors like retail and leisure outlets, companies producing consumer goods and a range of service industries. We estimate this induced effect will support wider employment of approximately 28-49 job years alongside £0.65-£1.14 million of wages. Through the numerous rounds of supply chain and consumer spending, all sectors in the economy will experience some degree of benefit (Table 13.4).

13.48 It is worth noting that the estimated benefits are at a Northern Ireland level. An exact amount attributable to the Mid and East Antrim Borough Council area is more difficult to identify and outside the scope of this report. Invariably it depends on the location of the companies appointed that enjoy the direct benefits and the location of the suppliers who provide them with the materials. However, speaking qualitatively, RES has informed Oxford Economics that their previous projects have utilised local contractors when possible and it remains their intention to use local suppliers and labour for much of the Balance of Plant (BOP) work. It makes sense, not least in terms of the costs and distance argument, to use local firms (e.g. looking at the cost of transporting aggregates). That is, local firms can prove to be more cost efficient given the closer proximity to required capital, personnel and resources. Indeed, RES has an office in the local area with employees that work in development and construction. This means that the vast majority of the direct and indirect benefits are likely to be realised within Northern Ireland, with Mid and East Antrim enjoying some uplift at the local level.

13.49 The benefits quantified above have been tested for robustness against reports compiled by BiGGAR Economics on behalf of RenewableUK and the Department of Energy and Climate Change (DECC)[2], and on behalf of NIRIG, IWEA and RenewableUK[3], for Northern Ireland specifically. In most cases, the benefits were of a similar magnitude when looking at jobs per megawatt.

13.50 The aforementioned BiGGAR Economics report backs up the scale of benefits that can be experienced locally, citing the: "…many local economies throughout the UK over the last few years, which have experienced significant direct, supply chain and wider economic benefits from onshore deployment."

Table 13.4: Total sectoral benefits from the construction phase

Total (direct, indirect and induced) benefits	Job years	Wages (£2018m)	GVA (£2018m)
Agriculture, forestry and fishing	1-1	0.01-0.02	0.01-0.02
Mining and quarrying	0-1	0.02-0.03	0.02-0.03
Manufacturing	6-10	0.14-0.24	0.35-0.59
Electricity, gas, steam and air conditioning supply	0-0	0-0.01	0.02-0.04
Water supply; sewerage, waste management and remediation activities	0-0	0.01-0.01	0.03-0.04
Construction	91-150	2.19-3.62	5.5-9.09
Wholesale and retail trade; repair of motor vehicles and motorcycles	8-14	0.17-0.29	0.38-0.66
Transportation and storage	1-2	0.03-0.05	0.05-0.09
Accommodation and food service activities	5-8	0.08-0.13	0.11-0.19
Information and communication	1-2	0.03-0.06	0.06-0.11
Financial and insurance activities	2-3	0.04-0.06	0.1-0.17
Real estate activities	7-13	0.18-0.32	0.35-0.61
Professional, scientific and technical activities	7-21	0.21-0.64	0.27-0.86
Administrative and support service activities	5-9	0.11-0.19	0.12-0.21
Public administration and defence; compulsory social security	0-1	0.01-0.02	0.03-0.05
Education	1-2	0.04-0.07	0.04-0.08
Human health and social work activities	1-2	0.04-0.06	0.04-0.08
Arts, entertainment and recreation	1-2	0.02-0.04	0.03-0.05
Other service activities	2-3	0.04-0.08	0.05-0.09
Total	**139-243**	**3.37-5.96**	**7.56-13.04**

Source: Oxford Economics
Note: May not add due to rounding

Economic impact of the operational phase

13.51 The starting point for modelling the operational phase of the project uses operations and maintenance direct job post figures again provided by RES, based on their extensive experience of operating projects not only in Northern Ireland but across the UK. RES has informed Oxford Economics that the Development will sustain one direct FTE job a year, in the capacity of an asset manager (Table 13.5).[8]

13.52 From there, all indirect and induced estimates are produced using the Economic Impact Model.

Direct operational impacts

13.53 Following the 12-month construction phase, the development is expected to be operational in August 2026. The operational phase impact estimates have therefore been produced using Oxford Economics' 2026 forecasts of both GVA, productivity and wages. Additional earnings/wages have been estimated using Oxford Economics forecasts for average annual earnings per worker from the broad sector 'Electricity, gas and steam' in 2026 (these forecasts are themselves based on published data in the Annual Survey of Hours and Earnings).

13.54 The total direct wage is estimated to be £0.04 million per year. After applying productivity estimates, the on-going direct employment is expected to generate £0.24 million of GVA a year. Given the 35-year lifetime of the development, this equates to 35 direct jobs, £1.32 million of direct wages and £8.32 million of direct GVA over the entirety of the operational phase.

Table 13.5: Direct annual benefits from the operational phase

Direct benefits	Job years	Wages (£2018m)	GVA (£2018m)
Asset manager	1	0.04	0.24

Source: Oxford Economics
Note: May not add due to rounding

Indirect and induced operational impacts

13.55 The electricity industry plays a significant role in enabling other parts of the economy to be more productive. The sector itself is one of the most productive in Northern Ireland, with output per worker significantly above that of the region overall. This reflects both the impact of high levels of investment and improving technology on productivity in the sector.

13.56 Using the adjusted UK input-output tables to identify the supply chain spending, it is estimated that the Development is likely to create or sustain a further indirect job in the Northern Ireland economy each year, with wages of £0.03 million and GVA of £0.08 million per annum respectively (Table 13.6).

[8] Given spare capacity in the economy and the relatively small scale of the development, assumptions include job displacement of zero relating to the operational phase estimates – see 13.24-13.27 for further discussion.

Table 13.6: Total annual benefits from the operational phase

Total (direct, indirect and induced) benefits	Job years	Wages (£2018m)	GVA (£2018m)
Direct	1	0.04	0.24
Indirect	1	0.03	0.08
Induced	1	0.02	0.03
Total	**3**	**0.09**	**0.35**

Source: Oxford Economics
Note: May not add due to rounding

Increased tax revenues and benefit savings

13.57 As part of this analysis it is assumed that approximately 36 percent of total wages would be paid to the Treasury through the channels of taxation.[9] This considers not only income tax, but value added tax through the purchase of goods and services by those in direct, indirect and induced employment.

13.58 During the construction period of the Development, tax receipts are likely to reach between £1.21-£2.15 million (including direct, indirect and induced wage impacts).

13.59 The operational phase is estimated to generate approximately £0.03 million in additional tax receipts each year of operation (Table 13.8). Over 35 years this would equate to £1.08 million in additional tax revenue.

Table 13.8: Annual tax revenues arising from the proposed Development

Tax revenue (over entire construction phase; per annum of on-going phase)	Wages (£2018m)	Tax revenue (£2018m)
Construction phase	3.37-5.96	1.21-2.15
Operational phase	0.09	0.03
Total	**3.46-6.05**	**1.24-2.18**

Source: Oxford Economics
Note: May not add due to rounding

13.60 In addition to tax receipts, employment creation will provide benefit savings. That is, assuming that each additional job attracts someone from the ranks of the unemployed directly or indirectly through the "job chain" effect, the construction or on-going operation of the site. While the Development may take someone from their current job, they will leave a vacancy and that will have to be filled, and so on and so forth – so eventually, a job will be filled down the line by someone from the ranks

[9] Based on the ONS publication 'The effects of taxes and benefits on household incomes, 2019/20'. Table 9. Accessed August 24th 2021. Direct tax as a share of gross income is 24.2 percent, and indirect taxes as a share of disposable income is 11.8 percent. Combined this indicates that 36 percent of gross income is paid to the Treasury via taxation.

of the unemployed, though not necessarily directly. As such, the creation of a new job in the economy will lead to a reduction in the unemployed by a similar amount.

13.61 Under the ‘new style’ Job Seekers Allowance, unemployment benefit varies between £59.20 and £74.70 per week.[10] Using these lower and upper levels, we estimate between £0.43-£0.94 million of savings will be made during the construction phase of the Development (Table 13.9).

Table 13.9: Annual benefits saving arising from the construction phase

Construction phase	Unemployment savings (£2018m)	
	Lower	Upper
Direct	0.26-0.46	0.33-0.59
Indirect	0.08-0.13	0.1-0.17
Induced	0.09-0.15	0.11-0.19
Total	**0.43-0.75**	**0.54-0.94**

Source: Oxford Economics
Note: May not add due to rounding

13.62 In addition, the on-going benefits are estimated to provide unemployment savings of between £0.32-£0.41 million over the project’s lifetime.

Other quantifiable benefits of the Development

Rates and taxes

13.63 Oxford Economics has agreed to use RES’ rateable value for wind farms in Northern Ireland. More specifically, for this analysis we assume that the rateable value is £15,000 per megawatt per annum. Given the Development will have a total capacity of 58.8MW, this means a figure of £0.9 million in rateable value is available to the government annually, or approximately £30.87 million over the course of the project.

13.64 It should be noted that there is a difference in the rateable value charged on which the above figures are based, and the business rates revenue collected by the local Councils and the Northern Ireland Assembly – allowing for regional and Borough rate poundages. The most recent figures for Mid and East Antrim Borough Council indicate (total) non-domestic poundage rates of 59.0p for every £1, of which 27.9p is a regional rate paid to the Northern Ireland Assembly, and 31.1p of which is a Borough rate paid to the local Council.[11]

[10] Figures taken from Citizen Advice. If individuals are eligible for the new style JSA, they can get a weekly ‘personal allowance’ of up to £59.20 (18-24 year olds) or £74.70 for those aged 25 and over. Date accessed: 15th October 2021

[11] https://www.finance-ni.gov.uk/articles/poundages-2021-2022 . Date accessed: 25th August 2021.

13.65 By applying the Non-Domestic Rate Poundage for Mid and East Antrim Council area, the above rateable values would leave additional business rates revenue of £0.46 million per annum and £18.22 million over the 35-year lifetime of the project. In every case, 52.7 percent of the totals would be attributable to the local Council and the remaining 47.3 percent would be realised by the Northern Ireland Assembly.

13.66 All these additional payments referred to in this paragraph will result in increased income to the recipients, who will spend it in the Northern Ireland economy; over and above those already accounted for in the construction and on-going operations phase results.

13.67 Over the lifetime of the project, rates and taxes will collectively amount to approximately £19.30 million. Due to sensitivity issues this figure excludes land rent contributions.

Energy and Environmental benefits

13.68 Northern Ireland is ahead of its renewable energy target. The region's 2010-2020 Strategic Energy Framework includes a target for 40 percent of its power to be generated from renewable sources by 2020. Latest statistics however show that the region has exceeded this target, with renewable sources accounting for almost half of total electricity consumption in Northern Ireland.[12] The report from the Department for the Economy, which covers the 12-month period to March 2021, shows that 83.7 percent of all renewable electricity generated within the region was by wind energy alone. In light of this and the publication of the Energy Strategy 2021 the new target of achieving at least 70 percent renewable energy production in Northern Ireland by 2030.[13] Indeed both these developments complement policies both nationally and regionally which highlight the need to move away from finite energy sources toward more renewable energy.

13.69 In addition, according to a report published by Northern Ireland's Department for the Economy, namely 'Energy in Northern Ireland 2020'[14], Northern Ireland had the largest percentage increase in the number of enterprises in the energy sector between 2010 to 2019, compared to other regions in the UK. Over this period, the region recorded an increase of 256 percent compared to 123 percent across the UK as a whole. Furthermore, of the total Low Carbon and Renewable Energy (LCRE) activity in Northern Ireland in 2018, Energy Efficient Products was the group that accounted for the largest proportion of activity—in terms of turnover and employees.

13.70 The Development is a 58.8MW wind farm consisting of 14 x 4.2MW turbines. The amount of electricity that could be produced by the Development is estimated at 236.9gWh per year which is enough electricity to meet the needs of 62,800 homes

[12] Electricity Consumption and Renewable Generation in Northern Ireland: year ending March 2021. Department for the Economy, Northern Ireland.

[13] Energy Strategy - The path to Net Zero 2021

[14] https://www.economy-ni.gov.uk/sites/default/files/publications/economy/Energy-In-Northern-Ireland-2020.pdf

each year[15], over 6,000 more than the current housing stock (of approximately 56,500[16]) in the local area.

13.71 The Development is also estimated to reduce CO_2 emissions by 104,300 tonnes each year. This equivalent to 65,700 newly registered cars.[17]

13.72 Not only does the generation of electricity through wind present environmental benefits but it also produces benefits for consumers. A recent independent study by Baringa Partners[18] into the benefits of wind energy in Northern Ireland found that renewable electricity produced by wind has benefited consumers. The study estimates that each consumer receives a payback of £4 each year since 2000.

[15] For the Development we have assumed a load factor of 0.46, which was provided previously by RES, and applied to Oxford Economics' calculations. This load factor allows us to account for wake and electrical losses using typical wind speeds/directions etc. to give a realistic prediction of electricity output (rather than using a theoretical maximum level whereby it is assumed that wind blows for 24 hours a day 365 days a year on every wind farm site.)

[16] Oxford Economics Internal Model Suite.

[17] https://www.gov.uk/government/publications/new-car-carbon-dioxide-emissions

[18] http://res-group.mediaroom.com/how-wind-pays-back-to-consumers

Socioeconomic Context

Northern Ireland and Mid and East Antrim Borough Council area

13.73 Both the new Brexit agreement and coronavirus pandemic will continue to impact growth prospects in the UK, its regions and local areas, including Mid and East Antrim Borough Council area. The following section considers the recent and future labour market performances of the region and the local area.

13.74 Prior to the onset of the Covid-19 pandemic, Northern Ireland's economy struggled to create employment opportunities. Between 2010 and 2019, job growth in the region averaged 0.8 percent per year—0.4 percentage points below the equivalent rate for the national average. In absolute terms, this pace of growth translates to approximately 7,000 net additional jobs per year across Northern Ireland. While most sectors in the region created jobs over this period, construction recorded an estimated loss of 3,500 jobs. We estimate that the sector was approximately 6 percent smaller in 2019, in employment terms, than in 2010.

13.75 The Covid-19 pandemic has created unprecedented challenges for the Northern Ireland economy. Multiple lockdowns and social distancing measures implemented by the Government to limit the spread of the virus inevitably led to the near shutdown of some industries, including wholesale & retail trade and accommodation & food services. Indeed, the coronavirus pandemic has somewhat dampened labour market prospects in the short and near term and will have slowed the construction sector's recovery, with employment levels in the sector remaining broadly steady in 2020 and 2021.

13.76 Labour market performance in the Council area has been weak as a result of wider socioeconomic headwinds. Between 2010 and 2019, the number of jobs in the Council area fell by 0.3 percent per year on average--making it the weakest performing Council area in Northern Ireland. Over this period, job growth was supported by the health & social work and accommodation & food services sector, however, these gains were offset by job losses in its sizeable manufacturing base.

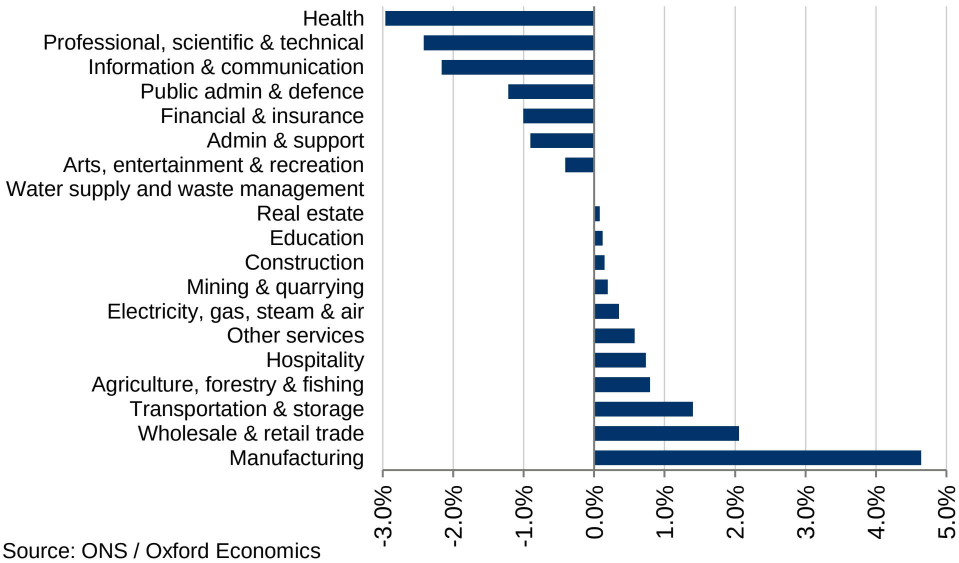
13.77 As of 1st January 2021, EU trade agreements no longer applied to the UK. The EU-UK trade deal secured currently prevents tariffs and quotas being imposed, which would have made trade more expensive and time consuming. However, since the UK no longer has to follow EU rules on product standards, new checks have been introduced. In addition, the UK government has agreed the broad terms of a free-trade deal with other countries including Australia, Japan and Norway. Combined, this could have implications on the UK's competitiveness, adding more pressure to the already declining manufacturing sector; particularly those that are more reliant on exporting.

13.78 Implications from the Brexit agreement, particularly those pertaining to the Northern Ireland Protocol, and other uncertainty stemming from the Covid19 pandemic, will continue to weigh on the national, regional and local economy near-term prospects. By the end of 2021, we expect a further contraction of 900 jobs within the Council area—accounting for more than a quarter of total job losses within Northern Ireland. One in ten job losses in the Council area are expected to be from construction, reflecting challenges faced by the sector including rising costs and supply-chain issues which are likely to trigger a loss in confidence. Job losses will mostly be concentrated in manufacturing, followed by the accommodation & food services sectors. Combined these sectors are estimated to shed almost 700 jobs in the year to 2021 across the local economy.

13.79 There is a need for local investment to support job creation. We do not expect jobs to recover to pre-crisis levels in the near-term, despite a recovery both regionally and nationally in 2022. Over the longer-term, our baseline forecast for the Council area shows the number of jobs will remain below levels recorded in 2019. By 2035, the local economy is expected to have approximately 20 percent fewer jobs than in 2019.

13.80 Employment growth prospects in the Council area can be, in part, explained by the area's employment structure. The figure below plots the percentage point difference between the share of employment by sector in Mid and East Antrim Borough Council area to the average for Northern Ireland. Sectors with a positive value employ a greater share of employment in the local area than the region as a whole. Conversely, sectors with a negative value employ a smaller share of employment in the local area compared to the regional average.

Figure 3: Percentage point share difference of employment, Council area v Northern Ireland, 2019



Source: ONS / Oxford Economics

13.81 Compared to Northern Ireland as a whole, the local area is overrepresented in sectors which have weak employment growth prospects such as manufacturing. Between 2022 and 2035, the manufacturing sector will continue to shed jobs at a rate of 2.3 percent a year, equivalent to 1,900 job losses. Furthermore, the local area is largely underrepresented in sectors likely to drive employment growth at the national level such as health & social work, administrative & support services and professional, scientific & technical activities. As such the Council area's low exposure to growth sectors will limit the scope to replace lost manufacturing employment. Over the 2022 to 2035 period, the health & social work sector is expected to be the largest contributor to job growth in the local area, providing 400 net additional jobs, followed by administrative & support services (170 net additional jobs). Weak labour market performance is also a reflection of a weak demographic outlook: both total and working age population are forecast to fall—a trend reflected across all Council areas in Northern Ireland.

13.82 Analysis of other labour market indicators further support the economic need for new employment opportunities. Our data shows that not only is the inactivity rate (the people who are not in employment, unemployed either because they are retired, students and/or long-term sick) for the local area is above the regional average, but it also has among the highest unemployment rates across the region. According to our latest estimates, the unemployment rate (ILO definition) for the local area stood at 3.0 percent in 2020, in line with Northern Ireland as a whole. However, we expect this rate to increase to 3.3 percent in 2021, broadly tracking the regional average, before slowly easing to 2.5 percent by 2035.

13.83 Furthermore, estimates from the Annual Population Survey show that working age economic inactivity rates within the local area is one of the highest in Northern Ireland, with over a quarter of working age residents economically inactive in 2018. And given we expect employment to fall and unemployment to rise in the near-term suggests that a larger proportion of residents will find themselves joining the economically inactive population.

13.84 Combined, this evidence base highlights the need for new job prospects in the local economy. Indeed, investment into local climate change assets will help to support the jobs recovery within the Council area, but also more widely via multiplier effects. Investment into such projects will also help to strengthen the UK's overall energy networks, helping to achieve the government's target of net zero emissions by 2050 and reduce the UK's reliance on energy imports.

Local skill levels among the lowest in Northern Ireland

13.85 At both ends of the educational spectrum, the Mid and East Antrim Borough Council area underperforms compared to others in Northern Ireland. According to figures published by NINIS, the proportion of the Council area's working age residents (aged between 16-64) having attained degree level qualification or above stood at 30.1 percent in 2018 – among the lowest of Northern Ireland's Council areas and lagging behind the regional average (34.9 percent). In addition, the local area has among the highest share of working age residents with below NVQ 4 at 52.6 percent in 2018, 2.2 percentage points above the regional average.

13.86 Relatively poor skill levels are likely to mean residents invariably do not possess the skills demanded by employers and are therefore more likely be excluded from the labour market. The weak outlook on jobs coupled alongside below average skill levels are likely to contribute to economic inactivity and social exclusion within the local community.

13.87 The local economy faces some key socioeconomic challenges, which have been further exposed by recent developments. The weak employment outlook is likely to make it more challenging for the local council to address economic need and development. Therefore, investment and development opportunities in the area should be encouraged in order to promote opportunities and boost economic growth prospects.

Conclusions

13.88 The Development will offer a much-needed boost of activity to the local and regional economy. Job creation and economic activity will result throughout its construction, with a strong likelihood of local labour involvement. Both the construction and operational phase will generate increased tax and business rates revenue payable to central, regional and local government.

13.89 Indeed, the Mid and East Antrim economy has faced a challenging backdrop in recent years; and given its exposure to the manufacturing sector, the local area has struggled to create job opportunities over the last decade. Therefore, the labour market conditions have not been ideal in the lead up to the coronavirus outbreak, and its subsequent lockdowns. Given the lockdown has had a significant impact on local businesses for at least the short term and put upward pressure on local unemployment, investment of this type and scale can provide positive (direct, indirect and induced) benefits across Northern Ireland; helping to provide and support economywide employment opportunities that would not otherwise have existed. It can also bring about catalytic benefits which can in turn attract further investment into Northern Ireland. For example, the knowledge, expertise and skills accumulated can act as a contributing factor to future investments in the area. Other local areas within Northern Ireland may also benefit as a result, helping to reduce the inequality across the region. Funding for such developments are usually project specific and involve a considerable amount of sunk costs. **Therefore, if the development does not take place the benefits, including the catalytic impact, are unlikely to be realised elsewhere in the Northern Ireland economy.**

13.90 The Development is estimated to involve a capital spend of £61.71 million. Of this total, £24.70 million (nominal prices) will be realised within the Northern Ireland economy. The projected 12-month construction phase is estimated to create or sustain 139-243 total (direct, indirect and induced) job years of employment, £3.37-£5.96 million (2018 prices) of wages and £7.56-£13.04 million (2018 prices) of GVA to the Northern Ireland economy.

13.91 The estimated total (direct, indirect and induced) benefits realised in Northern Ireland by the operational phase of the proposed Development includes wages of £3.2 million (2018 prices) and £12.3 million (2018 prices) in GVA over the 35-year operating period.

13.92 We also expect a fiscal injection from the Development. During the construction, the UK Exchequer is estimated to benefit from increased tax revenue of £1.24-£2.18 million. Over the 35-year operational phase, an estimated £1.08 million revenue will be generated and a further £0.43-£0.94 million in benefit savings during the construction phase.

13.93 Based on rateable values of £15,000 per MW—we calculate that the Development will increase rateable value by £0.9 million each year, or by £30.87 million over the project horizon. From these values business rates are calculated and collected for local Councils and the Northern Ireland Assembly. By applying Mid and East Antrim non-domestic poundage rates, we estimate additional business rates of £0.55 million each year and £19.30 million, or 59.02 percent of the Development's rateable value, over the 35-year lifetime of the project.

14

Summary of Mitigation

14 Summary of Mitigation

Alongside each mitigation measure identified, the proposed mechanism by which it will be adopted, implemented or enforced has been provided as well as the period by and /or timing which the mitigation measure will be undertaken.

Summary of Mitigation

ES Chapter	Potential Effect	Mitigation Proposed	Means of Implementation and timing
Chapter 4	LVIA	The exterior surfaces of the turbines will be painted in a recessive, non-reflective light grey colour to minimise their visual prominence against the sky in most weather conditions.	By condition.
		Ancillary facilities, such as the control building, substation and energy storage compounds, have been designed in a manner that is sensitive to the immediate landscape character with regards to location, scale, colour, and choice of materials. The sub-station and control building and energy storage compound will be located to the south of Turbine T14 which is one of the lower turbines in the layout at 237.44 m AOD.	Through Construction & Environmental Management Plan (CEMP) to be agreed with the Planning Authority prior to construction and implemented during construction.
		A new site entrance will be formed off the A42 near the Slane Road – Doonan Leap junction. This will include the partial removal of a small bank of existing trees which will be mitigated by proposals to create a new belt of mixed woodland on the southern side of this embankment, and to extend an existing belt of Scots Pine on the northern side to ensure that the site entrance and access track will steadily become more screened from view as the planting establishes and matures.	By Condition.
Chapter 5 Archaeology and Cultural Heritage	Potential direct effects on currently undiscovered archaeological remains and heritage assets on site	A programme of archaeological works can be implemented ahead of the development to detect and record any remains prior to any impact.	By Condition. Programme of Works to be agreed with the Planning Authority prior to construction and implemented during construction

Chapter 6 Ecology	General	Measures required to address ecological concerns described in this ES during the construction phase will be incorporated within a Construction and Environmental Management Plan), which will be submitted to and agreed with the Planning Authority at the pre-construction stage.	By Condition. CEMP will be agreed with the Planning Authority prior to construction and implemented during construction.
	Designated Watercourses	The contractor will prepare a CEMP prior to construction activities to provide a method statement for working practices that will include measures, among others, to prevent adverse impacts on rivers and other watercourses. Refer to the SUDS design Statement in Appendix 9.1.	By Condition HMP to be agreed with NIEA / the Planning Authority prior to construction and implemented during construction and operation.
	Loss of Wet Heath / degraded Blanket Bog	Heathland restoration and enhancement according to the Outline HMP.	By Condition HMP will be agreed with the Planning Authority prior to construction /NIEA and implemented during construction
	Bats	The proposed turbine layout was amended to ensure a minimum stand-off distance of 50 m (Natural England TIN051) to all habitat edges (shelterbelts and natural watercourses) which will be maintained through the lifetime of the Development. A Bat Monitoring & Mitigation Plan (BMMP) will be implemented under the Precautionary Principle.	By Condition BMMP to be agreed with NIEA / the Planning Authority prior to construction and implemented during construction and operation.

	Impact on Common Lizard (Viviparous Lizard)	Depending on the commencement of construction on site, the works corridor will be mowed. If possible, this work will be undertaken before the end February (to avoid a conflict with the bird breeding season). If this is not possible, then mowing will take place between August and September, when common lizards are likely to be fully active. Should the latter be required, the corridor will be subjected to an active nest survey by a suitably qualified ornithologist immediately prior to the commencement of mowing operations. Clearance of stones, tree stumps, logs, brash, rocks or piles of similar debris will be undertaken carefully and by hand. Although this is only required in a few areas where the proposed site tracks traverse low stone walls. This work will not take place during the hibernation period for common lizard (i.e. mid-October to mid-March). Clearance of tall vegetation will be undertaken using a strimmer or brush cutter with all cuttings raked and removed the same day. Cutting will only be undertaken in a phased way which will either include: • Cutting vegetation to a height of no less than 30mm, clearing no more than one third of the site in anyone day or; • Cutting vegetation over three consecutive days to a height of no less than 150mm at the first cut, 75mm at the second cut and 30mm at the third cut; Following removal of tall vegetation using the methods outlined above, the remaining vegetation will be maintained at a height of 30mm through regular mowing or strimming	By Condition CEMP and HMP, which will be agreed with NIEA / Planning Authority prior to construction and implemented during construction.

		to discourage common lizards from returning. Ground clearance of any remaining low vegetation (if required) and any ground works will only be undertaken following the works described above. As an additional precaution the ECoW will be present from the commencement of clearance/construction with a watching brief to ensure that no common lizards remain within the construction corridor and remain in situ until the area is cleared to ensure no species or habitat conflicts emerge affecting damage to the local lizard population. If any common lizards are found during excavation works, all works within the affected area will cease until the ECoW has safely removed them (under licence) from the construction corridor. Should it prove necessary during site supervision (i.e. lizards are observed returning to the construction corridor); a protective lizard barrier fence will be installed along both sides of the construction corridor (for 25m either side of the point where the lizard(s) were noted) in order to prevent common lizards from entering the works area.	
	Impact on Smooth Newt	Mitigation is required in order to reduce any potential significant effects to this protected species. It is proposed that any newts migrating towards the ponds would be captured using a combination of drift fencing (during the construction phase), physical searches, along with pitfall traps in order to prevent access by newts to the works area.	By Condition CEMP and HMP, which will be agreed with NIEA / Planning Authority prior to construction and implemented during construction.

Chapter 7 Ornithology	Impacts during bird breeding season	No development activity will take place on the Site between 1 March and 31 August in any year until an Ornithology Mitigation Strategy (OMS) has been prepared by a suitably experienced ornithologist and approved by the Planning Authority.	By Condition OMS which will be agreed with NIEA / Planning Authority prior to construction and implemented during construction. During Construction
	Ornithology Management and Monitoring Plan (OMMP)	No development activity will take place until an Ornithology Management and Monitoring Plan (OMMP) has been prepared by a suitably experienced ornithologist and approved by the Planning Authority.	OMMP to be agreed with NIEA / the Planning Authority prior to construction and implemented during construction and operation.

	Habitat Management Plan (HMP)	It is proposed to implement a programme of long-term habitat management (during the life of the Development) for curlew and snipe to compensate for potential displacement of breeding pairs. The habitat management area is to be of an adequate size to compensate for the potential displacement and at an appropriate distance from any species-specific turbine buffer zones. The habitat management is to follow the Northern Ireland Environmental Farming Scheme species-specific guidance for breeding waders.	HMP to be agreed with NIEA / the Planning Authority prior to construction and implemented during construction and operation.
Chapter 8 Fisheries	Sediment Run off & buffer zones	During the construction phase it is important that works should be avoided within the area of sensitive watercourses, with the preservation of intact vegetated buffer zones between the development infrastructure and stream channels. To this end, buffer zones of 10m and 50m minimum width are specified in Chapter 9 for minor and major watercourses, respectively. The larger minimum buffer of 50m will apply to the main channel Ticloy Water, the Glencloy River, and the main channel of Tributaries 2, 3 and the lower reaches of Tributary 4 of the Glencloy River, all of which are watercourses in terms of potential fisheries sensitivity.	CEMP, to be agreed with the Planning Authority prior to construction and implemented during construction.

	Timing of works	DCAL (now DAERA) Inland Fisheries produced Guidelines for Fisheries Protection during Development Works (undated) which identifies the likely impact of construction and development work on fisheries habitat and outlines practical measures for the avoidance and mitigation of damage. Of the major watercourses with potential fisheries sensitivity, the Development will require crossings on the main Ticloy Water, Glencloy River, and Tributaries 2-4 of the Glencloy River. It is recommended that construction works at these locations are avoided between October 1st and April 30th (as per DAERA guidelines).	CEMP, to be agreed with the Planning Authority prior to construction and implemented during construction.
	Surface Water Management	A surface water management plan will be developed using the principles of Sustainable Drainage, based on the on-site retention of flows and use of buffers, swales, check-dams and other silt removal techniques. Implementation of the management plan will prevent any adverse effects on the ecology of the principal receiving watercourses during the construction phase of the project.	
	Water Quality Monitoring	Implementation of a water quality monitoring programme to examine the effects of the infrastructure construction works on surface water quality. It is recommended that the monitoring programme be continued through the operation and decommissioning phases of the Development.	

	Release of other pollutants	A Pollution Prevention Plan will be included as part of the Construction & Decommissioning Method Statement (CDMS) for the Development, to be agreed with the local planning authority at the pre-construction stage. This will incorporate a contingency plan setting out the procedure to be followed in the event of a significant spillage occurring.	
	Surface Water Run-off (Operational Phase)	Site drainage will use the principles of SuDS, with installations to incorporate a "treatment train" of two to three stages of pollutant removal to all surface water runoff during the operational phase, as with the construction and decommissioning phases. Additional measures to prevent the release of suspended solids will include: • Preservation of natural run-off patterns; • Reduction of flow rates from access tracks through use of attenuating check-dams; • Use of shallow ponds to aid settlement; • Linear track drainage swales with regular outflow points throughout the SuDS system to limit the potential for large flows at single outflow points; • Avoidance of peat storage within denoted 10m or 50m watercourse buffer zones or in areas of overland water flow.	

	Fish passage obstruction/ inhibition	The proposed installation of open bottom (clear-span) culverts at all major watercourse crossings (also watercourses with 50m hydrological buffers), where there is potential fisheries sensitivity, will ensure free movement of any fish present in the channel and would prevent any change in channel morphology or flow alteration due to in-stream structures.	CEMP, to be agreed with the Planning Authority prior to construction and implemented during construction.
	Loss of habitat at stream crossings	The installation of open bottom (clear-span) culverts at all major watercourse crossings (i.e. those with salmonid fisheries potential) will ensure no loss of the habitat of fish or the potential productivity of algae/ plants and benthic invertebrates.	

Chapter 9: Geology & Water Environment	Site Drainage Management & SuDS Design	The proposed development will adopt a surface water management plan / site drainage design using the principles of Sustainable Drainage, promoting the principles of onsite retention of flows and use of buffers and other silt removal techniques. All drainage related mitigation measures proposed will be encompassed by a robust and proven Sustainable Drainage System (SuDS) design which will be used to control drainage and silt management on the site. Onsite drainage design will minimise modification and disruption of the existing natural hydrology by: • Maintaining existing overland flow routes and channels. Existing natural flow paths lateral to access roads will be maintained through the use of piped crossings under road alignments at natural depressions and at regular intermediate intervals. The spacing of cross drains will be specified at detailed design stage; • Avoiding transporting rainfall runoff in long linear drainage swales by providing regular channel “breakouts”, whereby water is encouraged to flow overland, thus maintaining existing natural hydrological patterns; • Reducing surface water flow rates and volumes by attenuating runoff from tracks and hard standings “at source” by providing check-dams in swales, whereby the flow velocity and rate of discharge is artificially reduced to mimic natural properties; • Providing settlement ponds at turbine hard standing areas and other main surface water	CDMS and CEMP, which will be agreed with the Planning Authority prior to construction and implemented during construction. Outline SUDS is provided in Technical Appendix 9.1

		discharge locations, where runoff from significant new impermeable areas is treated and attenuated before being released overland; • All swales, crossings and other hydraulic features will be engineered to ensure that dimensions are suitable to convey predicted flows and so prevent build-up of surface water and / or flooding.	

	Watercourse crossings	Culverts will be designed to accommodate track crossings and minimise length of affected channel in order to comply with Revised PPS15 policy FLD4. Hydraulic design of crossings will be undertaken as per the guidance and requirements provided in CIRIA C689 “Culvert Design and Operation Guide” (or other standard as may be required by DfI Rivers in post-consent consultation), with primary parameters likely to include: • Width of the culvert will be greater than the width of the active drainage channel; • Alignment of the culvert will suit the alignment of the drainage channel, i.e. preserve the existing direction of flow; • The slope of the culvert will not exceed the slope of the bed of the existing drainage channel. • Detailed design of crossings will assume a hydraulic capacity requirement of 1% Annual Equivalent Probability flow including factor for climate change as required by DfI Rivers Technical Flood Risk Guidance in relation to Allowances for Climate Change in Northern Ireland as a conservative measure. Detailed hydraulic design of culverts and similar structures post permission is normal and accepted practice for wind farms in Northern Ireland. • Fisheries shall be protected (where applicable) by adopting the guidance stated in Guidelines for Fisheries Protection during Development Works as published by Loughs Agency. Consultation and approval will be sought from all relevant parties as	CDMS and CEMP, which will be agreed with the Planning Authority prior to construction and implemented during construction.

		required by the DAERA Surface Waters Alteration Handbook (November 2017), including and DfI Rivers in particular, at the pre-construction detailed design stage for all works in and affecting watercourses and drains, as per the requirements of Schedule 6 of the Drainage (Northern Ireland) Order 1973 and subsequent amendments. The resultant structures comprise clear span crossings of the significant watercourses, which have been demonstrated to ensure that the effect on flood conveyance is satisfactorily managed and would have no significant adverse effect on flood levels and flood extent within the Site and no adverse effect elsewhere. Preliminary DfI Rivers approval has been sought for the significant watercourse crossings.	

	Water Quality Monitoring	A water quality monitoring program will be implemented to monitor effects on the surface water quality regime during the infrastructure construction, operational and decommissioning phases of the proposed development, in order to; • Demonstrate that the mitigation measures and surface water management is performing as designed; • Provide validation that the in-place mitigation measures are not having an adverse effect upon the environment; • Indicate the need for additional mitigation measures to prevent, reduce or remove any effects on the water environment, such as additional temporary settlement or filtration structures or short-term flocculant dosing to suit observed site conditions. It is intended that the water monitoring extent, duration and frequency will be agreed with the Department for Infrastructure or the relevant regulating body (nominally NIEA:WMU) post consent and will nominally consist of physicochemical and biological monitoring. The extent, duration and frequency of the monitoring will be proportionate to the level of activity during each phase of the proposed development and the associated perceived risks.	Through CDMS, which will be agreed with the Planning Authority prior to construction and implemented during construction. Operational phase. Decommissioning Method Statement

	Pollution Prevention	A detailed Pollution Prevention Plan (PPP) will be implemented and monitored by the site manager as part of a full Construction & Decommissioning Method Statement (CDMS) for the project, to be submitted post-consent following detailed site investigations and agreed with the local planning authority. Although this will be of particular importance during construction, it will apply to potentially polluting activities during all phases of the proposed development. The detailed PPP will be produced following consultation and agreement with NIEA, and all appropriate personnel working on the Site will be trained in its use. As a minimum, the PPP will comply with Guidance for Pollution Prevention (GPP) and Pollution Prevention Guidelines (in particular GPP 21: Pollution Incident Response Planning) and best practice as advocated by CIRIA. The PPP will identify site-specific measures and incorporate a Pollution Incident Plan, which will include emergency contact details, details of spill kits on the Site and instructions on actions in case of spillage / emergency.	Through CDMS, which will be agreed with the Planning Authority prior to construction and implemented during construction.
	Storage	All equipment, materials and chemicals on the Site will be stored away from any watercourse (i.e. outwith previously stated buffer zones). Chemical, fuel and oil stores will be sited on impervious bases in accordance with GPP2 and within a secured bund of 110% of the storage capacity, within the temporary storage compound	Through CDMS, which will be agreed with the Planning Authority prior to construction and implemented during construction

		Standing machinery will have drip trays placed underneath to prevent oil and fuel leaks causing pollution. Refuelling of vehicles and machinery will be carried out on an impermeable surface in designated areas, well away from any watercourse or drainage ditches (i.e. outwith previously stated buffer zones) and will adhere to best practice as detailed in PPG 7.	
	Construction in the vicinity of Watercourses	The following procedures apply to the general construction activities either within the watercourses or in defined watercourse buffer zones: • Due consideration will be given to the prevailing ground and weather conditions when programming the execution of the works in order to ensure that in-channel works are undertaken during periods of predicted low flow and low rainfall in order to minimise contact with water. • Ensure that roadside drains do not discharge directly into watercourses, but rather through a riparian buffer area of intact vegetation as denoted on design drawings.	

	Construction of Watercourses	Construction of watercourse crossings will be programmed to coincide with periods of predicted low flow in the affected channel (determined by rainfall and would generally coincide with summer months). Construction will be strictly as per the design for each identified watercourse crossing and will fully implement all SuDS and additional mitigating measures proposed at the detailed design stage. For purposes of outline design, the proposed mitigation will include: • Installation of silt fences parallel to the watercourse channel in the vicinity of the proposed crossing; • Installation of small cut-off drains to prevent natural surface runoff entering area of construction activity; • Installation of filtration or other silt entraining features within the watercourse channel immediately downstream of the works location; • Use of damming and over pumping to allow a dry working environment where deemed appropriate.	

	Temporary SuDs	Temporary drainage and silt management features (SuDS) will be constructed prior to earthworks (including preliminary or enabling works) proceeding to construct any linear works (tracks / hardstanding areas / cable routes), turbine bases, and other infrastructure. Drainage will be provided to temporary works and reinstated to suit the final footprint of the completed development. Temporary drainage measures in particular will be employed in enabling works to facilitate widening of existing tracks. Temporary measures may include: • Temporary silt fences erected in areas where risk of pollution to watercourses has been identified e.g. watercourse crossing locations and areas where tracks or other infrastructure lie within watercourse buffer zones. • Placing temporary filtration silt fences within drainage channels where siltation is observed. • Installing temporary constructed settlement features such as sumps or settlement ponds / lagoons where required. • Upslope cut-off drainage channels approximately parallel to the proposed track alignment installed in advance of any excavated cuttings for the track or turbine hardstanding areas. • Watercourses, drains, natural flow paths and cut-off drain outlet locations should be identified and charted, in order to ensure that piped	

		crossings can be installed in advance of or adjacent to the track construction. • Settlement ponds should be constructed in advance of commencing excavations for foundations and at any other locations identified as required at detailed design stage. • Trackside drainage swales should be installed in parallel with track construction. Note that this may require that drainage swales are reformed on an ongoing basis as temporary track alignments are modified to their eventual finished design level. Suitable prevention measures should be in place at all times to prevent the conveyance of silts to receiving watercourses.	
	Electrical Cable Laying	Due consideration will be given to the prevailing ground conditions and season when programming the execution of cable trench excavations in order to ensure works are undertaken during periods with low rainfall and elevated shallow groundwater levels in order to reduce the likelihood of runoff entering the excavations. Excavation of cable trenches will be carried out over short distances, with frequent backfilling of trenches to minimise opportunity for the ingress of water into open trenches, temporary silt traps will be provided in longer trench runs and on steeper slopes and spoil will be stored in line with a spoil management plan, which will be produced as part of the CDMS at the pre-construction stage.	

	Excavations and Spoil Management	Soil and subsoil excavation and movement will be undertaken in accordance with best practice guidelines such as Good Practice Guide for Handling Soils (MAFF, 2000) in order to minimise potential for silt laden runoff from spoil and excavations. Areas of stockpiled spoil including stored peat: • will not be permitted within previously identified watercourse buffer zones; and • will not be permitted to obstruct the flow of overland surface water with specific drainage to spoil mounds to be provided. Material produced from excavations on the Site will be reused where reasonably practicable in the reinstatement of the site. Excavated materials will be separated into rock material, subsoil, reusable peat and vegetated sod material and will be stored in the designated temporary stockpile zones, under the supervision of a geotechnical expert. These materials will be reused where possible to re-grade slopes, and to re-vegetate and stabilise the sides of access tracks and hard standing areas. A fire management response plan will be prepared in conjunction with the battery supplier and with the local Fire Service prior to construction. This will outline containment measures and chemical fire suppressant methods which will be implemented to mitigate risk of potential contamination to land or water environment. In the event of a fire all wastes will be dealt with appropriately through the procedures agreed within the site-specific Fire	

		Management Plan to be prepared post-consent. Spoil drainage will be designed on a bespoke basis for spoil storage areas to allow controlled dewatering and prevent washout of suspended solids to the receiving water environment. As part of the detailed CDMS a spoil management strategy will be developed by the appointed competent contractor for the development. Outline designs for drainage arrangements for temporary spoil areas are shown on the Drainage Management Drawings within Appendix 9.1: Water Framework Directive Assessment.	
	Dewatering of excavations	The majority of the turbine base foundations will be on bedrock or other hard strata above bedrock (to be confirmed by detailed site investigation prior to detailed design); therefore, deep excavations within bedrock and the associated bedrock aquifer are not anticipated and dewatering below the bedrock aquifer groundwater table is therefore not anticipated. Shallow groundwater (e.g., in areas of glacial sand and gravel) or rainfall runoff collected in excavations will be discharged via settlement ponds or filter strips prior to entry to the receiving water environment. Any settlement lagoons or filter strips associated with dewatering will be regularly inspected, particularly after periods of heavy rainfall and prior to periods of forecast heavy rainfall. Maintenance (to clear blockages or remove silt) will be carried out in periods of dry weather where practicable.	

	Dust Management	Loose track material generated during the use of access tracks and the construction compound will be prevented from reaching watercourses by maintenance to surface water drainage systems installed at aggregate based hard standing areas. In dry weather dust suppression methods such as by dust suppression bowser will be employed.	
	Borrow pits	For the avoidance of doubt, no borrow pits outside the development footprint are proposed at the Site, therefore associated pollution risks associated with rock extraction activities are not a consideration.	
	Radon	The Site is within an area of elevated radon potential, where 1–3 % buildings are above the action level. Radon protection measures are advised to be implemented for the permanent sub-station and control building or as may be directed by the local Building Control office suitable to the nature of the proposed enclosed space.	

	Operational Phase	Ensure best practice is adhered to on the Site and avoid pollution release to watercourses by incorporating NIEA Pollution Prevention Guidance notes into management policy. In the event that permanent welfare facilities are installed as part of control building / substation facilities, foul effluent will be disposed of through the use of sealed cesspools or chemical facilities with periodic tankered removal by a licensed waste haulier for licensed offsite disposal (i.e., there shall be no emission on the site). Cyclical maintenance of permanent SuDS drainage features installed during the construction phase, including unblocking of drains, maintenance of access road and other hard standing surfaces, and removal of silt build-up from settlement features. An outline maintenance programme is included in Appendix 9.1: Appendix 9.1: Surface Water Management Plan.	Operational Development

Chapter 10: Noise	Potential for noise to be created during general construction activities and by construction traffic	Due regard for 'best practicable means' (defined by Section 72 of the Control of Pollution Act 1974) A range of noise mitigation measures are proposed for the construction phase in accordance with measures outlined in BS 5228-1:2009Site operations to be limited to 0700-1900 Monday to Saturday (except during turbine erection and commissioning/periods of emergency work) Construction traffic to be controlled on Saturdays between 1300-1900, if necessary, to ensure relevant noise criteria are met.	Noise mitigation measures would be implemented as part of the Construction and Environmental Management Plan which would be required to be agreed as a condition of consent. Provision of a Construction Traffic Management Plan to be incorporated into the CEMP and delivered as a condition of consent

Chapter 11: Traffic & Transport	Impact on other road users	A Traffic Management Plan (TMP) will be prepared by the Applicant in accordance with the requirements of Department of Infrastructure NI, the local PSNI, and if required, any other relevant stakeholders. Features of the TMP will include: • Details of the access route, conformation of any points along the access route that require street furniture removal, details of traffic numbers, delivery timings, and signage and escort requirements • A delivery schedule for normal and abnormal loads to minimise disruption as far as reasonably practicable • Details of how any movements will comply with legislation regarding the movement of abnormal loads e.g. notice procedures and notice periods • Details on the use of escorts where required. Where long vehicles and abnormal loads would have to use the wrong side of the carriageway or need to swing into the path of oncoming vehicles a lead warning vehicle would be used. One escort vehicle would drive ahead and pull oncoming traffic into identified passing places. An escort vehicle would travel directly in front of the convoy and pull over any oncoming traffic that comes onto the road after the first escort vehicle has passed. A further convoy escort vehicle would follow the convoy • Information about marking of vehicles as long/abnormal loads	Through CDMS, which will be agreed with the Planning Authority prior to construction and implemented during construction

		• Information will be given on how warning signs will be used. These will be used to advise other road users of 'Caution Slow Plant Turning Ahead' and will be placed at intervals from both directions along the main road approaching the site entrance during the construction phase. The TMP will also detail additional measures to ensure impacts from traffic movements are minimised where possible, for example provision of road sweepers and/or wheel wash facilities. • If required, the wheel wash facilities will include a waterless drive over wheel wash for lorries. This will be provided at the site entrance to prevent mud and dust being brought out from the Site onto the public highway and anything being brought onto Site from public highway. Although experience has shown the majority of mud is shaken off wheels on site before the vehicle reaches the public road, the site entrance and adjacent public highway will also be monitored and cleaned if necessary. • The TMP will include details about Video Surveying and Road Repairs. A video survey of the pre-construction condition of all public roads will be recorded around the site entrances and access routes (but including the site entrance and access roads), to provide a baseline record of the state of the roads prior to construction work commencing. This will enable	

		any repairs and maintenance work required to the relevant road due to any damage caused by the passing of heavy vehicles associated with the wind farm construction to be identified following the construction phase. The roads will be returned, at minimum, to the baseline condition at the end of the construction phase. Any damage caused by wind farm traffic during the construction period, which would be hazardous to public traffic, will be repaired immediately. These works will be carried out under permits with DfI Roads, as appropriate. • The TMP will include plans for notifying relevant stakeholders in advance of delivery periods, including the emergency services, DfI Roads, local residents, local business, local services and schools. The local community will be informed prior to the commencement of construction and prior to the commencement of turbine deliveries by letter and through local press. The contact details of the Construction Site Manager will be made available as a contact point for enquiries. Local schools on the delivery routes will be contacted to identify school and nursery drop-off and pick up locations and times. Construction deliveries will be scheduled to avoid these busy periods as far as reasonably possible. • If cutting or removal of hedges and trees is required,	

		then this should be done outside the bird breeding season (1st March to 31st August). If work is to be done during the breeding season, then there should be a survey to establish whether nesting birds are present.	
Chapter 12: Shadow Flicker	Material reduction to residential amenity	Mitigation measures can be incorporated into the operation of the Wind Farm to reduce the instance of shadow flicker. Mitigation measures include planting tree belts between the affected dwelling and the responsible turbine(s) and shutting down individual turbines during periods when shadow flicker could theoretically occur.	By Condition