SCLENTEUCH WIND FARM

Environmental Impact Assessment Report 2022



Volume 1 - EIAR Chapters 1-17

powering change

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Environmental Statement – Volume 1

This is to certify that

Natural Power Consultants Limited

is a member of the

EIA Quality Mark

for the registration period covering

18th April 2022 – 17th April 2023*

*Subject to meeting the requirements of registration

1 Introduction

1.1 Introduction

1.1.1 This Environmental Impact Assessment Report (EIAR) has been prepared in support of an application submitted by Renewable Energy Systems Ltd (RES) (the 'Applicant') under Section 36 of the Electricity Act 1989 and deemed planning under section 57(2) of the Town and Country Planning Act 1997 to construct and operate Sclenteuch Wind Farm (the Proposed Development).

1.1.2 The Proposed Development is located in both South Ayrshire and East Ayrshire near Waterside, west of the A713.

1.1.3 The site of the Proposed Development (the 'Proposed Development Area') is currently a mixture of sheep grazing and commercial forestry. It occupies forested hills and the River Doon valley passes to the east, with settlements at Dalmellington, Waterside and Patna. To the west is the Water of Girvan, which flows through the village of Straiton. The Proposed Development Area is centred on Ordnance Survey grid ref 240700E, 607500N and covers an area of approximately 1,000 ha.

1.1.4 The EIAR describes the natural and human environment of the area in which the Proposed Development would be situated (if consented). It describes the details of the construction, operational and decommissioning phases of the Proposed Development and assesses the potentially significant effects that the Proposed Development could have on the biological environment, the physical environment and on human health and population, as well as on material assets, cultural heritage and the landscape. It also describes the policy context in relation to the Proposed Development for renewable energy within East Ayrshire and South Ayrshire, Scotland and the UK, and the overall policy context as set out in international agreements to reduce emissions of climate change gases, and targets set for the growth of renewable energy generation.

1.2 Structure of the EIAR

1.2.1 The EIAR has been prepared in accordance with the EIA Regulations and follows the structure presented in Table 1 below. Where relevant each EIAR chapter considers the baseline environment, the likely significant effects for each phase of the Proposed Development and cumulative impacts.

Table 1: EIAR Structure

Volume	Heading	Description
1	EIAR Chapter 1: Introduction	Presents the Proposed Development and provides a brief overview of the Applicant and the EIAR.
1	EIAR Chapter 2: Proposed Development/Project Description	Provides a detailed description of the likely infrastructure associated with the Proposed Development.
1	EIAR Chapter 3: Design Evolution and Alternatives	Explains the site selection and the design evolution process that has resulted in the Proposed Development.
1	EIAR Chapter 4: Approach to EIA/Climate Change, Legislative and Policy Context	Identifies the energy and land use policies and outlines the need for the Proposed Development and its benefits within the context of international climate change agreements and European, UK and Scottish renewable energy policy.
1	EIAR Chapter 5: Landscape and Visual Impact Assessment (LVIA)	Provides an assessment of the potential landscape and visual effects of the Proposed Development including residential visual amenity and night-time effects.
1	EIAR Chapter 6: Cultural Heritage Assessment	Provides an assessment of the potential effects of the Proposed Development upon cultural heritage assets.
1	EIAR Chapter 7: Ecology Assessment	Provides an assessment of the habitats and (non-avian) fauna present within the Proposed Development area and immediate surrounding environment.
1	EIAR Chapter 8: Ornithology Assessment	Provides an assessment of the potential effects upon avian species.
1	EIAR Chapter 9: Geology, Hydrology and Hydrogeology Assessment	Assesses the potential effects on the hydrological, geological and hydrogeological environment by the Proposed Development, including private water supplies and peat.
1	EIAR Chapter 10: Forestry	Assesses how the Proposed Development will affect the existing plans for felling, restocking, and proposes suitable amendments to forestry design plan(s) to accommodate the Proposed Development.
1	EIAR Chapter 11: Traffic and Transport	Provides an indicative construction programme, load requirements and assesses the potential effects upon the transport network resulting from the Proposed Development.
1	EIAR Chapter 12: Noise	Provides an assessment of the potential noise effects of the Proposed Development.
1	EIAR Chapter 13: Socioeconomics	Provides an assessment of the potential socioeconomic and tourism effects of the Proposed Development.
1	EIAR Chapter 14: Climate Change	Climate impact assessment of the Proposed Development.
1	EIAR Chapter 15: Aviation, Safety and Other Issues	Provides an assessment of the potential effects upon aviation, Ministry of Defence (MoD) interests, communication operations and existing site infrastructure.

1	EIAR Chapter 16: Synergistic effects, Residual Effects and Schedule of Environmental Mitigation.	Assesses the potential synergistic effects created by effects from different subject areas in combination and summarises the proposed mitigation and residual effects of the Proposed Development. Schedule of mitigations
2a	Figures	EIAR Figures except for LVIA
2b	Figures	LVIA Figures only
2c	Figures	LVIA and Cultural Heritage Visualisations
3	Technical Appendices	Provide additional supporting documents and data which inform the EIA.
4	Non-Technical Summary	Provides a high-level summary of the EIA's results in terms that can be understood by a layperson.

1.3 Project Background

1.3.1 The Proposed Development is located to the west of Waterside, Dalmellington that was subject to a previous application for wind energy development by RES in 2013, which will be referred to throughout this document as the Keirs Hill Wind Farm application. The Keirs Hill Wind Farm application was for 17 wind turbines each up to 149m to blade tip, and whilst it was unfortunately refused at Public Local Inquiry (PLI) the reporter concluded that "the site is a suitable one for a wind farm development".

1.3.2 Since the Keirs Hill Wind Farm application was refused, international and European commitments to reducing CO_2 and tackling climate change have been made by all major economies. In response to these issues the UK has made significant, legally binding commitments to increase the use of renewable energy.

1.3.3 As recently as May 2019 the Scottish Government announced its intention to set a legally binding goal to achieve net-zero greenhouse gas emission by 2045. In response, both East Ayrshire and South Ayrshire councils have developed strategies to reduce greenhouse gas emissions and improving, protecting and enhancing the local environments[1,2]

1.3.4 The Proposed Development relates directly to both the need and those commitments, while addressing the key concerns raised in the reporters' report following the PLI of the Keirs Hill Wind Farm application, notably landscape and visual impact, residential amenity, historic sites (eg the Waterside Ironworks).

1.3.5 The Proposed Development Area was previously considered to have sufficient capacity for approximately 33 wind turbines; however the Proposed Development considers a reduction to 9 wind turbines to mitigate some concerns raised on the previous Keirs Hill Wind Farm application, for 17 wind turbines. Based on 6 MW wind turbines, the Proposed Development would produce sufficient electrical energy to satisfy the average annual requirements of approximately 6,796 homes[3]. Further information on the evolution of design and rationale is set in Chapter 3: Design Evolution and Alternatives.

1.3.6 Figures 1.1 and 1.2 in Volume 2a illustrate the location of and the extent of the Proposed Development Area respectively. The Proposed Development consists of up to 9 wind turbines and associated infrastructure and is presented in Figure 1.3. It is expected to have an operational life of 50 years.

1.3.7 The Proposed Development's generating capacity of renewable electricity of up to 54 MW subject to final wind turbine procurement, excluding battery storage. There is, potentially, up to 45 MW of storage capacity also proposed within the battery energy storage system compound. Therefore, the application is made pursuant to Section 36 of the Electricity Act 1989 and the EIA has been undertaken in accordance with The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017.

1.3.8 The details of the Proposed Development as set out in Chapter 2: Proposed Development/Project Description but the application is seeking consent for the following main elements:

- up to nine three-bladed horizontal axis wind turbines of up to 200 m tip height.
- at each wind turbine, associated low to medium voltage transformers and related switchgear;
- wind turbine foundations;
- hardstand areas for erection cranes at each wind turbine location;
- a network of access tracks including passing bays and a site entrance from the public road;
- a substation compound including a communications mast;
- potential for battery energy storage system compound of up to 45 MW; a network of buried electrical cables;
- borrow pits (dependent on availability of stone on-site);
- signage;
- felling and replanting of forestry;
- temporary construction compounds, working areas and laydown areas; and
- improved and new walking trails (Keir Glen Trail), footbridges and pass through gates for pedestrian access.

[1] South Ayrshire Council Sustainable Development and Climate Change Strategy, 2019
[2] East Ayrshire Council State of the Environment Report, 2019
[3] Based on the annual average homes consumption figures from BEIS -National Energy Efficiency Data-Framework (NEED) 2021; figures may vary depending on final number of turbines and model chosen.

1.3.9 Habitat management will be undertaken within the Proposed Development Area. The land where wind turbines will be erected has established forestry and as such forest felling and replanting will be undertaken to facilitate the Proposed Development.

1.3.10 A Scoping Report was submitted to the ECU on 10 August 2021. A copy of this can be found in Technical Appendix 1.1 in Volume 3 of this EIAR. The full Scoping Opinion was received from the ECU on 05 November 2021 and is provided in Technical Appendix 1.2 in Volume 3 of this EIAR. It informs the scope of the EIA undertaken for the Proposed Development. The Scoping Opinion was used during the iterative design evolution along with other assessments of the Proposed Development.

1.4 The Applicant

1.4.1 RES is the world's largest independent renewable energy company active in onshore and offshore wind, solar, energy storage and transmission and distribution. At the forefront of the industry for 39 years, RES has delivered more than 18GW of renewable energy projects across the globe and supports an operational asset portfolio exceeding 6GW worldwide for a large client base. Understanding the unique needs of corporate clients, RES has secured 1.5 GW of power purchase agreements (PPAs) enabling access to energy at the lowest cost. RES employs more than 3,000 people and is active in ten countries.

1.4.2 From its Glasgow office RES has been developing, constructing and operating wind farms in Scotland since 1993. RES has developed and/or built twenty-one wind farms in Scotland with a total generation capacity of 597 MW. RES is currently constructing Blary Hill Wind Farm in Argyll and Bute and has recently finished constructing Solwaybank Wind Farm in Dumfries and Galloway and Freasdail Wind Farm in Argyll and Bute. The Applicant has the necessary knowledge and experience in renewable energy to develop the Proposed Development.

Table 1.1: Details of the Applicant

Applicant	
Renewable Energy Systems Ltd	Third Floor, STV, Pacific Quay, Glasgow, G51 1PQ

1.5 EIA Project Team

1.5.1 The Proposed Development has been designed by the Applicant with input from its lead EIA consultants, Natural Power Consultants Ltd, herein referred to as Natural Power (Table 1.2), and the EIA chapter authors in an iterative way to minimise environmental effects as much as possible whilst maximising renewable energy generation potential. Natural Power has been appointed to coordinate and produce this EIAR and associated EIA documentation.

1.5.2 Natural Power has been providing expertise to the renewable energy industry since the company was formed in 1995 and is one of the UK's leading renewable energy consultants. Natural Power currently employs over 400 people working full time providing renewable energy services nationally and internationally. Testimony to Natural Power's experience and ongoing commitment to competency and continual improvement, its Planning and Environment Departments are accredited by the Institute of Environmental Management and Assessment. In addition, Natural Power also operates in formally accredited health and safety (ISO: 45001), environmental (ISO:14001) and quality (ISO:9001) management systems. As well as development and EIA services, Natural Power also provides expert advice and due diligence consultancy, site construction management and site operation and maintenance. Thus, Natural Power is a competent and experienced consultant to co-ordinate and undertake EIA and prepare the EIAR. Natural Power is headquartered approximately 16.1 km from the Proposed Development.

1.5.3 Contact details for Natural Power and other consultants involved in the production of the EIAR are provided in Tables 1.2 & 1.3 below. Competency statements for other consultants involved in the EIA are provided in their respective EIAR Chapters.

Table 1.2: Details of agent and lead consultancy

EIA Co-ordinator and Planning Consultancy	
Natural Power Consultants Limited	The Green House, Forrest Estate, St John's Town of Dalry, DG7 3XS

Table 1.3: Other consultants involved in the production of this EIAR

EIA Contributors	
Landscape and Visual Impact Assessment	
Land Use Consultants (LUC)	250 Waterloo Road, London, SE1 8RD

Cultural Heritage Assessment	
Archaeological Management Solutions (AMS)	Popeshead Court Offices, Peter Lane, York, Y01 8SU
Ecology and Ornithology Assessments	
Natural Power Consultants Limited	The Green House, Forrest Estate, St John's Town of Dalry, DG7 3XS
Geology, Hydrology and Hydrogeology Assessment	
SLR	7 Wornal Park, Menmarsh Road, Worminghall, Aylesbury, HP18 9PH
Forestry Assessment	
DGA Forestry	Forestry Managers and Consultants, 40 Main Street, New Abbey, DG2 8BY
Traffic and Transport Assessment	
Pell Frischmann	5th Floor 85 Strand, London, England, WC2R 0DW

2 Proposed Development

2.1 Introduction

2.1.1 This chapter of the EIAR describes the components of the Proposed Development for which consent is being sought and which have been assessed through the EIA process. It includes details about the construction, operation and decommissioning of the Proposed Development, and outlines measures proposed to mitigate effects on the environment during these stages.

2.1.2 This chapter is supported by the following appendices:

- Technical Appendix 2.1: Outline Construction and Environmental Management Plan (CEMP);
- Technical Appendix 2.2: Outline Borrow Pit Management Plan (BPMP);

2.1.3 A number of figures have also been prepared to support the chapter, which provide an overview of the key components of the Proposed Development.

2.2 Location and Description

2.2.1 The Proposed Development is located in both South Ayrshire and East Ayrshire near Waterside, west of the A713.

2.2.2 The site of the Proposed Development (the 'Proposed Development Area') is currently a used for a mixture of commercial forestry and sheep grazing. It occupies forested hills of Green Hill and Lamdoughty Hill. The River Doon valley passes to the east, with settlements at Dalmellington, Waterside and Patna. To the west is the Water of Girvan, which flows through the village of Straiton. To the south the operational Dersalloch Wind Farm across the B741. The Proposed Development Area is centred on Ordnance Survey grid reference 240700E, 607500N and covers an area of approximately 1,000 ha.

2.2.3 The Proposed Development may include:

- up to nine three-bladed horizontal axis wind turbines of up to 200 m tip height.
- at each wind turbine, associated low to medium voltage transformers and related switchgear;
- wind turbine foundations;
- hardstand areas for erection cranes at each wind turbine location;
- a network of access tracks including passing bays, watercourse crossings and a site entrance from the public road;
- a substation compound including a communications mast;
- potential for battery energy storage system compound of up to 45 MW;
- a network of buried electrical cables;
- borrow pits (dependent on availability of stone on-site);
- signage;
- felling and replanting of forestry;
- temporary construction compounds, working areas and laydown areas;
- improved and new walking trails (Keir Glen Trail), footbridges and pass through gates for pedestrian access; and
- habitat management and biodiversity enhancement (see Chapter 7: Ecology for details)

2.2.4 The Proposed Development is expected to operate for up to 50 years following which decommissioning of the turbines and other infrastructure would be undertaken as required.

Proposed Development Layout

2.2.5 Figure 1.3 presents the infrastructure layout of the Proposed Development.

2.2.6 Table 2.1 gives the centre point location and proposed hub height for each of the proposed wind turbines.

Table 2.1: Wind Turbine Locations

Wind Turbine	Easting	Northing	Tip Height (m)	Hub Height (m)
T1	240561	606791	200	125
T2	240421	607686	200	125
T3	240939	607242	200	125
T4	241459	606902	200	125
T5	240860	608277	180	105
T6	241367	607831	180	105
T7	242026	607321	180	105
T8	242038	606687	200	125
T9	242550	606977	180	105

2.2.7 For the purpose of assessment, a maximum wind turbine tip height of up to 200 m to tip has been used. Where necessary for assessment purposes a rotor blade diameter of 150 m has been used although the blade length may vary (within the maximum turbine tip height) depending on turbine availability at the time of construction.

2.3 Construction Phase

Proposed Infrastructure

2.3.1 Prior to the commencement of construction, a Construction Environmental Management Plan (CEMP) would be produced setting out in detail the individual items of works associated with the construction of the Proposed Development and is considered as embedded mitigation (see Technical Appendix 2.1: Outline CEMP).

2.3.2 Below is a high-level overview of the infrastructure that forms the Proposed Development including reference to relevant figures submitted with the application. Where applicable it includes construction and reinstatement methodologies. For the purposes of carrying out the assessments on construction activities in the EIAR, the reasonable worst-case scenario has been adopted.

Wind Turbines

2.3.3 Consent is being sought for the installation and operation of up to nine three-bladed horizontal axis wind turbines.

2.3.4 The specific wind turbine model has not yet been selected but to inform modelling and assessment a wind turbine up to a maximum blade tip height of 200 m above ground level has been assumed. Each with a rotor diameter of approximately 150 m with, nominally, 6 MW generating capacity. The hub heights vary between 105 m and 125 m as indicated in Table 2.1. Indicative drawings of the proposed turbines are presented in Figures 2.1a & 2.1b.

2.3.5 Each of the wind turbines consist of the following components:

- blades;
- hub
- nacelle;
- tower; and
- external transformer.

2.3.6 Three blades will attach to the hub forming the rotor assembly which is mounted to the nacelle. The nacelle contains the gearbox, generator and associated control and monitoring equipment. The nacelle and rotor assembly are mounted atop a tapered tubular tower mounted onto a reinforced concrete foundation.

2.3.7 All wind turbine components are pre-fabricated off-site. Towers would likely be three to four sections and made from steel and the blades from fibreglass. It is proposed that the wind turbine tower, nacelle and blades be finished in a semi-matt, off-white/pale grey colour.

2.3.8 Wind turbines shall not carry any symbols, logos or other lettering except where required under other legislation. However, it is proposed to add wind turbine numbers to the base of each tower to aid service engineers during the operational phase of the wind farm.

2.3.9 Numbers would be up to 1000 mm tall by 900 mm wide and would be positioned between up to 3 m from finished ground level in order to be visible from the approaching access track.

2.3.10 A transformer will be required for each wind turbine which is assumed to be located external to the wind turbine.

2.3.11 External transformer housing would be situated adjacent to each of the wind turbine towers. The requirement for such structures, along with their dimensions, would vary based on the final wind turbine choice. It is possible that the transformer will be internal to the wind turbine structure however an indicative design for a typical external transformer housing is included in Figures 2.2a & 2.2b.

2.3.12 Since all wind turbines in the Proposed Development exceed 150 m above ground level to blade tip height, they are within scope of Article 222 of the Air Navigation Order, which requires all obstructions of 150 m or more above ground level to be fitted with medium intensity steady red lights on the highest practicable point. Chapter 15: Aviation, Safety and Other Issues provides details of a lighting scheme proposed for the wind turbines, which has been consulted with the CAA, and Chapter 5: Landscape and Visual Impact Assessment assesses the associated impacts of this lighting scheme.

Wind Turbine Foundations

2.3.13 Foundations will be required to support the wind turbines. These are typically steel reinforced concrete structures constructed in the ground to which the wind turbines are bolted to. Until a detailed ground investigation can be carried out it is not clear what form the foundation will take. Typically wind turbine foundations are either gravity type foundations or piled type foundations.

2.3.14 Regardless of the sub-structure, the above ground finish will see a 4.5 m – 5.5 m diameter foundation plinth protrude from the ground to support the wind turbine. It is proposed that a 5 m wide maintenance path surrounds the plinth connecting either to the adjacent access track or crane hardstand.

2.3.15 Figures 2.2a & 2.2b present the typical design for a both gravity type and piled type foundations.

Crane Hardstands

2.3.16 Adjacent to each wind turbine, an area of permanent hardstand approximately 35 m x 55 m will be constructed of compacted stone bearing directly on a suitable formation strata, for use of erection cranes. The exact geometry and position of the crane hardstands will depend on the wind turbine supplier's specifications, the cranes selected for erection and the findings of detailed ground investigations prior to construction. An indicative crane hardstand arrangement is presented in Figure 2.3.

2.3.17 The crane hardstands would be constructed using the same method as the excavated access tracks.

2.3.18 After wind turbine erection is complete, the temporary hardstand areas (as shown on Figure 2.3) would be reinstated. There would be a need to use cranes from time to time during the operational phase of the Proposed Development. The 'Good Practice during Wind Farm Construction'[1] guide recommends that crane hardstand areas are not covered with peat or topsoil. Therefore, the crane hardstands would be left uncovered, which would ease maintenance activities and comply with best practice guidance.

Access Tracks

2.3.19 Approximately 10.01 km of access track will be constructed for the Proposed Development as shown in Figure 1.3. This comprises 6.45 km of new track construction and 3.56 km of upgraded track construction. The access track layout has been designed in order to maximise the use and upgrade of existing tracks as far as reasonably practicable.

2.3.20 For construction of access track, alternative methods would be utilised for different areas of the Proposed Development Area, depending on site specific conditions. For each method, the access track running width shall be approximately 4.5 m and will be constructed of compacted crushed stone. Access track widths may also be wider for short sections such as at passing places, at sharp bends or turning heads and junctions. Eight passing places and three full AIL turning heads have been proposed as presented on Figure 1.3. Full AIL turning heads are required to facilitate both forward and reverse delivery of wind turbine blades to each wind turbine location. This is required when constructing a rotor at ground level to perform a full rotor lift. Alternatively, wind turbine blades can be lifted individually to the hub, a single blade lift. Should the latter blade lift be adopted then the full AIL turning heads can be reduced or removed.

2.3.21 It is expected that all access tracks would be excavated whereby overlying soil or peat material would be removed to a suitable formation strata from which the access track would be built in compacted stone.

2.3.22 Where peat depths are greater than 1 m deep, it is generally more efficient to "float" the access track over peat using geogrid. Typical access track construction details are presented in Figure 2.4.

2.3.23 Four watercourse crossings are required as part of the Proposed Development, including the construction of a new bridge over the River Doon near the new site entrance. These watercourse crossings shall be designed to ensure that fish and mammal movement is not restricted. It is understood that applications will need to be made to SEPA under The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR) for authorisation of the various watercourse crossings. An example design of a typical watercourse crossing is presented in Figure 2.7. A typical bridge design, similar to what may be adopted for the River Doon crossing, is presented in Figure 2.8. Further information on watercourse crossings is provided in Chapter 9: Hydrology, Geology & Hydrogeology.

2.3.24 For safety reasons, marker posts may be placed in the ground by the edge of the access track in order to guide on-site vehicles during times of poor visibility.

Public Road Access

2.3.25 The Proposed Development will be accessed directly from the A713 via a new site entrance near Waterside. The new site entrance will be designed to accommodate deliveries for wind turbine components. Figure 2.5 presents an indicative layout of the new site entrance.

2.3.26 Note: Until the access track and site entrance from the A713 are constructed, initial construction access to the Proposed Development will be primarily taken via the B741 onto an existing track into High Keirs Forest. This will allow access to the borrow pit search areas where working of the borrow pits can commence. Once the access track and site entrance from the A713 are constructed, construction access to the Proposed Development will switch to be taken via the A713.

2.3.27 Wheel cleaning facilities will be set up at both the above mentioned site entrances to site from the A713 and B741 to remove mud from the wheels of vehicles leaving

[1] http://www.snh.gov.uk/planning-and-development/renewable-energy/onshore-wind/good-practice-during-windfarm-const/

the Proposed Development. Public roads will be inspected daily and a lorry-mounted road brush will be employed to remove any mud or debris transferred onto the roads from on-site activities.

Description of Abnormal Access

2.3.28 The delivery of the Abnormal Indivisible Loads (AILs) only will be from the King George V Dock. The AILs will leave the dock along Kings Inch Drive joining the M8 at Junction 26. They will continue east joining the M73 at Junction 8 and then the M74 at Junction 1. They will then join the M77 (A77) at Junction 22 southwards towards the Proposed Development joining the A713 at Bankfield Roundabout.

2.3.29 Continuing along the A713 the AILs will adopt newly constructed overruns at Hollybush and Holehouse Bridge. These have been specifically constructed to fasciliate AIL delivery to South Kyle Wind Farm and are suitable for the AILs associated with the Proposed Development. AILs would then continue to the new site entrance at Waterside. Further details are available in Chapter 11: Traffic and Transport of the EIAR.

2.3.30 Public roads would be utilised and repaired where necessary. An assessment of the public road access is provided in Chapter 11.

On-site cabling

2.3.31 The wind turbines envisaged for use on the Proposed Development would initially generate electricity at 690 – 1000 V. This typically needs to be stepped up to the on-site distribution voltage of 33 kV via the ancillary transformer, as mentioned above in the Wind Turbines section. Each wind turbine will be connected to the substation compound via underground electricity cables.

2.3.32 Cable trenches will accommodate these electricity cables, including also communication cables and the earthing cable network. Figure 2.12 presents the typical cable trench cross section that shall be adopted across the site. Where cables need to cross tracks or hardstands they will be routed through ducts.

2.3.33 The layout of the cable trenches within the Proposed Development Area would generally run adjacent to the access tracks where possible. The route would be marked above ground with clearly identified posts, spaced at suitable intervals along the length.

Substation and Battery Energy Storage System Compounds

2.3.34 A substation compound is required to collect the electricity generated and distribute it off-site to the electricity grid system. A substation compound of 60 m x 55 m with an ancillary vehicle parking compound of 28 m x 16 m is proposed in the east of the of the Proposed Development at approximate Ordnance Survey grid reference 242273E, 606897N. It will be constructed of compacted stone bearing directly on a suitable formation strata including reinforced concrete foundations for the buildings and ancillary equipment. The substation compound would contain a 33kV/132kV step-up transformer, associated switchgear, telecommunications mast and ancillary equipment suitable for a transmission connection to the electricity grid system. The wind farm control building required at the substation would accommodate metering equipment, switchgear, the central computer system and electrical control panels. It is anticipated that Transmission Operator will also require their own control building. In addition to the two control buildings a welfare building will be installed for all personnel.

2.3.35 Figures 2.9a & 2.9b present indicative substation compound layout and elevations. This is indicative and the design and layout are subject to change once the expected point of connection is known, see Grid Connection section below.

2.3.36 The telecommunications mast is expected to be up to 10 m tall. A typical elevation of the telecommunications mast is presented in Figure 2.10.

2.3.37 In order to match on-site energy generation to energy demand, as well as facilitate options such as a reduction in any possible grid constraint requirements, the Proposed Development also includes a battery energy storage system (BESS).

2.3.38 The BESS compound is proposed to be 156 m x 45 m located opposite the access track to the substation compound at approximate Ordnance Survey grid reference 242135E, 606912N. It will be constructed of compacted stone bearing directly on a suitable formation strata including reinforced concrete foundations for the building and ancillary equipment. Within the BESS compound permanent containers, mounted on small concrete foundations would house an energy storage device, inverters and other ancillary equipment. The containers would be of steel construction, and very similar to shipping containers in appearance. It is likely that each container would typically measure 14 m (length) x 2.5 m (width) x 3 m (height). For each container there would be a transformer located on the hardstand. The final design of the BESS compound would be based upon the technology available at the time of construction.

2.3.39 Should the BESS compound be realised it will be formed by expanding the temporary construction compound as indicated on Figure 1.3. Figures 2.11a & 2.11b present indicative BESS compound layout and elevations

2.3.40 For both the substation and BESS compounds foul drainage will be provided in accordance with Building Control requirements and in agreement with SEPA.

Grid Connection

2.3.41 The proposed point of connection for the Proposed Development into the electricity grid system is at the substation compound. The Proposed Development would most likely be connected at Coylton Substation, a substation located approximately 13 km north of the Proposed Development. The connection would be comprised of buried 132 kV cables and/or OHL. The exact arrangement of this grid connection is subject to detailed design by Scottish Power Transmission, the Transmission Operator (TO). To confirm the Applicant has made an application to the TO for an offer of grid connection.

2.3.42 The grid connection will be offered by the TO through National Grid and the Applicant will have no absolute control over the nature and location of the eventual grid connection. The optimum interconnection point depends upon power flows and available capacity in the wider grid network. Given that these are constantly changing, particularly at the current time with the widespread development of renewable energy projects, it is impossible to guarantee the detail of the grid connection until the time at which the connection is secured for the Proposed Development.

2.3.43 Should further detailed studies determine that a grid connection to another transmission entry point prove more suitable, the TO will advise the applicant in due course. Any final grid connection route and associated consents would be the responsibility of the TO and this route would require further studies and would be subject to a separate consenting process and EIA if required.

Borrow Pits

2.3.44 Borrow pits may be used to provide the stone for the construction of access tracks, compounds and hardstands, subject to sufficient quality and quantity of stone being available at the identified borrow pit search areas, as indicated on Figure 1.3. These borrow pit search areas are shown as the maximum potential area of borrow pit extraction, but it is not anticipated that these areas would be fully exploited. An indicative borrow pit arrangement is shown in greater detail in Figure 2.15.

2.3.45 It is expected that construction access can be gained directly to the borrow pit search areas from the existing track via an access point off the B741.

2.3.46 Final borrow pit locations within the borrow pit search areas would be subject to detailed ground investigations to confirm suitability of material.

2.3.47 If an on-site batching plant is required it would be situated within a borrow pit or at another secure location which would be agreed in advance with SEPA and Scottish Water prior to construction. Figure 2.17 presents a typical batching plant layout).

2.3.48 The batching plant equipment will include:

- concrete and aggregate storage bins;
- concrete batching equipment;
- wash out facilities;
- testing facilities;
- water supply; and
- waste storage area.

2.3.49 It is anticipated that a borehole would be sunk to provide a reliable water supply for the batching plant. Any borehole would be subject to suitable yields being available, which will be determined through future detailed ground investigation. Any borehole would require suitable authorisation from SEPA under CAR.

Felling

2.3.50 The forestry within the Proposed Development Area consists of three contiguous woodlands under two separate ownerships, High Keirs Forest and Sclenteuch & Lamerty Forests. There is an active Forest Plan on High Keirs which expires in 2025. The Forest Plan on Sclenteuch & Lamerty Forests expired in 2020 and does not appear to have been renewed. The forests lie outwith the boundary of the larch dieback disease (Phytophthora ramorum) management zone and have been issued with Statutory Plant Health Notices for the clearance of infected larch.

2.3.51 The Wind Farm Forest Plan would be largely driven by technical constraints. Areas of forestry would require to be felled to accommodate the construction and operation of the Proposed Development. NOTE: Pre construction ground investigation would require felling pre-commencement however this requirement is included in total felling allowance.

2.3.52 Full details of the forestry felling, restocking and forest management practices are provided in Chapter 10: Forestry, of the EIAR.

Keirs Glen Trail

2.3.53 It is proposed to construct a new footpath between proposed access track and the existing High Keirs track to form a walking and cycling trail to provide recreational benefits to the local community. The footpath will also include new footbridges and pass through gates. Figure 2.16 presents the proposed Keirs Glen Trail. As footpaths effects are minimal these have not been considered in assessment.

Temporary Compounds

2.3.54 Three temporary compounds will be constructed to provide a secure area for office facilities and storage of materials and components. A temporary enabling works compound of 20 m x 20 m will be required adjacent to the existing track near the existing entrance off the B741, at approximate Ordnance Survey grid reference 242595E, 606162N. A temporary construction compound of 70 m x 45 m will be required opposite the substation compound at approximate Ordnance Survey grid reference 242178E, 606915N. The other temporary enabling works compound will be located adjacent the new site entrance and new River Doon bridge location at approximate Ordnance Survey grid reference 243431E, 608739N. All three will be constructed of compacted stone bearing directly on a suitable formation strata.

2.3.55 The temporary compounds will be used to accommodate a number of construction facilities including site offices and meeting rooms, staff welfare facilities, storage and laydown areas for construction vehicles, plant, equipment, turbine components, other materials and aggregate recycling. The compound will also provide sufficient parking for the on-site personnel, deliveries and visitors.

2.3.56 There will be a sealed bunded area where fuel and oil storage tanks will be situated, to prevent potential contamination in accordance with SEPA guidance the bunded area will be situated a minimum of 50m from any watercourse to reduce the risk of pollution entering watercourses.

2.3.57 Depending on the time of year and the stage of the construction programme, temporary lighting may be required at the temporary compounds and at work areas during working hours. It is not proposed that the lighting will be on outside of working hours.

2.3.58 A typical layout of the temporary construction compound and enabling works compounds is presented in Figures 2.13 and 2.14 respectively.

Signage

2.3.59 There would be a requirement for signage at the Proposed Development to provide safe day-to-day navigation, for emergency vehicles to navigate to emergencies, should they arise, as well as aid the development of comprehensive risk assessment for those visiting and using the Proposed Development Area.

Construction & Reinstatement

2.3.60 Construction of the Proposed Development will consist of the following key construction activities:

- forestry felling;
- ground investigation;
- construction of the temporary compounds;
- extracting stone from borrow pit;
- construction of the access tracks, including passing places, turning heads, junctions, drainage and water crossings;
- construction of site entrance to A713;
- construction of the substation compound;
- construction of the BESS compound;
- construction of the wind turbine foundations;
- construction of crane hardstands;
- excavation of trenches and laying of cabling adjacent to the access tracks connecting the turbines to the substation compound;
- delivery and erection of wind turbines;
- testing and commissioning of site equipment including wind turbines; and
- site restoration (including tree replanting).

Working of Borrow Pits

2.3.61 Excavation of material from the borrow pits will be carried out using standard quarrying techniques, which may include blasting and mechanical excavation.

2.3.62 The general methodology set out below for careful management of the borrow pit will be adhered to in order to minimise potential environmental impact.

2.3.63 A Borrow Pit Management Plan will be agreed with SEPA and the planning authorities prior to the commencement of construction. Provisions for the control of surface run-off during and post construction (SuDs) and the re-vegetating of working faces post construction will be included.

2.3.64 As a worst case, it is anticipated that blasting may occur up to 2-5 times a week for the first six months, before tapering off and becoming less frequent.

2.3.65 Appropriate dust suppression at the borrow pits and any materials storage areas will be provided as required.

2.3.66 Once operations are sufficiently underway, restoration will take place progressively behind the working area to encourage re-vegetation. This will minimise any impact to the surrounding environment by minimising the working area at any point.

2.3.67 An Outline Borrow Pit Management Plan is provided as Technical Appendix 2.2.

Construction of Excavated Access Tracks, Hardstands and Compounds

2.3.68 The construction method for excavated access tracks, hardstands and compounds would generally be as follows:

- The topsoil will be excavated and stored to one side for reuse during the reinstatement of the structure;
- Excavation will be undertaken to competent material. Excavated subsoil material may be stockpiled temporarily adjacent to the excavation for later use as backfill or stored elsewhere on Proposed Development. Temporary and permanent drainage shall be installed at the same time as the excavation works for the structure;
- In the case where competent material is lower than the required formation level the foundation will likely be over-excavated to competent material and compacted engineering fill placed to the required formation level;
- Where excavation is required to extend below the water table or in material which does not drain freely, appropriate pumping will be employed to keep the excavation dry. Water pumped from an excavation shall not be discharged directly to any watercourse;
- If ground conditions dictate a geotextile membrane will be applied;
- Crushed stone will be placed and compacted in layers to achieve the required structural dimensions;
- For the compounds, ducting and reinforced concrete foundations will be constructed at the required design level;
- Drainage will be excavated adjacent to the structures where required. Surface water runoff will not be allowed to discharge directly into existing watercourses but will be routed through a sustainable drainage system (SuDS) in accordance with the Pollution Prevention Plan;
- A surface water cut off ditch may be installed on the slope above the earthworks footprint where achievable given the topography; and
- Depending on depth and type of material, cut slopes are anticipated to be between 1:1 to 1:3.

Construction of Floating Access Tracks

2.3.69 Floating access track construction may be adopted where the ground conditions dictate. This system involves installing a geosynthetic reinforcement directly onto the organic vegetated layer and placing layers of crushed stone and additional geosynthetic reinforcement (if required by the design) above. If ground conditions require a geotextile membrane may be applied also.

Installation of Cabling

2.3.70 The cable trench construction and installation method would generally be as follows:

- Trenches will be excavated and a suitable bedding material placed for which to lay the cables upon.
- The cables shall be laid directly onto the bedding material and spaced according to the design;
- The trench will then be backfilled and compacted with suitable material up to the required level and finished with a layer of topsoil to aid in the trench reinstatement;
- A suitable marking tape is installed between the cables and the surface; and
- The cables are terminated at each wind turbine and at the substation compound.

Construction of Wind Turbine Foundations

2.3.71 The gravity type foundation construction method would generally be as follows:

- The topsoil will be excavated and stored to one side for reuse during the reinstatement round the finished foundation;
- Excavation will be undertaken to competent material. Excavated subsoil material may be stockpiled temporarily adjacent to the excavation for later use as backfill or stored elsewhere on in the Proposed Development. Temporary and permanent drainage shall be installed at the same time as the excavation works for the foundation;
- In the case where competent material is lower than the required formation level the foundation will likely be over-excavated to competent material and compacted engineering fill placed to the required formation level;
- Where excavation is required to extend below the water table or in material which does not drain freely, appropriate pumping will be employed to keep the excavation dry. Water pumped from an excavation shall not be discharged directly to any watercourse;
- A layer of concrete blinding will be laid directly on top of the newly exposed formation, finished to ensure a flat and level working surface;
- Steel reinforcement, the turbine anchorage system and cable ducts will be fixed in place and formwork erected around the steel cage;
- Concrete will be placed using a crane, pump or other suitable lifting device and compacted using vibrating pokers;
- The foundation will be backfilled with suitable material, and landscaped using the topsoil set aside during the initial excavation; and

- A maintenance path will be built leading from the access track or crane hardstand to the wind turbine door or access steps and around the wind turbine for maintenance.

2.3.72 The piled type foundation construction method would be as follows:

- The topsoil will be excavated and stored to one side for reuse during the reinstatement round the finished foundation;
- A suitable level piling platform will be constructed which will likely consist of compacted stone designed to comply with the requirements of the piling rig being used;
- Formation of the pile shaft will be achieved by rotary methods to the required depth and embedment in the competent soils or bedrock. Any spoil produced shall be removed and stored at the selected location within the Proposed Development Area. Depending on the selected piling technique, it may be necessary to insert temporary casing into the ground to support the pile bore;
- Delivery and placement of the concrete into the pile bore will be undertaken using a concrete pump;
- The pile reinforcement cage may be installed before or after the concrete placement depending on the selected technique;
- On completion of all the piles within a turbine foundation, the piling rig and ancillary equipment shall be moved to the next turbine location as required; and
- A reinforced concrete pile cap, connected to the piles below, would then be constructed in much the same manner as the gravity type foundation.

Erection of Wind Turbines

2.3.73 The following general steps will be undertaken in order to erect the wind turbines:

- Some components will be pre-delivered in sections and offloaded at the crane hardstands;
- The remaining components will be delivered on a just-in-time basis and be lifted directly from vehicle trailers;
- Components will be lifted by adequately sized cranes (one main crane and one smaller assist crane) and positioned on the foundations / other sections until the entire wind turbine is erected;
- Upon completion of the erection all fasteners will be tightened and the internal fit out of the wind turbine undertaken;
- The wind turbines will then be connected to the wind farm substation; and
- Wind turbine testing and commissioning will be undertaken before the wind turbines will be handed over as complete.

Reinstatement

2.3.74 Following construction, the Proposed Development will be reinstated. The anticipated type and extent of reinstatement is outlined below.

2.3.75 Where a re-turfing method is appropriate, such as along access track verges, the surface layer of soil and vegetation will be stripped and stored separately from the lower soil layers, and replaced as intact as possible once construction is complete.

2.3.76 Local restoration will be carried out to retain the structure and composition of the original plant communities, as well as forming a stable area over reformed ground, thus reducing erosion by rain, run-off and wind.

2.3.77 Bare soil areas will be allowed to re-vegetate naturally in combination with reseeding using a low density (~20kg per hectare) seed mix which mirrors local vegetation to help bind the soil more quickly.

2.3.78 Access tracks, hardstands and compounds are required throughout the operation of the wind farm to permit access for maintenance and repair operations. They will also be necessary to allow access during the decommissioning stage. Generally, the sloping verges of access tracks, hardstands and compounds will be dressed with site sourced turf or seed bank material. If suitable material is generated during the construction of the structure, this material can be used to form a low lying screening verge along the downhill side of the structure. This will assist in reducing the visibility of the structure. Further detail is provided in Technical Appendix 9.2 : PMP.

2.3.79 The temporary compounds will be reinstated into the surrounding landscape and restored to its original condition.

2.3.80 It is essential that the access track width is retained during the operation of the proposed wind farm to allow occasional crane access if required, hence no works to reduce the track width, post turbine erection, are proposed.

2.3.81 Cable trenches would be similarly reinstated. Where practicable, vegetation over the width of the cable trenches would be lifted as turves and replaced after trenching operations to reduce disturbance.

Micrositing

2.3.82 Micrositing allows the locations of the wind turbines and infrastructure to be modified post-consent within specified parameters, following detailed ground investigation and ground clearance. Through industry experience, a micrositing allowance of up to 100 m is considered appropriate for wind turbines and associated

infrastructure, subject to certain conditions, such as ensuring buffers from watercourses are maintained. The assessments within this EIAR account for the potential micrositing of the wind turbines and associated infrastructure. Figure 3.1 includes a proposed micrositing buffer taking due cognisance of the known constraints.

Construction Programme

2.3.83 Construction of the Proposed Development is estimated to last 14 months. An indicative programme for the construction activities of the Proposed Development is shown in Table 2.2 below.

Table 2.2 Outline Programme

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mobilisation	■	■												
Forestry clearance	■	■	■	■	■									
Site entrance and tracks		■	■	■	■	■	■	■						
Crane hardstands				■	■	■	■	■	■					
Wind turbine foundations					■	■	■	■	■					
Substation & BESS							■	■	■					
Cable installation								■	■	■	■	■		
Turbine deliveries									■	■	■	■		
Turbine erection										■	■	■	■	
Operational take over													■	■

Construction Hours

2.3.84 In general, working hours for construction will be from 07.00 to 19.00 Monday to Saturday. No working is proposed on Sundays or public holidays.

2.3.85 Exceptions to the proposed working hours will be made for foundation pours and wind turbine erection. Concrete pouring for an individual wind turbine foundation must take place continuously and so activity will only cease when the pour has been completed. Wind turbine erection can only occur during periods of low wind speeds and so to minimise the construction programme, lifting operations may need to be scheduled out with the above hours. In addition, it may be necessary to complete a particular lifting operation to ensure the structure is left safe.

Environmental Management

Construction Environmental Management Plan (CEMP)

2.3.86 A CEMP will be prepared prior to the start of construction, detailing measures to avoid or mitigate potential effects associated with key construction activities. These will reflect and expand upon measures identified in the EIA Report, and will be agreed with the planning authorities, SEPA, NatureScot and other stakeholders where appropriate. An outline CEMP is provided as Technical Appendix 2.1

2.3.87 The CEMP will, as a minimum, include details of:

- schedule of mitigation;
- construction methodologies;
- pollution prevention measures;
- public liaison provision;
- peat slide, erosion and compaction management;
- control of contamination/pollution prevention;
- drainage management;
- water quality monitoring;
- management of construction traffic;
- control of noise and vibration; and
- control of dust and other emissions to air.

2.3.88 Typically, the CEMP will contain the following supporting documents:

- A Pollution Prevention Plan;
- A Peat Management Plan;
- A Traffic Management Plan;
- A Path Management Plan;
- A Water Quality Monitoring Plan;
- A Borrow Pit Management Plan
- A Site Waste Management Plan; and
- A Decommissioning Plan.

Pollution Prevention Plan

2.3.89 CAR dictates that a Construction Site License will be required from SEPA for the Proposed Development prior to commencement of construction. To make this application a Pollution Prevention Plan would be prepared. Once approved by SEPA it would act as a supporting document to the CEMP.

Peat Management Plan

2.3.90 Prior to construction of the Proposed Development a detailed ground investigation will be carried out. This will allow for a post consent update of the Peat Management Plan, following the principles set out in the draft PMP provided as Technical Appendix 9.2.

Traffic Management Plan

2.3.91 As detailed in Chapter 11, a Traffic Management Plan (TMP) would be developed to ensure road safety for all users during transit of loads to the Proposed Development. 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 the planning authorities, the police, Transport Scotland and the local community and agreed before deliveries to the Proposed Development commence.

Site Waste Management Plan

2.3.92 The Proposed Development would produce small amounts of general, municipal and hazardous waste during its construction, operation and decommissioning. The Site Waste Management Plan would be put in place to ensure waste generated from the Proposed Development is kept to a minimum and does not have a significant cumulative effect on local waste management infrastructure

Environmental Clerk of Works (ECoW)

2.3.93 An ECoW would be appointed to undertake site surveys, monitor the construction activities and report to both the Applicant and planning authorities of any incidences. The ECoW will ensure compliance with the CEMP and any other environmental documentation required by planning condition. The ECoW would liaise closely with the Applicant, providing expert advice to help rectify any potential environmental matters that arise during the construction phase.

Planning Monitoring Officer (PMO)

2.3.94 A PMO would be appointed to undertake site surveys, monitor the construction activities, monitor compliance of the Proposed Development with the planning requirements of its consent during construction and report to both the Applicant and the planning authorities. The PMO would liaise closely with the Applicant, providing expertise to help rectify any potential planning issues that might arise.

2.4 Proposed Aviation Lighting

2.4.1 Due to the height of the turbines proposed (up to 180 and 200 m to turbine blade tip) visible aviation safety lighting is required. The proposed lighting scheme includes two medium intensity 'steady' red lights (2000 candela (cd)) located on the turbine hubs of T1, T2, T4, T5, T6, T7, T8 and T9 (8 No. turbines in total). The secondary light is fitted for use in the event of failure of the primary light, and so will not be lit concurrently. No low intensity red lights located on the intermediate level on the turbine tower are proposed as part of this lighting scheme. The lights will only be illuminated at night, which is defined by the Schedule 1 of the Air Navigation Order (ANO) 2016 as "*the time from half an hour after sunset until half an hour before sunrise (both times inclusive), sunset and sunrise being determined at surface level*".

2.4.2 CAA guidance permits 2000 cd lights to be dimmed to 10% of the minimum peak intensity when horizontal meteorological visibility exceeds 5 kilometres (in all directions. Where atmospheric conditions limit visibility to distances of less than 5 km in any direction (e.g., presence of low cloud cover, rain, mist, haze or fog) the lights are illuminated at the necessary intensity of 2000 cd. When atmospheric conditions result in visibility at distances of 5 km or greater from the turbines, the lights operate in a lower intensity mode of 200 cd. Visualisations which support this assessment have been provided to illustrate aviation lighting at both 2000 and 200 cd mode.

2.4.3 Aviation obstruction lights are designed to emit lighting at an intensity that meets the minimum regulatory requirements, in a broadly horizontal direction. The light fitting is designed to reduce the amount of light that shines upward or downward from the light fitting. The detail of this reduction is dependent on the specific model of light that is installed, but the values set out in Table 2.3 are widely accepted as a reasonable estimation. These values show that a viewer looking up at the light from a lower elevation would see a reduced intensity of light, compared to the maximum intensity.

Table 2.3: Lighting intensity by vertical angle

Vertical angle of lighting from nacelle	Maximum luminous intensity (cd)	10% of maximum luminous intensity (cd)
Above 2°	1500-750	150-75
1° to 2°	2500-1500	250-150
0° to 1°	2000-2500	200-250
-1° to 0°	2000-1000	200-100

-2° to -1°	1000-400	100-40
-3° to -2°	400-200	40-20
Below -3°	Below 200	Below 20

2.4.4 The values shown in Table 2.3 have been used to generate ZTV maps and photomontages. See Chapter 5: Landscape and Visual Assessment and Chapter 6: Cultural Heritage for impact assessment of aviation lighting.

2.5 Operational Phase

2.5.1 Once operational, the Proposed Development will not be permanently staffed and it is envisaged that the amount of traffic associated with the Proposed Development will be minimal. Traffic generated will comprise routine maintenance and service team visits, together with the occasional need for more extensive maintenance or repair. Wind turbine operations will be overseen by suitably qualified contractors.

2.5.2 Routine maintenance and servicing will take place two to four times per year. Servicing will include the performance of tasks such adjustment of blades, inspection of blade tip brakes and inspection of welds in the tower. Other visits to the Proposed Development will take place more frequently to ensure that the wind turbines are operating at their maximum efficiency. In the event of any unexpected events onsite appropriate repair works will be carried out.

2.5.3 The vehicle used for the majority of these visits is likely to be a small four wheel drive vehicle, although there may be an occasional need for an HGV or crane to access the site for heavier maintenance and repairs.

2.5.4 On going access track maintenance will generally be undertaken in the summer months when tracks are dry. Safe access will be maintained all year round.

2.5.5 The Proposed Development would have a sophisticated overall Supervisory Control and Data Acquisition system (SCADA) that would continually interrogate each of the wind 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.

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

2.5.7 If a fault should occur, the operator would diagnose the cause. If the repair warranted the Proposed Development being disconnected from the grid then the operator would make contact with the TO. 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 entirety of the Proposed Development would be automatically disconnected.

2.5.8 Signage would be placed on the Proposed Development giving details of emergency contacts. This information would also be made available to the local police station and the TO.

2.6 Decommissioning Phase

2.6.1 In the event of decommissioning, or replacement of the wind turbines, it is anticipated that the likelihood of effects is similar to, or less than, that expected during construction. Decommissioning would be undertaken in line with best practice processes and methods at that time and will be managed through an agreed CEMP.

2.6.2 Decommissioning will involve the following:

- dismantling and removal of wind turbines and electrical equipment;
- restoration of the wind turbine areas, hardstands and access tracks; and
- dismantling and removal of the substation and BESS compounds.

2.6.3 Wind turbine components and electrical equipment will be dismantled and removed in a similar manner to their delivery and erection. The wind turbines will be split into sections which will then be transported from the Proposed Development by HGVs unless the components are sold on, in which case, they will be removed as AILs. Wind turbine components will be cut up offsite in controlled environments ready for reuse, recycling or appropriate disposal.

2.6.4 The removal of the top of the turbine base will be undertaken requiring an excavated trench around the upstand to provide a working area. Breakout of the top part of the upstand will be undertaken using an excavator mounted jack hammer. The cables will be cut level with the remaining concrete. Once the broken-out concrete has been removed, the area will be reinstated by backfilling with topsoil / peat.

2.6.5 The cables will be left in place to avoid unnecessary ground disturbance.

2.6.6 The CEMP will be updated as required to ensure best practice is adopted during decommissioning of the Proposed Development.

2.6.7 An assessment of the decommissioning of the Proposed Development has not been undertaken as part of the EIA as:

- the future baseline conditions (environmental and other developments) cannot be predicted accurately at this stage; and
- the proposals for refurbishment / decommissioning are not known at this stage.

2.7 Health and Safety

Construction Phase

2.7.1 The construction site would be managed and operated in accordance with Health and Safety at Work etc. Act 1974 and comply with relevant Health and Safety Regulations, including:

- The Management of Health and Safety at Work Regulations 1999
- Electricity Safety, Quality and Continuity Regulations 2002
- Construction (Design and Management) Regulations 2015

2.7.2 In awarding any civil, electrical or other contracts for the construction of the Proposed Development the appointed contractor is obligated by law to follow the CDM Regulations implemented by the Health and Safety Executive (HSE). These are based on standard procedures that are adapted to take account of all site specific requirements. The CDM Regulations require due consideration is given to construction workers and the public, with risk assessments and method statements created to cover all risks identified including access rights across the Proposed Development Area.

2.7.3 The Applicant will appoint a Principal Designer to ensure all the CDM Regulations are correctly implemented, and to compile a Health and Safety File, which would be used in the operational phase of the Proposed Development. The Applicant would be required to provide a timescale and start date for the Proposed Development, to allow the Principal Designer to review the adequacy of the contractor involved against the description of the required works. Additionally, a representative from the Applicant would be at the Proposed Development during the construction period. This person would be empowered to halt any or all construction works if they believe correct health and safety procedures are not being adhered to. Similar procedures for site workers, visitors and civilians must be drawn up for the operational phase. The HSE can investigate safety aspects of the Proposed Development and visit at any time if they have concerns.

Public Safety

2.7.4 Throughout the construction phase of the Proposed Development, the relevant statutory requirements would be adhered to. All potentially hazardous areas would be fenced off and all unattended machinery would be stored in the temporary construction compound or immobilised to prevent unauthorised use. In addition, signage would be placed at each possible entrance to the Proposed Development Area and in areas where there may be further danger, for example around open borrow pits.

2.7.5 Throughout construction, measures to manage diversion routes would be secured. The diversion routes would be clearly marked and for safety reasons would direct the user away from any areas of construction.

2.7.6 Straiton to Patna Hill Track (SKC11) right of way passes through the western edge of the Proposed Development Area. The Proposed Development does not intersect the right of way. The nearest section of proposed infrastructure is approximately 370 m from the right of way and the nearest proposed turbine is approximately 520 m from the right of way. It will not be necessary to restrict the use of the right of way that passes through the Proposed Development Area during the construction phase.

2.7.7 Although members of the public have the right to roam land in Scotland under the Land Reform (Scotland) Act 2003 there will be restricted access around the Proposed Development during the construction phase for health and safety purposes.

Operational Phase

2.7.8 Wind farms have a proven track record for safety. A very small number of wind turbines have been known to suffer mechanical damage through lightning strikes or mechanical failure. Experience on operational wind farms has shown that allowing the public to access an operating wind farm does not lead to a compromise with respect to safety issues.

2.7.9 Companies supplying products and services to the wind energy industry operate to a series of international, European and British standards. A set of product standards for wind energy equipment has been developed by the International Electrotechnical Commission - IEC 16400. There are a number of British Standards that correspond to it, for example; BS EN 61400-1 ed3.0: 2005 “Wind turbines – Part 1: Design requirements”.

2.7.10 The Applicant would commit to installing wind turbines and components that meet BS EN 61400-1 ed3.0.

2.7.11 Public access to the Proposed Development Area after construction has been completed would remain the same as the current situation, although with some specific improvements to footpath infrastructure to facilitate public access which have been proposed as part of the Proposed Development. Appropriate warning, directional and identification signs would be installed on the wind turbines, transformers and at the substation and BESS compounds. Access to these would be restricted to wind farm personnel. At all times these facilities would be locked. Additionally, safety and/or directional signs would be placed at strategic points across the Proposed Development Area, particularly on the public routes to inform members of the public that they are entering a wind farm, to make them aware of potential hazards and provide direction for emergency services should the need arise. Any signage would be agreed with the relevant authorities prior to installation.

2.7.12 No resulting safety risks are expected as a result of public access to the Proposed Development. Wind turbine models being considered for the Proposed Development Area would operate automatically and have sensors to detect any instabilities or unsafe operation during high wind speeds. Should sensors placed within the nacelle and tower of the wind turbine detect any other malfunction in operation or should wind speeds increase over maximum operational thresholds, the brakes would be automatically applied in order to rapidly shut the wind turbine down.

2.7.13 Icing in Scotland is likely to be a rare occurrence, especially with the Proposed Development Area in the south of Scotland, icing conditions are expected to be benign. The design of the Proposed Development has taken into account the possibility of ice throw occurring and wind turbines have been sited in locations to ensure that the rotor blades do not oversail any public roads to minimise the risk from ice fall. To further minimise the risk public notices will be displayed at new and existing access points to the Proposed Development Area, alerting members of the public and staff accessing the Proposed Development Area of the possible risk of ice throw under certain weather conditions. Further information is detailed in Chapter 13.

2.7.14 If the cause of the shutdown was high wind speeds, then the wind turbine would automatically begin operation once the average wind speed reduced to within operational levels. Under other causes of shutdown, e.g., through malfunction, the wind turbine would remain shut down and in a safe condition (i.e., commonly with the blades orientated 90° to the wind direction) until restarted by a member of the operations and maintenance (O&M) team following satisfactory investigation. This procedure ensures safe operation of wind turbines to protect members of the public walking, cycling or riding past wind turbines during the operational phase. In addition, the vibrometers in the nacelles would detect rotor imbalance in blades caused by icing and the wind turbine's control and monitoring system would shut the wind turbines down under these conditions. The wind turbines are also equipped with lightning protection equipment so that strikes would be conducted from the nacelle down the tower into the earth.

2.8 Conclusion

2.8.1 This chapter has set out a description of the Proposed Development and provided details of the activities that would be undertaken throughout the construction, operation and decommissioning phases of the Proposed Development.

2.8.2 There is sufficient detail to provide consultees with a reasonable understanding of the Proposed Development and to assess its likely significant environmental effects. Further construction details would be provided in the CEMP, which would be submitted for approval prior to the construction of the Proposed Development.

3 Design Evolution and Alternatives

3.1 Introduction

3.1.1 This Chapter provides a description of the site selection process and design strategies that were adopted in arriving at the final design of the Proposed Development described in Chapter 2: Proposed Development of this EIAR. Firstly, the site selection process is described. Thereafter, general design principles adopted by the Applicant and the design objectives for the Proposed Development are outlined. Finally, an overview of the evolution of the turbine layout of the Proposed Development is given, including references to identified/adopted design constraints that include details of the further refinements made to the turbine layout between conception and this application.

3.1.2 The Proposed Development Area is shown in Figure 1.2.

3.2 Site Selection and Alternatives

Alternative Sites

3.2.1 The Applicant maintains sophisticated Geographic Information System (GIS) models for site selection which seek to mirror planning, environmental, technical and commercial requirements. Previously, the Applicant undertook a computer-based analysis to establish wind farm site suitability across Scotland. Use of GIS technology enabled objective and consistent treatment of the whole country and this work has since been updated regularly when new data has become available or other factors have changed. Where available and appropriate, the GIS model incorporates published advice from statutory consultees.

3.2.2 The Applicant's GIS model is based upon a combination of generalised and graded suitability assessments covering environmental, visual, economic and technical aspects. In addition, a number of filters are applied which remove sites likely to conflict with residential amenity, consider landscape character and anticipate possible incompatibility with radar and air traffic control interests. All layers are assessed using a 0% – 100% suitability scale, represented by a 0 – 1 score, where 0 represents unsuitable and 1 represents 100% suitability.

3.2.3 The key factors included in the GIS modelling are listed in the following sub-sections.

Landscape, Natural & Built Heritage

3.2.4 Scottish Planning Policy (SPP) was first introduced by the Scottish Government in June 2014 alongside NPF3. A revised version of SPP was published in 2020. SPP states that its purpose 'is to set out national planning polices which reflect Scottish Ministers' priorities for operation of the planning system and for the development and use of land' (Scottish Government, 2020).

3.2.5 The subject policies contained in SPP mirrors the structure of the NPF3 and are set out under the following headings:

- A Successful, Sustainable Place;
- A Low Carbon Place;
- A Natural, Resilient Place; and
- A Connected Place.

3.2.6 The narrative and policies under the Low Carbon Place heading are of most relevance to the Proposed Development, as this section contains commentary relating to renewable energy matters in general and in relation to onshore wind in particular.

3.2.7 In order to achieve this, paragraph 155 states that Development Plans 'should seek to ensure an area's full potential for electricity and heat from renewable sources is achieved, in line with national climate change targets, giving due regard to relevant environmental, community and cumulative impact considerations'.

3.2.8 In relation to onshore wind, SPP Table 1 'Spatial Frameworks', provides locational guidance for onshore wind developments, as follows:

- Group 1: Areas where wind farms will not be acceptable (National Parks and National Scenic Areas);
- Group 2: Areas of Significant Protection (National and international designations, other nationally important mapped environment interests including areas of wild land) and a 2 km community separation distance for consideration of visual impact; and
- Group 3: Areas with potential for wind farm development.

3.2.9 The eastern portion of the Proposed Development Area falls predominantly within SPP Group 2 on account of its proximity to the defined settlement boundaries for both Patna and Waterside. The western portion is located mostly in a Group 3 area with pockets of Group 2 owing to the mapped presence of carbon rich soils/deep peat. These were taken into account in the design process and avoided as much as possible (see EIAR Figure 9.2 for example). Those parts of the site which fall within

Group 2 due to the strategic identification of carbon rich soils have been found after further assessment not to be carbon rich soils.

3.2.10 Paragraph 169 stipulates that proposals for energy infrastructure should always take into account spatial frameworks for wind farms, where relevant. The same paragraph sets out a range of development management criteria for the consideration of energy infrastructure proposals including socio-economic impacts, scale of contribution to renewable energy targets, cumulative impacts, and many technical and environmental impacts to be considered, for example, landscape, historic environment and natural heritage. These issues are considered in greater depth in the Planning Statement, which accompanies this EIAR.

3.2.11 According to their sensitivity, and in keeping with NatureScot guidance, International and Natura 2000 designations are scored 0 and the areas are removed from further consideration. Other designations are scored above 0 as appropriate. Layers are multiplied together so that multiple designations in one location results in a downgraded score (e.g., two overlapping areas both scoring 0.5 results in a score of 0.25).

Economics

3.2.12 The wind speed is assessed as appropriate for wind energy generation and the Proposed Development Area is accessible.

Visual Significance

3.2.13 The general significance of wind farm visibility is assessed focusing on transport corridors and residential areas, taking due account of diminishing impact with distance.

Proximity to Housing

3.2.14 The GIS tool uses a housing density layer, buffered by 1050 m, to remove from consideration all but the lowest density housing. Based on the turbine layout for the Proposed Development, as shown in Figure 1.3, the nearest turbine to the nearest inhabited house is 1194 m. Further information on distances between the Proposed Development and houses is described in Chapter 13

3.2.15 **Note:** a new housing development of 138 houses has been approved in Patna, East Ayrshire. At the time of writing the construction has not been initiated however early assessments have considered impact, where possible, with information currently available.

Combined Score

3.2.16 Having scored with medium to excellent preferability on all inputs, the combination of the scored layers results in a good score for the Proposed Development. Figure 3.5 shows the site selection results. Warmer colours from orange, yellow through to green represent suitability for wind farm development whereas areas of no colour are less suitable. Figure 3.5 shows that the Proposed Development Area scores a maximum suitability score of 90%< and is therefore considered to be capable of accommodating a wind farm development.

Aviation & Radar

3.2.17 A complex layer showing the location of radar line of sight and other aviation considerations was created. This aviation and radar data is included in the GIS for information, but not scored and combined into the results See Chapter 15: Aviation, Safety and Other Issues of this EIAR for more information regarding effects on aviation.

3.2.18 Finally, for each site area, a visual sweep of the following informative, non-constraining GIS layers was made and those which impinged on the Proposed Development were noted:

- MOD Tactical Training Areas;
- electromagnetic links and utilities;
- location of existing wind farm sites (pre-planning, consented and operational); and
- other information gleaned from maps or knowledge of the area such as masts, undesignated parks, tourist attractions, etc).

3.2.19 Having identified the development potential of the hills to the south and west of Patna the Applicant undertook a number of detailed assessments which in turn informed the scale and design of the Proposed Development. During the course of these assessment the design of the Proposed Development evolved and eventually came to be consolidated within the Proposed Development Area.

3.2.20 Based on the above analysis, and bearing in mind that the Proposed Development Area was subject to a previous application for wind energy development by the Applicant in 2013, which will be referred to throughout this document as Keirs Hill Wind Farm application. This was refused at Public Local Inquiry (PLI) however, the reporter concluded that ‘the site is a suitable one for a wind farm development’, it is considered that the Proposed Development Area remains suitable for a commercial scale wind farm.

3.2.21 The ongoing climate emergency and commitment to reduce emissions, add further justification for progressing the Proposed Development.

Do Nothing Alternative

3.2.22 The science behind climate change is clear that we urgently need reduce our reliance on fossil fuels in order to prevent adverse economic, environmental and social effects. Since the Keirs Hill Wind Farm application was refused, international and European commitments to reducing CO2 and tackling climate change have been made by all major economies. The UK has made significant, legally binding commitments to reduce emissions.

3.2.23 As recently as May 2019 the Scottish Government announced its intention to set a legally binding goal to achieve net-zero greenhouse gas emission by 2045. To help meet this goal, the Scottish Government's ambition is to secure an additional 8- 12 GW of installed onshore wind capacity by 2030.[1] In response, both East Ayrshire and South Ayrshire councils have developed strategies to reduce greenhouse gas emissions and improving, protecting and enhancing the local environments.

3.2.24 Should the Proposed Development as described in Chapter 2: Proposed Development not be consented, it is anticipated that the Proposed Development Area will not alter from the current baseline described above and in this EIAR. Furthermore, then the environmental benefits associated with the Proposed Development would not be realised and the land would continue to be used for its current purposes of commercial forestry and rough grazing.

3.3 General Principles of Wind Farm Design

3.3.1 There are a number of ways in which a wind farm can be designed, but all approaches involve balancing the potentially conflicting interests of:

- technological/economic requirements (high energy production from the turbines and low inter-turbine distortion of the wind flow);
- landscape character and visual amenity; and
- constraints concerning natural and built heritage such as ecological, hydrological and archaeological interests; and utility services such as pipelines and microwave links.

3.3.2 The level of weight that should be attached to each element is a site-dependent consideration. This results in different design approaches and strategies. Typical design approaches include:

- establishing and mapping constraints related to the natural and built heritage, developing a turbine layout that best satisfies technological/economic requirements and thereafter adjusting the design to improve visual appearance (this is the traditional wind farm design approach that was almost universally adopted until recently, and is still appropriate for more remote wind farms);
- adopting a specific design strategy that addresses aesthetic and functionality targets and thereafter identifying whether the impacts on other non-visual environmental interests are sufficiently severe to warrant compromising the visual design (this is an approach advocated by Architecture and Design Scotland; it is an approach that lends itself to locations where the wind farm would be highly visible). In establishing this design strategy guidance contained in the Siting and Designing Wind Farms in the landscape, Version 1 (Scottish Natural Heritage (SNH), December 2009) was referred to; and
- establishing and mapping natural and built heritage constraints as per the first approach, but then developing a turbine layout which achieves visual balance and harmony from key viewpoints, thereafter, only altering the turbine layout if essential engineering requirements are compromised (this approach lends itself well to wind farms in the worked and working rural environment where they may become a feature of everyday life for the local population).

3.3.3 For the Proposed Development, the third of the above design approaches was selected with particular consideration given to the effects on sensitive landscape and visual receptors within the adjacent Doon Valley to the east and Girvan Valley to the west. These receptors included the nearby communities of Patna, Waterside and Straiton.

3.3.4 Therefore, key focuses during the design of the Proposed Development were;

- maintaining a set back from the edge of the Doon Valley, to limit visibility of the Proposed Development from communities within the valley;
- retaining separation of the Proposed Development from the Girvan Valley, to limit visibility from Straiton;
- retain the separation of the Proposed Development from the designed gardens and landscapes at Craigengillan and Blairquhan, as per Keirs Hill Wind Farm application; and
- limiting the visibility of the Proposed Development from the Scottish Dark Skies Observatory and Galloway Dark Sky Park located to the south.

[1] https://www.gov.scot/publications/onshore-wind-policy-statement-refresh-2021-consultative-draft/

3.3.5 Buffer distances were applied to natural watercourses and areas of standing water, protected species recorded during the ecological surveys and archaeological features. The increased separation of the Proposed Development from the more ecological sensitive areas around Loch Spallander, a key constraint in the Keirs Hill Wind Farm application, was also maintained.

3.4 Development Considerations

Context of the Proposed Development Area

3.4.1 The closest settlement to the Proposed Development is the village of Patna which is located 1 km to the north, Waterside is located 1.7 km to the east, Straiton 3.7 km to the southwest and Dalmellington 4.2 km to the southeast. The closest residential property is High Keirs Cottage, located 1194 m to the east of T9.

3.4.2 The Proposed Development Area comprises an area of approximately 1,000 hectares. The majority of this is a commercial forestry plantation with the remainder used as rough grazing. The River Doon runs parallel to the A713 across the eastern most part of the Proposed Development Area. Several other small watercourses and a number of field drains associated with the commercial forestry plantation run across the Proposed Development Area. Forestry operations are ongoing within the Proposed Development Area. The wider area is characterised by forest plantations, upland farming and both operational and historical industrial uses, particularly open cast coal mining.

Topography

3.4.3 The topography of the Proposed Development Area is typical of the surrounding area with gently rolling slopes. The Proposed Development Area is centred around Keirs Hill, however it is the adjacent Green Hill, at 306 m Above Ordnance Datum (AOD) that marks the highest point of the Proposed Development Area. The terrain is gently to moderately sloping, with slopes generally of less than 6°. The lowest point within the Proposed Development Area is at the site entrance directly off the A173 where the access track crosses the River Doon.

3.5 Design Evolution and Alternative Turbine Layouts

General Chronology of Design Development at Sclenteuch

Keirs Hill Wind Farm

3.5.1 As detailed above, a portion of the Proposed Development Area was subject to a previous application for wind energy development by the Applicant in 2013, Keirs Hill Wind Farm application.

3.5.2 The Keirs Hill Wind Farm application was for 17 turbines each up to 149 m to blade tip. The project was refused following a PLI in 2017, though the reporter concluded that *'the site is a suitable one for a wind farm development'*.

Stages of Design Development

3.5.3 With consideration to the conclusions of the PLI, known site data, up-to-date turbine technology and the design principles set out above, the final design of the Proposed Development was the result of several iterations:

- the feasibility stage - turbine layouts were developed that sought to improve upon the turbine layout included in the Keirs Hill Wind Farm application, whilst employing modern turbine sizes to maximise contribution of renewable energy from the Proposed Development Area. These turbine layouts underwent initial landscape and visual analysis;
- the scoping stage - limited details of the finer characteristics of the Proposed Development Area were known, but a notional turbine layout was a useful focus for discussions with consultees and interested parties;
- the project design stage - the baseline constraints were fully defined, and an informed design of the turbine layout could be undertaken; at this stage a clear design strategy could be selected; and
- the refinement stage - further refinement to the Proposed Development following ongoing site assessment work and consultation with statutory and non-statutory consultees before final optimisation of the layout taken forward to application.

Feasibility Stage

3.5.4 The layout of the Keirs Hill Wind Farm application is shown as 'Keirs Hill Wind Farm Layout (17 turbines)' in Figure 3.1.

3.5.5 Whilst the reporter found that site (included within the Proposed Development Area) was a suitable one for wind farm development, consent was refused due partly to the impacts of the turbine layout on views from the Doon Valley, including Waterside and Patna. The reporter attributed the adverse effect of Keirs Hill Wind Farm application to the height and proximity of the turbines to the Doon Valley.

3.5.6 Advances in turbine technology mean that larger, more efficient turbines are now being deployed and it is recognised that turbines will continue to increase in tip height and rotor diameter in order to maximise the generation of electricity. The dimensions of newer turbines are larger than the turbines proposed as part of the Keirs Hill Wind Farm application and their potential to generate electricity is much greater than those previously proposed. To ensure optimal capture of wind energy

and associated generation of electricity, spacing between turbines increases with turbine size usually leading to fewer, more productive turbines across any given site.

3.5.7 An initial landscape and visual analysis was undertaken by Land Use Consultants to review the landscape and visual baseline and provide advice on broad areas within the Proposed Development Area that would be capable of accommodating such larger turbines.

3.5.8 Based on this analysis and site constraints known at that stage, a sequence of three turbine layouts were produced for consideration and are shown in Figure 3.1:

- 'Feasibility Layout (14 turbines)' consisting of 14 turbines with a tip height of 150 m, a rotor diameter of 112 m and notional generator size of 3.45 MW;
- 'Feasibility Layout (12 turbines)' consisting of 12 turbines with a tip height of 200 m, a rotor diameter of 136 m and a notional generator size of 4.5 MW; and
- 'Scoping Layout (9 turbines)' consisting of 9 turbines with a tip height of 200 m , a rotor diameter of 150 m and a notional generator size of 6 MW.

3.5.9 Each of these layout iterations took cognisance of the reporter's conclusion in the PLI with respect to potential effects on views from Waterside and Patna, and refinements sought to balance the maximisation of electrical generation for the least environmental impact. As a result of these refinements, the 'Scoping Layout (9 turbines)' was selected as an appropriate layout to take forward into the scoping stage

Scoping Stage

3.5.10 This nine turbine layout was used to inform the Scoping Report submitted to the Energy Consents Unit (ECU) in August 2021. The Scoping Report sought comments on the suitability of this layout consisting of turbines with a tip height of up to 200 m, as shown on Figure 3.1.

3.5.11 Consultation responses were received from a range of stakeholders. The Scoping Opinion is provided in Technical Appendix 1.2.

Project Design Stage

3.5.12 Technical and environmental assessments were carried out to determine the current baseline environmental conditions within the Proposed Development Area. These included ornithology, geology, peat, hydrology, ecology, archaeology and cultural heritage. This information was collated and used to inform the siting of turbines.

3.5.13 During these assessments, it was discovered that some previous residential properties were no longer inhabited or in a habitable state. The residential property buffers were revised and suitable locations for two additional turbines were identified. The 'Pre-Design Freeze Layout (11 Turbines)' in Figure 3.1 shows the location of these additional turbines.

3.5.14 A review of the visual impacts from inclusion of these two turbines was carried out. Figures 3.3a & 3.3b present comparative wirelines for views from Waterside and Patna respectively. Comparing wirelines for 'Pre-Design Freeze Layout (11 Turbines)' against the wirelines for 'Scoping Layout (9 turbines)' it was apparent that the two additional turbines were closer to the edge of the Doon Valley. Ensuring turbines were set back from this valley edge had been a key focus for design development. This sought to limit visibility of the turbines from the communities of Patna and Waterside. The additional two turbines instead increased this visibility, and it was therefore decided that they should not be included.

Refinement Stage

3.5.15 A design chill workshop was held in November 2021 which was attended by the various technical, engineering and environmental specialists from the project team to refine the turbine layout.

3.5.16 Decisions made during the design chill workshop included;

- Moving turbines 1,2 and 5 out of watercourse buffers;
- Moving turbines 2,3,4,5 and 9 out of areas of deep peat;
- Moving turbines 8 and 9 to reduce visibility from the Doon Valley;

3.5.17 This workshop also included further landscape and visual analysis which concluded in the reduction of turbine tip height from 200 m to 180 m for turbines 5, 6, 7 and 9. The purpose of this tip height reduction was to further limit the visibility of turbines from the Doon Valley. By reducing tip heights of the closer turbines, their relative scale is reduced, thereby improving the appearance of the Proposed Development from the Doon Valley.

3.5.18 Following the design chill of the Proposed Development, further site surveys, focussed on the area covered by and adjacent to Proposed Development, were carried out to provide additional detail to the combined constraints drawing. Taking cognisance of the combined constraints and proposed turbine tip heights as discussed above, a turbine layout optimisation was carried out using software developed by the Applicant. This iterative micro siting of each individual turbine presents the most efficient turbine layout with respect to electricity generation.

3.5.19 Following this refinement and a final site visit, a design freeze meeting was held internally by the Applicant. This resulted in the design freeze layout being issued in January 2022 to the project team for assessment. 'Design Freeze Layout (9

turbines)' as shown on Figure 3.1 presents this layout developed during the refinement stage. Wirelines from Waterside and Patna for the 'Design Freeze Layout (9 turbines)' are also presented on Figures 3.3a and 3.3b which clearly demonstrate the improvements made during the design development from the Scoping Stage through to the Refinement Stage. Figure 3.2 presents the combined constraints and the Proposed Development with respect to the 'Design Freeze Layout (9 turbines)' layout.

3.5.20 As mentioned above in paragraph 3.5.6, the reporter attributed the adverse effect of Keirs Hill Wind Farm to the height and proximity of the turbines to the Doon Valley. Although the Proposed Development includes larger turbines than those proposed for Keirs Hill Wind Farm, careful consideration has been given to limiting the apparent scale of the turbines in views from the Doon Valley. Turbines have been located further west, away from the edge of the Doon Valley, and from the settlements of Patna and Waterside, while at the same time having regard to views from the Girvan Valley.

3.5.21 As a result, while the Proposed Development will still be visible from the Doon Valley, the turbines will be fewer in number, will be set lower on the skyline, and will occupy a smaller angle of view, than that predicted within the Keirs Hill Wind Farm application. This is clearly presented in Figure 3.4a and 3.4b and forms the Proposed Development to be assessed in this EIA.

On-site Infrastructure

3.5.22 As described in Chapter 2: Proposed Development, the permanent infrastructure consists of the following elements: wind turbines and foundations, crane hardstands, on-site access tracks including water crossings, a substation compound including a communications mast and a battery energy storage system compound.

3.5.23 While turbine location is a key consideration, refinement of the design needs to take consideration of the locations of required infrastructure surrounding the turbines. As such some turbine locations are dictated by environmental constraints pertaining not only to the turbine but also the adjacent crane hardstand and access track.

3.5.24 The Proposed Development was the result of extensive design work, to sensitively locate the infrastructure required to facilitate construction and operation of the turbines. Potential construction and operational hazards were mitigated through Designer's Risk Assessment.

3.5.25 The following design principles have been adhered to when designing the infrastructure:

- minimisation of conflict with ecological, ornithological, geological, hydrological and archaeological constraints where possible;
- minimisation of track lengths;
- adoption of existing track where practicable;
- adoption of floating tracks to minimise disturbance of peat where appropriate;
- minimisation of cut and fill through appropriate routing of infrastructure;
- minimisation of forestry felling by locating infrastructure in areas of existing open ground;
- avoidance or minimisation of water crossings; and
- inclusion of engineering considerations and turbine manufacturer requirements.

3.5.26 The use of fewer, larger, more efficient turbines has allowed for a reduction in the proposed permanent land take from infrastructure in comparison to the Keirs Hill Wind Farm application as follows:

- The Proposed Development comprises approximately 2.6 km less access track, not including 3.5 km of existing track upgrade included in the Proposed Development. Assuming a 5 m width this represents a 13,000 m^2 reduction in permanent land take.
- The Proposed Development proposes eight fewer crane hardstands and turbine foundations (including the maintenance track surrounding the turbine foundation). The size of foundation and hardstand required for the Proposed Development are larger however this reduction in number presents approximately 3,750 m^2 reduction in permanent land take.

3.6 Summary

3.6.1 The Proposed Development:

- reduces the scale and extent of the Proposed Development in views from the Doon Valley, in comparison to Keirs Hill Wind Farm;
- maintains the limited visibility of the Proposed Development from the Girvan Valley, including the designed gardens and landscape at Blairquhan, as per Keirs Hill Wind Farm Application;
- maintains an increased separation of the development from the more ecological sensitive areas around Loch Spallander, as dictated in Keirs Hill application;
- will incorporate replanting of the felled forestry into the Proposed Development Area which will provide opportunities for habitat enhancement and some screening of the Proposed Development from closer viewpoints;
- limits visibility of the Proposed Development from Craigengillan Estate to the south; and

- limits visibility of the Proposed Development from the Scottish Dark Skies Observatory and Galloway Dark Sky Park located to the south.
- maintains the residential visual amenity enjoyed by the individual dwellings assessed in (see EIAR Technical Appendix 5.4), in comparison to Keirs Hill Wind Farm;
- increases the separation distance between the proposed wind turbines and the designated assets of cultural heritage significance at Waterside, thereby minimising the impacts on their settings, in comparison to Keirs Hill Wind Farm (See Chapter 6: Cultural Heritage)

3.6.2 Since the Keirs Hill Wind Farm application was refused, international and European commitments to reducing CO2 and tackling climate change have been made by all major economies. In response to these issues the UK has made significant, legally binding commitments to increase the use of renewable energy.

3.6.3 The Proposed Development relates directly to the need of those commitments. It addresses the key concerns raised in the reporters' report, following the PLI of the Keirs Hill Wind Farm application, notably landscape and visual impact, residential amenity, historic sites (e.g. the Waterside Ironworks, see Chapter 6: Cultural Heritage).

3.6.4 The final nine turbine layout is shown in Figure 1.3. Based on 6MW wind turbines, the Proposed Development would produce sufficient electrical energy to satisfy the average annual requirements of approximately 6,796 homes[2].

3.6.5 The Proposed Development Area scores a maximum of 1.0 within the Applicant's site searching model and is therefore considered to have the potential to accommodate a wind farm.

3.6.6 The Proposed Development has been informed by a robust design evolution process, takin into account environmental, technical and engineering considerations.

3.6.7 The design aim has been to minimise landscape and visual effects whilst achieving an appropriate landscape fit, and avoiding areas constrained by other environmental considerations such as ecology, ornithology, geology, hydrology and archaeology.

3.6.8 Nine turbines are proposed with a tip height to a maximum of 200 m.

3.6.9 The turbine height will allow for the replanting of the commercial forestry plantation across the majority of the Proposed Development Area.

3.6.10 The use of fewer, more efficient turbines has allowed for a reduction in the proposed permanent land take from infrastructure in comparison to the Keirs Hill Wind Farm application while also maximising electrical generation.

3.6.11 Ancillary infrastructure, both permanent and temporary, has been carefully sited to respect logistical, economic, visual and other environmental sensitivities.

[2] Based on the annual average homes consumption figures from BEIS -National Energy Efficiency Data-Framework (NEED) 2021; figures may vary depending on final model chosen.

4 Approach to EIA/Climate Change, Legislative and Policy Context

4.1 Introduction

4.1.1 This chapter of the Environmental Impact Assessment Report (EIAR) describes the legislative and policy background relevant to the Proposed Development. It refers to energy and planning policy at a national and local level. This chapter does not include an assessment of the accordance of the Proposed Development with reference to planning policy: a separate Planning Statement has been prepared to support the application and should be referred to for a detailed planning policy appraisal.

4.1.2 This chapter has been written by Simon Herriot MRTPI, Director at Savills. Simon has 25 years' experience of planning and development matters and is a specialist in renewables and onshore wind planning.

4.2 Legislative Framework

The Electricity Act 1989

4.2.1 Section 36 of the Electricity Act 1989 (the Electricity Act) (HM Government, 1989)[1] provides that a generating station with a capacity in excess of 50 MW shall not be constructed, extended or operated except in accordance with a consent granted by the Scottish Ministers.

4.2.2 Paragraph 3(2) of Schedule 9 of the Electricity Act requires the Scottish Ministers, in considering any relevant proposals for which their consent is required under Section 36, to have regard to:

- the desirability of the matters mentioned in paragraph 3(1)(a) of the Schedule; and
- the extent to which the person by whom the proposals were formulated has complied with his duty.

4.2.3 The matters mentioned in paragraph 3(1)(a) are: the desirability of preserving natural beauty, conserving flora, fauna and geological or physiographical features of special interest and of protecting sites, buildings and objects of architectural, historical or archaeological interest.

4.2.4 The duty under paragraph 3(1)(b) requires the person who formulated the proposals to do what he reasonably can to mitigate any effect that the proposals would have on the natural beauty of the countryside or on any such flora, fauna, features, sites, buildings or objects. Sub-paragraph 1 can be relevant to the applicant if they hold a Licence at the date a Section 36 application is made.

4.2.5 Paragraph 3(3) of Schedule 9 stipulates a further requirement to seek to avoid as far as possible, causing injuries to fisheries or to the stock of fish in any waters.

4.2.6 The Electricity Act does not say that these are the only matters to be taken into account. Scottish Ministers will take into account other matters which are material to their decision. These will include: national energy policy, national and local planning policy as well as the full scope of the environmental information submitted with the application.

The Town and Country Planning (Scotland) Act 1997

4.2.7 Primary planning legislation in Scotland is the Town and Country Planning Act (Scotland) 1997 (the Planning 1997 Act) (Scottish Government, 1997)[2] as amended by the Planning etc. (Scotland) Act 2006 (Scottish Government, 2006)[3] and the Planning (Scotland) Act 2019 (Scottish Government, 2019)[4].

4.2.8 Section 57 of the Planning 1997 Act addresses development with government authorisation. Section 57(2) states that:

'On granting or varying a consent under section 36 or 37 of the Electricity Act 1989, the Scottish Ministers may give a direction for planning permission to be deemed to be granted, subject to such conditions (if any) as may be specified in the direction, for - (a) so much of the operation or change of use to which the consent relates as constitutes development; (b) any development ancillary to the operational change of use to which the consent relates'.

The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017

4.2.9 The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (the EIA Regulations) (Scottish Government, 2017)[5] require that all applications

[1] https://www.legislation.gov.uk/ukpga/1989/29/contents
[2] https://www.legislation.gov.uk/ukpga/1997/8/contents
[3] https://www.legislation.gov.uk/asp/2006/17/contents
[4] https://www.legislation.gov.uk/asp/2019/13/contents/enacted
[5] https://www.legislation.gov.uk/ssi/2017/101/contents/made

for Section 36 consent considered likely to have significant effects on the environment must be subject to an Environmental Impact Assessment (EIA) and the applicant must submit an EIAR.

4.2.10 Schedule 1 of the EIA Regulations lists types of development for which EIA is mandatory, whilst Schedule 2 highlights the types of development for which the need for EIA is judged by the Scottish Ministers on a case-by-case basis. The Proposed Development falls within the definition of Schedule 2 development.

4.2.11 The Applicant has considered the Proposed Development in light of Schedule 2 of the EIA Regulations, and has concluded that, due to its nature, size and location, it has the potential to cause significant environmental effects. Therefore, there is a requirement for an EIA to be undertaken and an EIAR to be submitted in support of the application.

4.3 International Climate Change and Energy Policy

4.3.1 As of 31 January 2020, the UK ceased being a member of the European Union (EU). A transitional period was in place until the end of 2020, during which time the UK remained bound by EU rules, including the renewable targets noted in the following paragraphs. Following the end of the transitional period, Section 2 of the European Union (Withdrawal) Act 2018[6] (as amended) provides that all EU derived domestic legislation continues to have effect after exit day.

4.3.2 EU energy legislation and policy, like that in the UK, is driven by international co-operation to cut the emission of greenhouse gas emissions, as a means of combating climate change. This includes the 'Paris Agreement' (United Nations, 2015)[7], established through the 21st session of the Conference of Parties ('COP 21'). Ratified in the UK on 17 November 2016, the Paris Agreement sets out the ambition of holding the increase of global average temperature to *'well below 2°C'* and pursuing efforts to limit temperature increase to 1.5°C. The COP26 'Glasgow Climate Pact'[8] published in 2021 reaffirms the Paris Agreement temperature goal of holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels.

4.3.3 The United Nations Emissions Gap Report 2021 entitled 'The Heat is On: A World of Climate Promises Not Yet Delivered'[9] is the twelfth in a series of reports comparing where greenhouse gas emissions are heading, against where they need to be and highlighting the ways to close the gap. This latest report shows that new national climate pledges combined with other mitigation measures put the world on track for a global temperature rise of 2.7°C by the end of the century. That is well above the goals of the Paris Agreement and the Glasgow Climate Pact and would lead to catastrophic changes in the Earth's climate. To keep global warming below 1.5°C this century, the aspirational goal of the Paris Agreement, this report states that the world needs to halve annual greenhouse gas emissions in the next eight years.

4.4 UK Climate Change and Energy Policy

4.4.1 Energy policy in Scotland is a matter that is reserved to the UK Parliament. However, as the following Section notes, the Scottish Government has published several of its own energy policy and strategy documents that apply to Scotland only and these are material to the determination of this application.

Climate Change Act 2008

4.4.2 The Climate Change Act became law on 26 November 2008 and introduced a legally binding target for the UK to reduce CO_2 emissions by at least 80% by 2050, relative to 1990 levels.

4.4.3 In June 2019, the UK Government passed the draft Climate Change Act 2008 (2050 Target Amendment) Order 2019[10] to amend the Climate Change Act 2008, by introducing a target for at least a 100% reduction of greenhouse gas emissions in the UK, compared to 1990 levels. This Order follows on from the recommendations presented by the Committee on Climate Change (CCC) publication 'Net Zero, The UKs contribution to stopping global warming'[11].

4.4.4 Efforts to reduce greenhouse gas emissions in Scotland would contribute to achievement of UK wide targets, as well as meeting Scotland specific targets as discussed below.

British Energy Security Strategy – Secure, clean and affordable British energy for the long term

4.4.5 In April 2022 the UK Government published the above Strategy[12], primarily in response to rising global energy prices and following the Russian invasion of Ukraine.

[6] http://www.legislation.gov.uk/ukpga/2018/16/contents/enacted
[7] https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement
[8] https://unfccc.int/process-and-meetings/the-paris-agreement/the-glasgow-climate-pact-key-outcomes-from-cop26
[9] https://www.unep.org/resources/emissions-gap-report-2021
[10] https://www.legislation.gov.uk/ukdsi/2019/9780111187654
[11] https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/
[12] https://www.gov.uk/government/publications/british-energy-security-strategy/british-energy-security-strategy

A key aim of the Strategy is to reduce our dependence on imported oil and gas and to help decarbonise the energy sector, achieving net zero by 2050.

4.4.6 The Introduction notes that *'the transition away from oil and gas then depends critically on how quickly we can roll out new renewables'*. It continues and notes that *'the growing proportion of our electricity coming from renewables reduces our exposure to volatile fuel markets'*.

4.4.7 The Strategy discusses a range of technologies including offshore and onshore wind, solar, hydrogen and nuclear. It recognises that *'onshore wind is one of the cheapest forms of renewable power'* and that there is a *'strong pipeline of future projects in Scotland'*. While there is a strong focus in the Strategy on new nuclear and the continued expansion of offshore wind, the report recognises that *'…we need to be bolder in removing the red tape that holds back new clean energy developments and exploit the potential of all renewable technologies'* (underlining added).

Energy Security Bill

4.4.8 The Energy Security Bill13, introduced to Parliament on 6 July 2022, seeks to deliver a cleaner, more affordable, and more secure energy system. Including 26 measures, the Bill is expected to bring £100 billion in private sector investment into diversifying the UK's energy mix by 2030.

4.4.9 Growing renewable markets is a key focus, with an expectation that close to 480,000 new jobs will be created by the legislation.

4.4.10 In a push to reduce the UK's dependence on volatile fossil fuel markets and gas prices, the Bill seeks to improve domestic energy production and make the country more self-sufficient when it comes to the energy it uses.

4.4.11 Announcing the Bill, Business Secretary Kwasi Kwarteng said, *'this is the biggest reform of our energy system in a decade'* and, *'the measures in the Energy Security Bill will allow us to stand on our own two feet again, reindustrialise our economy and protect the British people from eye-watering fossil fuel prices into the future'*.

Committee on Climate Change – The Sixth Carbon Budget, The UK's Path to Net Zero

4.4.12 In December 2020 the CCC published 'The Sixth Carbon Budget'[14] which comprises three documents: 'The UK's Path to Net Zero'; 'Methodology Report'; and 'Policies for the Sixth Carbon Budget and Net Zero'. The 2020 CCC Report describes what the potential path options to net-zero look like and what steps must be taken to achieve this. A key recommendation of the Report is that the UK Government requires a reduction in UK greenhouse gas emissions of 78% by 2035 relative to 1990 and that this should be coupled with a pledge by 2030 to reduce emissions by at least 68% from 1990 levels.

4.4.13 The Foreword by Lord Deben highlights the importance of taking decisive action in the 2020s, noting that if efforts are not scaled up in this *'decisive decade'* then the UK will not deliver net zero by 2050. The Foreword notes that that *'utmost focus is required from government over the next ten years'* and that policy now needs to be *'scaled up across every sector'* to deliver net-zero.

4.4.14 The Report recognises that reducing emissions from electricity generation to near-zero will require significant expansion of low-carbon generation. Emphasis is also placed on the increasing demand for electricity through the electrification of the economy. Wind power is highlighted in the 2020 Report as the backbone of renewable energy production, stating that the deployment of 3 Gigawatts (GW) per year of new wind capacity is required, plus repowering of existing sites.

Progress in reducing emissions and Progress in adapting to climate change – 2021 Progress Reports to Parliament

4.4.15 The above reports were published in June 2021 (Committee on Climate Change, June 2021) by the CCC[15]. The Executive Summaries within the respective reports state that, *'in assessing the UK's progress in the last year, we acknowledge the increase in the scale of Government's efforts. But progress is not yet in step with the urgency of the challenge'* and, *'climate change impacts are increasing, but the UK Government's National Adaptation Programme has not delivered the necessary improved resilience to the changing climate as was intended under the UK Climate Change Act.'*

4.4.16 The 'Progress in reducing emissions report' also states that *'projections for renewable deployment are being revised upwards, but investment needs to scale up faster. More than 80% of new electricity capacity added in 2020 came from renewable sources. The International Energy Agency (IEA) recently increased their forecast for capacity installations for wind and solar electricity generation over the coming years by around 40% relative to a year ago'*.

[13] https://www.gov.uk/government/collections/energy-security-bill#:~:text=The%20Energy%20Security%20Bill%2C%20introduced,Energy%20Security%20Bill

[14] https://www.theccc.org.uk/publication/sixth-carbon-budget/

[15] https://www.theccc.org.uk/publication/2021-progress-report-to-parliament/

Energy White Paper – Powering our Net Zero Future

4.4.17 The UK Government published the above paper in December 2020 (HM Government, 2020)[16] which sets out the approach to be taken to tackling the challenge of climate change. Recognising the world-leading UK net-zero target, the Foreword states that this will require decisive global action and significant investment to open up opportunities for economic growth and job creation.

4.4.18 The various actions set out in the White Paper are described as *'a strong signal to project developers and the wider investor community about the government's commitment to delivering clean electricity'*. In the Section 'Our Key Commitments', the White Paper notes that *'onshore wind and solar will be key building blocks for the future generation mix, along with offshore wind'*. The White Paper continues and states that *'we will need sustained growth in the capacity of these sectors in the next decade to ensure that we are on a pathway that allows us to meet net-zero emissions in all demand scenarios'*.

4.4.19 The White Paper further underlines the need for fast and decisive action on climate change and confirms the important role that the continued development of renewable energy generation projects will play in delivering net zero.

4.5 Scottish Climate Change and Energy Policy

4.5.1 Like the UK Government, Scotland too has legislated to achieve net-zero carbon emissions. In October 2019, The Climate Change (Emissions Reduction Targets) (Scotland) Bill received Royal Assent. The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 builds on a number of energy policy documents that recognise the Scottish Governments commitment to tackling climate change and promoting the growth of renewable energy. The Scottish Government has published a number of climate change and energy policy documents and its own targets. The most relevant Scottish publications include:

- The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019[17];
- The Climate Change (Scotland) Act 2009[18];
- The Scottish Government's 'Programme for Scotland 2021-2022: A Fairer, Greener Scotland' (2021)[19];
- The 'Progress in Reducing Emissions in Scotland 2021 Report to Parliament' (Committee on Climate Change, October 2021)[20];
- The Scottish Climate Change Plan (February, 2018)[21];
- Climate Change Monitoring Report 2021[22];
- Update to the Climate Change Plan 2018 – 2032: Securing a Green Recovery on a Path to Net Zero (December, 2020)[23];
- The Scottish Energy Strategy (December, 2017)[24];
- Scotland's Energy Strategy Position Statement (2021)[25];
- The Onshore Wind Policy Statement (December, 2017)[26]; and
- The 'Onshore Wind Policy Statement Refresh 2021: Consultative Draft' (2021)[27].

Climate Change (Emissions Reduction Targets) (Scotland) Act (2019)

4.5.2 The Climate Change (Emissions Reduction Targets) Act 2019 (Climate Change Act 2019) amends the Climate Change (Scotland) Act 2009 and sets a target date of 2045 for reaching net-zero greenhouse gas emissions. The Climate Change Act 2019 also states that the Scottish Ministers must ensure that the net Scottish emissions account for the year (with 1990 being the baseline year):

- 2020 is at least 56% lower than the baseline;
- 2030 is at least 75% lower than the baseline; and
- 2040 is at least 90% lower than the baseline.

4.5.3 It is important to note that these targets are minimum targets, they are not maximums or aspirations. The targets legally bind the Scottish Ministers and have largely been legislated to set the framework for Scotland's response to the climate emergency.

The Scottish Government's 'Programme for Scotland 2021-2022 'A Fairer, Greener Scotland'

4.5.4 On 7th September 2021, the Scottish Government published its 'Programme for Scotland 2021-2022: A Fairer, Greener Scotland.' The Programme was introduced amidst the ongoing process to lead the country out of the COVID-19 pandemic and much of the focus of the Programme is on the response to the challenges presented by this. The Introduction from the First Minister within the Programme states that,

[16] https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future
[17] https://www.legislation.gov.uk/asp/2019/15/enacted
[18] https://www.legislation.gov.uk/asp/2009/12/contents
[19] https://www.gov.scot/publications/fairer-greener-scotland-programme-government-2021-22/
[20] https://www.theccc.org.uk/publication/progress-reducing-emissions-in-scotland-2021-report-to-parliament/
[21] https://www.gov.scot/publications/scottish-governments-climate-change-plan-third-report-proposals-policies-2018/
[22] https://www.gov.scot/publications/climate-change-plan-monitoring-reports-2021-compendium/
[23] https://www.gov.scot/publications/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/
[24] https://www.gov.scot/publications/scottish-energy-strategy-future-energy-scotland-9781788515276/
[25] https://www.gov.scot/publications/scotlands-energy-strategy-position-statement/
[26] https://www.gov.scot/publications/onshore-wind-policy-statement-9781788515283/
[27] https://www.gov.scot/publications/onshore-wind-policy-statement-refresh-2021-consultative-draft/

'In the year of COP26 – being hosted in our great city of Glasgow – we will rise to the other global challenge we face, taking the necessary action to stem climate change. We will do so in a way which ensures we grasp the opportunities to put a net-zero Scotland at the heart of our economic prosperity.'

4.5.5 The Programme goes on to state that the Scottish Government is committed to securing between 8 and 12 GW of installed onshore wind by 2030, recognising the vital role that this technology has to play in delivery the net zero commitment. The Programme also confirms that Scotland is leading the way in new forms of clean energy and states that in 2020 almost 100% of gross electricity consumption came from renewable sources. The Scottish Government's aim is that by 2030 50% of Scotland's overall energy consumption will come from renewable sources, which will pave the way for decarbonising the country's energy system almost completely by 2050. The Programme recognises that '*development of renewable energy presents an immense opportunity for Scotland to lead by example – showing how a clean energy future is possible at home, and as a net exporter of renewable energy, attracting further investment and ensuring our progress to net zero is environmentally and economically beneficial'* (page 64).

4.5.6 As well as focussing on the delivery of net zero in relation to tackling climate change, the Programme also recognises the importance of renewable energy to the economic recovery post-COVID. '*A just transition to net zero requires a robust, diversified economy where businesses can make investments with confidence – domestically and globally – and will ensure Scotland is a world-leader, showcasing our strengths including in green and renewable technologies. That isn't just a moral obligation in meeting our ambitious targets to end Scotland's contribution to climate change, it is an economic opportunity to be grasped: benefiting businesses by leveraging public and private sector finance to create new markets and business opportunities, and benefiting people by protecting existing jobs, and creating new skills, training and employment opportunities'* (Page 78).

Progress in reducing emissions in Scotland – 2021 Progress Report to the Scottish Parliament (2021)

4.5.7 Published on 7th December 2021, the 2021 Progress Report to the Scottish Parliament (Committee on Climate Change, December 2021) assesses Scotland's overall progress in achieving its legislated targets to reduce greenhouse gas emissions. This is the tenth annual Progress Report to the Scottish Parliament as required by the Climate Change (Scotland) Act 2009. This latest report shows that, in 2019, Scotland's greenhouse gas emissions fell by 2% compared to 2018, and are now 44% below 1990 levels. The reductions were largely driven by the manufacturing and construction, and fuel supply sectors, with electricity generation remaining the biggest driver of emissions cuts over the past decade (2009-2019).

4.5.8 There are a number of key messages from this report including a recognition that the annual targets set for the 2020s will be very difficult to meet, even with strong climate policy support. Climate policy in Scotland must focus on the transition required to net zero in order to make rapid progress by 2030 and the focus must also be on implementation and delivery of real-world progress.

4.5.9 The report makes a number of recommendations including for the Scottish Government to '*set out an updated assessment of how much renewable and low-carbon electricity generation will be required to meet Net Zero in Scotland and contribute cost-effectively to Net Zero in the UK, with a clear trajectory to 2045'*, as well as to '*complete the definition and enforcement of a planning and consenting scheme for onshore wind and other low carbon generation in a manner that is consistent with other policies on land use, supporting repowering and life extension of existing wind power in Scotland, and aligning with adaptation priorities under the Scottish Climate Change Adaptation Programme.'*

Climate Change Plan (2018) and Monitoring Report (2021)

4.5.10 The vision of the Climate Change Plan (Scottish Government, 2018) (CCP) sets out that *'by 2032, Scotland's electricity system will supply a growing share of Scotland's energy needs and by 2030, 50% of all Scotland's energy needs will come from renewables'*.

4.5.11 The CCP includes two specific policy outcomes in relation to electricity generation, as follows:

- Policy Outcome 1: From 2020 onwards, Scotland's electricity grid intensity will be below 50 grams of carbon dioxide per kilowatt hour. The system will be powered by a high penetration of renewables, aided by a range of flexible and responsive technologies; and
- Policy Outcome 2: Scotland's energy supply is secure and flexible, with a system robust against fluctuations and interruptions to supply.

4.5.12 Implementation indicators for Policy Outcomes 1 and 2 are:

- increase amount of electricity generated from renewable sources in Scotland;
- increase the installed capacity of sites generating electricity from renewable sources in Scotland. By 2030, it is expected that the installed capacity of renewable electricity generation sources will be between 12GW and 17GW;

- increase total community and locally owned renewable energy capacity operational, and in development, in Scotland;
- increase total renewable capacity in Scotland by planning stage; and
- increase the share of electricity generated from renewable sources, as a proportion of total electricity generated in Scotland.

4.5.13 The first Climate Change Plan Monitoring Report was published in May 2021. In terms of the electricity sector, it notes that it is on track to meet the outcomes set by the CCP, including a reduced CO_2 electricity grid intensity, an increase in the installed capacity of renewable generation and an increase in the capacity of renewable energy projects at the planning stages.

4.5.14 Against these positives however, the Monitoring Report notes that *'efforts to decarbonise the electricity sector will need to be stepped up in the face of Scotland's new Net Zero commitment, with sharp rise in capacity expected to be necessary in order to reach the target and to help drive decarbonisation across other sectors'*.

Update to the Climate Change Plan 2018-2032: Securing a Green Recovery on a Path to Net Zero

4.5.15 In December 2020, the 'Update to the Climate Change Plan 2018 – 2032: Securing a Green Recovery on the Path to Net Zero' (CCP Update) (Scottish Government, 2020) was published. Building on the policy outcomes identified in the 2018 CCP, the CCP Update sets the Scottish Government's legislative commitment to reducing emissions by 75% by 2030 (compared with 1990) and to net-zero by 2045 in the context of a post-COVID green recovery.

4.5.16 The CCP Update highlights that a key part of the green recovery is a co-ordinated approach across sectors. For example, the development of renewable energy supports the decarbonisation of numerous sectors, including industry and agriculture. The CCP Update emphasises the growth and success to date of Scotland's renewable energy generation as well as stating strongly the determination that this growth must continue. Page 78 states that '*planning has been, and will remain, a critical enabler of rapid renewables deployment in Scotland*'. Referring particularly to onshore wind generation, on page 84 it is noted that there is a motivation to reduce determination periods for applications so as to enable projects to be awarded consent to be developed more quickly.

Scottish Energy Strategy (2017)

4.5.17 In December 2017, the Scottish Energy Strategy (SES) (Scottish Government, 2017) was published by the Scottish Government alongside the then Draft CCP and the Onshore Wind Policy Statement.

4.5.18 A key goal within the SES is that Scotland will become a world leader in renewable and low carbon technologies and services. The SES sets out a target for Scotland to achieve almost complete decarbonisation of energy and sets a 2030 '*all energy*' target for the equivalent of 50% of Scotland's heat, transport and electricity consumption to be supplied from renewable sources. This vision is also included in the CCP (February, 2018), which is discussed above.

4.5.19 The SES sets out on page 35 *that 'Scottish Government analysis underpinning this target shows that renewable electricity – which has already outperformed our interim 2015 target of 50% – could rise to over 140% of Scottish electricity consumption, ensuring its contribution to the wider renewable energy target for 2030'*, and that *'this assumes a considerably higher market penetration of renewable electricity than today – requiring in the region of 17 GW of installed capacity in 2030 (compared to 9.5 GW in June 2017) – with greater interconnection with parts of continental Europe providing an expanded market for our electricity'*.

4.5.20 In general terms, onshore wind is also recognised as a key opportunity. The SES sets out that *'onshore wind is now amongst the lowest cost forms of power generation of any kind, and is a vital component of the huge industrial opportunity that renewables create for Scotland. The sector supports an estimated 7,500 jobs in Scotland, and generated more than £3 billion in turnover in 2015'*.

Scotland's Energy Strategy Position Statement (2021)

4.5.21 On 16th March 2021 the Scottish Government published its position statement in relation to the SES. The Energy Strategy Position Statement provides an overview of the key priorities for the short to medium-term in ensuring a green economic recovery, whilst remaining aligned to the net zero ambitions.

4.5.22 The Energy Strategy Position Statement confirms that Scotland continues to make excellent progress in areas such as renewable electricity generation and that this progress reflects the huge strides that have been made over the last couple of decades in onshore wind deployment. However, it is also recognised that there remains potential for much more development of renewable energy infrastructure across Scotland, both in the established forms, such as onshore wind, as well as other forms of technology.

4.5.23 Within the section relating to support for the renewable energy sector, the Energy Strategy Position Statement notes that *'the Scottish Government is committed to supporting the increase of onshore wind in the right places to help meet the target of Net Zero. In 2019, onshore wind investment in Scotland generated over £2 billion in turnover and directly supported approximately 2,900 full-time equivalent jobs across the country. We continued to make good progress last year, with Scotland's renewable electricity generation having grown to such an extent that it was able to meet the equivalent of 90% of Scotland's gross electricity consumption – making 2019 another record breaking year for the sector.'*

Onshore Wind Policy Statement (2017)

4.5.24 The Onshore Wind Policy Statement (Scottish Government, 2017) along with the SES was published in December 2017, providing specific national policy with regards to onshore wind. The Ministerial Foreword sets out that *'there is no question that onshore wind is a vital component of the huge industrial opportunity that renewables more generally create for Scotland. The sector supports an estimated 7,500 jobs in Scotland, or 58% of the total for onshore wind across the UK, and generated more than £3 billion in turnover in 2015. Developers are increasingly managing international onshore wind projects from their bases in Scotland'* (page 2).

4.5.25 It further adds that *'our energy and climate change goals mean that onshore wind will continue to play a vital role in Scotland's future – helping to substantively decarbonise our electricity supplies, heat and transport systems, thereby boosting our economy, and meeting local and national demand. This important role means we must support development in the right places, and – increasingly – the extension and replacement of existing sites, where acceptable, with new and larger turbines, based on an appropriate, case by case assessment of their effects and impacts'* (page 3).

4.5.26 The section of the report 'Route to Market' sets out that *'in order for onshore wind to play its vital role in meeting Scotland's energy needs, and a material role in growing our economy, its contribution must continue to grow. Onshore wind generation will remain crucial in terms of our goals for a decarbonised energy system, helping to meet the greater demand from our heat and transport sectors, as well as making further progress towards the ambitious renewable targets which the Scottish Government has set'* and, *'this means that Scotland will continue to need more onshore wind development and capacity, in locations across our landscapes where it can be accommodated'* (page 6).

Onshore Wind - Policy Statement Refresh 2021: Consultative Draft (2021)

4.5.27 The above document was published in October 2021 and the period of consultation ran until the end of January 2022. The report seeks views on a range of issues, including the Scottish Government's ambition to secure an additional 8-12 GW of installed onshore wind capacity by 2030; how to tackle the barriers to deployment of more onshore wind; and how to secure maximum economic benefit from these developments.

4.5.28 The Ministerial Foreword notes that onshore wind remains vital to Scotland's future energy mix and recognise that *'we will need much more'* as we move towards net zero. Chapter 2 notes that *'a consistently higher rate of onshore wind and other renewables capacity will be required year on year'*. Importantly, Chapter 4 notes that the decisive action required to address climate change means that the way Scotland looks will change as a result of the *'need to deploy significant volumes of onshore wind generation over the next decade'*. There is also recognition that this will necessitate the use of modern, efficient and taller wind turbines.

4.6 Scottish Planning Policy and Advice

4.6.1 National planning policy of relevance to the determination of the Proposed Development currently comprises the National Planning Framework for Scotland 3 (2014)[28] and Scottish Planning Policy (2014)[29]. In addition, a Draft National Planning Framework 4 (2021)[30] was published for consultation in November 2021. At the time of writing this document has yet to be approved by the Scottish Government.

The National Planning Framework for Scotland 3

4.6.2 The third National Planning Framework 3 for Scotland (NPF3) (Scottish Government, 2014), published in June 2014, represents a spatial expression of the Scottish Government's aspirations for sustainable economic growth in Scotland over the next 20-30 years. It sets out at the national level, the Scottish Government's strategy for the country's development, in terms of how we are to develop our environment and includes development proposals identified as schemes of national importance. NPF3 is a material consideration of relevance to the Proposed Development.

[28] https://www.gov.scot/publications/national-planning-framework-3/
[29] https://www.gov.scot/publications/scottish-planning-policy/
[30] https://consult.gov.scot/local-government-and-communities/draft-national-planning-framework-4/

4.6.3 The development of onshore wind is supported in NPF3. Paragraph 3.23 highlights the important role that wind energy can play in contributing towards a low carbon economy and states, *'onshore wind will continue to make a significant contribution to diversification of energy supplies'*. In addition, paragraph 3.7 recognises that onshore wind development can be an opportunity to improve the long-term resilience of rural communities.

Draft National Planning Framework 4

4.6.4 In November 2021 the Scottish Government published its Draft Scotland 2045: Our Fourth National Planning Framework (Draft NPF4). Only limited weight can be given to the polices in Draft NPF4 at this stage, given that it is anticipated to be subject to further revision prior to adoption. When adopted NPF4 will replace both NPF3 and Scottish Planning Policy and will form part of the statutory Development Plan.

4.6.5 The opening paragraphs of Draft NPF4 (page 3) state *'we have set a target of net zero emissions by 2045, and must make significant progress towards this by 2030. This will require new development and infrastructure across Scotland'*.

4.6.6 Draft NPF4 continues to set a positive context for renewable energy developments embedded in NPF3 that will help achieve the legally binding net zero greenhouse gas emissions target by 2045 (with associated interim targets, including a 75% reduction by 2030 compared to 1990 levels). Various parts of Draft NPF4 are relevant to the Proposed Development:

- Part 2 – National Developments. National Development 12 'Strategic Renewable Electricity Generation and Transmission Infrastructure' sets out a list of developments that would have national status including 'Electricity generation, including electricity storage, from renewables of or exceeding 50 megawatts capacity'. National development status means that 'the principle of the development does not need to be agreed later in the consenting process, providing more certainty for communities, business and investors'.
- Part 3 – National Planning Policy. Within this section various draft policies would apply to the Proposed Development including *inter alia* Policy 2 – Climate Emergency, Policy 3 – Nature Crisis, Policy 19 – Green Energy, Policy 28 – Historic Assets and Places and Policy 32 – Natural Places.

4.6.7 Policy 2 - Climate Emergency highlights the increased material weight for proposals that seek to combat the impacts of climate change and greenhouse gas (GHG) emissions, stating that *'when considering all development proposals significant weight should be given to the Global Climate Emergency'*.

4.6.8 The pre-amble to Policy 19 - Green Energy states, *'we want our places to support continued expansion of low-carbon and net zero energy technologies as a key contributor to net zero emissions by 2045'*. Part (b) of the policy states that *'development proposals for all forms of renewable energy…together with…energy storage such as battery storage, should be supported in principle'*. Part (d) adds that outwith National Parks and National Scenic Areas *'development proposals for new wind farms should be supported unless the impacts identified (including cumulative effects) are unacceptable'*.

4.6.9 Draft NPF4 is discussed further in the accompanying Planning Statement.

Scottish Planning Policy

4.6.10 Scottish Planning Policy (SPP) was published in June 2014 (Scottish Government, 2014) and is a statement of Scottish Government policy on land use planning. SPP emphasises the importance of tackling climate change and, in particular, the need to reduce greenhouse gas emissions. SPP is a material consideration of relevance to the Proposed Development. The following paragraphs set out the policy issues which are most relevant to the Proposed Development.

Scottish Planning Policy (SPP) - Sustainable Development and Climate

4.6.11 One of the over-arching aims of SPP is to achieve Sustainable Development. SPP emphasises as a 'policy principle' that there is a presumption in favour of development that contributes towards sustainable development (the presumption). In considering whether the SPP 'presumption' applies, SPP paragraph 29 sets out a series of sustainable development principles against which proposals are to be assessed. The accompanying Planning Statement considers the Proposed Development against these principles.

4.6.12 In relation to climate change and delivering Outcome 2 of SPP 'A Low Carbon Place', paragraph 19 notes that the planning system can play a key role in supporting '*the transformational change required to meet emission reduction targets and influence climate change'*.

Scottish Planning Policy (SPP) - Renewable Energy

4.6.13 Paragraph 154 states that the planning system should *'support the transformational change to a low carbon economy, consistent with national objectives and targets'*.

4.6.14 Paragraph 154 goes on to state that the planning system *'should support the development of a diverse range of electricity generation from renewable energy technologies – including the expansion of renewable energy generation capacity...'*.

4.6.15 In order to achieve this, paragraph 155 states that Development Plans *'should seek to ensure an area's full potential for electricity and heat from renewable sources is*

achieved, in line with national climate change targets, giving due regard to relevant environmental, community and cumulative impact considerations'.

4.6.16 In relation to onshore wind, SPP Table 1 'Spatial Frameworks', provides locational guidance for onshore wind developments, as follows:

- Group 1: Areas where wind farms will not be acceptable (National Parks and National Scenic Areas);
- Group 2: Areas of Significant Protection (National and international designations, other nationally important mapped environment interests including areas of wild land) and a 2 km community separation distance for consideration of visual impact; and
- Group 3: Areas with potential for wind farm development.

4.6.17 The eastern portion of the Proposed Development Area falls predominantly within Group 2 'Areas of Significant Protection' on account of its proximity to the defined settlement boundaries for Patna and Waterside. The western portion is located mostly in an 'Area with Potential for Wind Farm Development' (Group 3) with pockets of land categorised as 'Areas of Significant Protection' (Group 2) owing to the mapped presence of carbon rich soils/deep peat.

4.6.18 Paragraph 169 stipulates that proposals for energy infrastructure should always take account of spatial frameworks for wind farms, where relevant. The same paragraph sets out a range of development management criteria for the consideration of energy infrastructure proposals including socio-economic impacts, scale of contribution to renewable energy targets, cumulative impacts, and many technical and environmental impacts to be considered, for example, landscape, historic environment and natural heritage. These issues are considered in greater depth in the accompanying Planning Statement.

Scottish Planning Policy (SPP) - Valuing the Natural Environment

4.6.19 The policy principles for this subject matter are set out in paragraph 194 of the SPP. This states that the planning system should *'facilitate positive change while maintaining and enhancing distinctive landscape character…conserve and enhance protected sites and species, taking account of the need to maintain healthy ecosystems and work with the natural processes which provide important services to communities'*.

4.6.20 Paragraph 196 states that *'buffer zones should not be established around areas designated for their natural heritage importance. ……. The level of protection given to local designations should not be as high as that given to international or national designations'*.

Scottish Planning Policy (SPP) – Valuing the Historic Environment

4.6.21 Paragraph 135 states that *'planning has an important role to play in maintaining and enhancing the distinctive and high-quality, irreplaceable historic places which enrich our lives, contribute to our sense of identity and are an important resource for our tourism and leisure'*. Paragraph 137 goes on to state that the planning system should, *'promote the care and protection of the designated and non-designated historic environment (including individual assets, related settings and the wider cultural landscape) and its contribution to sense of place, cultural identity, social well-being, economic growth, civic participation and lifelong learning'*.

Scottish Planning Policy (SPP) - Community Benefit

4.6.22 SPP realises the benefits of developer contributions to local communities and states in paragraph 173 that *'where a proposal is acceptable in land use terms, and consent is being granted, local authorities may wish to engage in negotiations to secure community benefit in line with the Scottish Government Good Practice Principles for Community Benefits from Onshore Renewable Energy Developments'*.

4.7 Development Plan

Current Development Plan

4.7.1 The Proposed Development lies partly within the administrative boundary of East Ayrshire Council and partly within that of South Ayrshire Council. As such, the Development Plan for both Council areas is relevant. The statutory Development Plan for the Proposed Development Area comprises the following:

- South Ayrshire Local Development Plan 2014 (SALDP)[31];
- South Ayrshire Supplementary Planning Guidance: Wind Energy 2015[32];
- East Ayrshire Local Development Plan 2017 (EALDP)[33]; and
- East Ayrshire Local Development Plan Supplementary Guidance: Planning for Wind Energy 2017[34].

[31] https://archive.south-ayrshire.gov.uk/documents/localdevplan_final.pdf

[32] https://ww20.south-ayrshire.gov.uk/ext/committee/CommitteePapers2015/Leadership%20Panel/3rd%20November%202015%20public/LP-03Nov-Wind%20Energy-Supplementary%20Guidance%20-%20Appendix%201.pdf

[33] https://www.east-ayrshire.gov.uk/PlanningAndTheEnvironment/Development-plans/LocalAndStatutoryDevelopmentPlans/East-Ayrshire-Local-Development-Plan-2017.aspx

[34] https://www.east-ayrshire.gov.uk/Resources/PDF/P/Planning-SG-Planning-for-Wind-Energy.pdf

4.7.2 Also of relevance is the South Ayrshire Landscape Wind Capacity Study (2018)[35] and the East Ayrshire Landscape Wind Energy Capacity Study (2018)[36], although both these documents are non-statutory guidance and do not form part of the Development Plan.

Emerging Development Plan

4.7.3 South Ayrshire Council has now submitted to the Scottish Ministers the version of the Local Development Plan 2 (2022)[37] (Proposed SALDP2), as modified following Examination, that it intends to adopt. The Proposed SALDP2 therefore carries significant weight in the determination of the Proposed Development.

4.7.4 East Ayrshire Council began preparation of its Local Development Plan 2 (LDP2) in 2020. At the time of writing this chapter, the Proposed LDP2 has been published for consultation.

4.8 Review of Development Plan Policy

Local Development Plan Policy

4.8.1 This section identifies adopted local planning policies within both East Ayrshire and South Ayrshire which will be potentially relevant in the determination of the application. Policies are arranged by theme and reflect chapter divisions within the EIAR where possible. Table 4.1 below identifies potentially relevant adopted Development Plan policies:

Table 4.1: Adopted relevant Local Development Plan Policies

Development Plan	Policy Number and Name
South Ayrshire Local Development Plan 2014	LDP Policy: Sustainable Development
	LDP Policy: Delivering Infrastructure
	LDP Policy: Tourism
	LDP Policy: Glasgow Prestwick Airport
	LDP Policy: Galloway and Southern Ayrshire Biosphere
	LDP Policy: Landscape Quality
	LDP Policy: Protecting the Landscape
	LDP Policy: Preserving Trees
	LDP Policy: Central Scotland Green Network
	LDP Policy: Water Environment
	LDP Policy: Flooding and Development
	LDP Policy: Air, Noise and Light Pollution
	LDP Policy: Renewable Energy
East Ayrshire Local Development Plan 2017	LDP Policy: Wind Energy
	LDP Policy: Historic Environment
	LDP Policy: Archaeology
	LDP Policy: Natural Heritage
	LDP Policy: Dark Skies
	LDP Policy: Land Use and Transport
	LDP Policy: Strategic Road Development
	LDP Policy: Outdoor Public Access and Core Paths
	OP1 Overarching Policy OP1
	RE1 Renewable Energy Developments
	RE3 Wind energy proposals over 50 metres in height
	RE5 Financial Guarantees
	T1 Transportation Requirements for New Development
	T4 Development and Protection of Core Paths and Natural Routes
	ENV1 Listed Buildings
	ENV2 Scheduled Monuments and Archaeological Resources
	ENV3 Conservation Areas
	ENV4 Gardens and Designed Landscapes
	ENV6 Nature Conservation
	ENV7 Wild Land and Sensitive Landscape Areas
	ENV8 Protecting and Enhancing the Landscape
	ENV9 Trees, Woodland and Forestry
	ENV10 Carbon Rich Soils
	ENV11 Flood Prevention
	ENV12 Water, air and light and noise pollution
	TOUR4 The Dark Sky Park
	TOUR5 Galloway and Southern Ayrshire Biosphere

Renewable Energy

4.8.2 LDP Policy: 'Renewable Energy' and LDP Policy: 'Wind Energy' of the SALDP and Policies RE1 'Renewable Energy Developments' and RE3 'Wind energy proposals over 50 metres in height' of the EALDP are the most relevant adopted local planning policies to the Proposed Development.

4.8.3 SALDP Policy 'Renewable Energy' states that, *'we will support proposals for generating and using renewable energy in standalone locations, and as part of new and existing developments, if they will not have a significant harmful effect on*

[35] https://archive.south-ayrshire.gov.uk/planning/documents/south%20ayrshire%20landscape%20wind%20capacity%20study%20-%20final%20august%202018.pdf

[36] https://www.east-ayrshire.gov.uk/Resources/PDF/L/Landscape-wind-capacity-study.pdf

[37] https://archive.south-ayrshire.gov.uk/planning/local-development-plans/ldp2/

residential amenity, the appearance of the area and its landscape character, biodiversity and cultural heritage. Development proposals will not be permitted where they would adversely affect the integrity of a Natura 2000 site' (page 46).

4.8.4 SALDP Policy 'Wind Energy' states that:

'We will support proposals if:

a. they are capable of being accommodated in the landscape in a manner which respects its main features and character (as identified in the South Ayrshire Landscape Wind Capacity Study or in any subsequent updates to that study), and which keeps their effect on the landscape and the wider area to a minimum (through a careful choice of site, layout and overall design);

b. they do not have a significant detrimental visual impact, taking into account views experienced from surrounding residential properties and settlements, public roads and paths, significant public viewpoints, and important recreational assets and tourist attractions;

c. they do not have any other significant detrimental effect on the amenity of nearby residents, including from noise and shadow flicker;

d. they do not have a significant detrimental effect on natural heritage features, including protected habitats and species, and taking into account the criteria in LDP policy: natural heritage;

e. they do not have a significant detrimental effect on the historic environment, taking into account the criteria in LDP policy: historic environment and LDP policy: archaeology;

f. they do not adversely affect aviation, defence interests and broadcasting installations; and

g. their cumulative impact in combination with other existing and approved wind energy developments, and those for which applications for approval have already been submitted, is acceptable.

We will produce supplementary guidance on wind farms, which will identify preferred areas of search, areas with potential constraints and areas requiring significant protection; and will provide more detail on how the above-mentioned criteria will be applied in assessing all proposals for wind farms and turbines. We will use the South Ayrshire Landscape Wind Capacity Study (or any subsequent updates to that study) to help us decide the effect of proposals on the landscape. Development proposals will not be permitted where, either individually or cumulatively, they would adversely affect the integrity of a Natura 2000 site' (page 47).

4.8.5 EALDP Policy RE1 'Renewable Energy Developments' states that, *'proposals for the generation and utilisation of renewable energy in the form of new build development, infrastructure or retrofit projects will be supported in standalone locations and as integral parts of new and existing developments where it can be demonstrated that there will be no unacceptable significant adverse impacts on all of the relevant Renewable Energy Assessment Criteria set out in Schedule 1 of the LDP, that the scale of the proposal and its relationship with the surrounding area are appropriate and that all relevant policies are met. In this regard, applications for renewable energy proposals should be accompanied by detailed supporting information'* (page 81).

4.8.6 EALDP Policy RE3 'Wind energy proposals over 50 metres in height' states that:

'All wind energy proposals over 50m in height, including extensions and proposals for repowering, will be assessed using the spatial framework for wind development shown on Map 12 and all relevant Renewable Energy and other LDP policies.

The Council will afford significant protection to Group 2 areas shown on Map 12. Development may be appropriate in some circumstances within these areas in cases where it can be demonstrated that any significant adverse effects on the environmental characteristics of these areas can be substantially overcome by siting, design or other mitigation and where the proposal is acceptable in terms of all applicable renewable energy criteria set out in Schedule 1.

Within those areas shown on the Spatial Framework (Map 12) as Group 3 - Areas with Potential for Wind Energy Development, proposals for wind energy over 50m in height will be supported where it can be demonstrated that they are acceptable in terms of all applicable Renewable Energy Assessment Criteria set out in Schedule 1.

Supplementary Guidance on Planning for Wind Energy will be prepared in order to provide more information on:

- *the spatial framework; and*
- *the considerations that will apply to wind energy developments of more than 50 metres in height'* (page 82).

Sustainable Design

4.8.7 SALDP Policy 'Sustainable Development' aims to support the principles of sustainable development by ensuring that all development meets certain principles in relation to a number of factors including scale, massing and its relationship to its surroundings.

4.8.8 SALDP Policy 'Delivering Infrastructure' expects all new development proposals to provide any appropriate measures for on and off-site infrastructure.

4.8.9 'Overarching Policy' OP1 of the EALDP states that all development proposals will be required to meet the criteria set out in the policy in so far as they are relevant or otherwise demonstrate how their contribution to sustainable development in the context of the subsequent relevant policies in the LDP and SPP would outweigh any lack of consistency with the relevant criteria. Relevant criteria include complying with the provisions and principles of the LDP vision and spatial strategy, all relevant LDP policies and associated supplementary guidance and non-statutory guidance, be fully compatible with surrounding established uses and have no unacceptable impacts on the environmental quality of the area, ensure that there is no unacceptable loss of safeguarded areas of open space/green infrastructure and prime quality agricultural land, protect and enhance natural and built heritage designations and link to and integrate with green infrastructure where possible and ensuring that there are no unacceptable impacts on the landscape character or tourism offer of the area.

Landscape and Visual amenity

4.8.10 SALDP Policy 'Landscape Quality' aims to maintain and improve the quality of South Ayrshire's landscape and local characteristics. Development proposals are required to conserve a number of landscape features including skylines and hill features, historic landscapes and community settings.

4.8.11 SALDP Policy 'Protecting the Landscape' establishes criteria for the assessment of proposals within or next to Scenic Areas including considering the significance of impacts and cumulative impacts on the environment; and how far they would benefit the economy and whether they can be justified in a rural location.

4.8.12 EALDP Policy ENV 7 'Wild Land and Sensitive Landscape Areas' states that the Council will give priority and prime consideration to the protection and enhancement of the landscape in its consideration of development proposals within the Sensitive Landscape Areas identified on the LDP maps (page 109).

4.8.13 EALDP Policy ENV8 'Protecting and Enhancing the Landscape' states that the protection and enhancement of East Ayrshire's landscape character as identified in the Ayrshire Landscape Character Assessment will be a key consideration in assessing the appropriateness of development proposals in rural areas. Policy ENV 8 requires that development proposals are sited and designed to respect the nature and landscape character of the area and to minimise visual impact. Where visual impacts are unavoidable, development proposals should include adequate mitigation measures to minimise such impacts on the landscape. Particular features that contribute to the value, quality and character of the landscape are require to be conserved and enhanced.

Hydrology, Hydrogeology, Geology and Soils

4.8.14 SALDP Policy 'Sustainable Development' states that support will be given to development proposals that protect peat resources.

4.8.15 SALDP Policy 'Water Environment' states that the Council supports the objectives of the Water Framework Directive (2000/60/EC), including that development should not harm the water environment or pose an unacceptable risk to the quality of controlled waters.

4.8.16 SALDP Policy 'Flooding and Development' requires that development should avoid areas likely to be affected by flooding or increase the likelihood of flooding elsewhere. This policy goes on to state, *'areas of impermeable surfaces should be kept to a minimum in all new developments. Development proposals must include Sustainable Urban Drainage Systems (SUDS)…..where possible, SUDS should be designed to maximise the opportunities for habitat restoration and biodiversity'* (page 44).

4.8.17 EALDP Policy ENV10 'Carbon Rich Soils' states that, *'development may be permitted for renewable energy generating developments on carbon rich soils where it can be demonstrated (in accordance with the Scottish Government's 'carbon calculator') that the balance of advantage in terms of climate change mitigation lies with the energy generation proposal, and that any significant effects on these areas can be substantially overcome by siting, design or other mitigation'* (page 111).

4.8.18 EALDP Policy ENV 11 'Flood Prevention' states that the Council will take a precautionary approach to flood risk from all sources and will promote flood avoidance in the first instance. It also states that the Council will encourage new flood management measures, including flood protection schemes, restoring natural features, enhancing flood storage capacity and avoiding the construction of new culverts and the opening of existing culverts.

Socio-Economics, Recreation and Tourism

4.8.19 SALDP Policy 'Tourism' states that the Ayrshire and Arran Tourism Strategy will be taken into account in assessing planning applications. SALDP Policy 'Galloway and Southern Ayrshire Biosphere' states, *'we will support development that promotes the aims of the biosphere and shows an innovative approach to sustainable living and the economy, and supports improving, understanding and enjoying the area as a world-class environment'* (page 26).

4.8.20 SALDP Policy 'Dark Skies' states, *'we will support the Galloway Forest Dark Sky Park, and will presume against development proposals within the boundaries of the park that would produce levels of lighting that would adversely affect its 'dark sky' status. The boundaries of the Dark Sky Park [and of the buffer zone] are shown on the map on page 40'* (page 51).

4.8.21 EALDP Policy TOUR4 'The Dark Sky Park' states that East Ayrshire Council will support the Galloway Forest Dark Sky Park, and will presume against development proposals within the boundaries of the park that would produce levels of lighting that would adversely affect its 'dark sky' status. The boundaries of the Dark Sky Park and of the buffer zone are shown on Map 10. Development will require to be in line with statutory guidance on Dark Sky Park Lighting.

4.8.22 Outwith the Dark Sky Park, and in particular within the 10 mile radius of the Park known as the transition zone, the Council will encourage developers to take account of the Dark Sky Park designation and take measures to limit light pollution.

4.8.23 EALDP Policy TOUR5 'Galloway and Southern Ayrshire Biosphere' states that *'the Council will encourage developments and proposals that support the aims of the Biosphere, particularly where they provide an innovative approach to sustainable living and the economy. Developments which support and improve the understanding and enjoyment of the area as a world class environment will also be supported'* (page 74).

Noise, Air and Light

4.8.24 SALDP Policy 'Air, Noise and Light Pollution' states, *'we will not allow development which would expose significant numbers of people to unacceptable levels of air, noise or light pollution'* (page 44).

4.8.25 EALDP Policy ENV12 'Water, Air and Light and Noise Pollution' states that all development proposals must incorporate design measures which minimise or reduce light pollution. EALDP Policy ENV12 states that all developers will be required to ensure that their proposals have minimal adverse impact on air quality.

Ecology and Ornithology

4.8.26 SALDP Policy 'Natural Heritage' states, in respect of international designations, that development likely to have a significant effect on Special Protection Areas or Special Areas of Conservation should not adversely affect the integrity of the designation. For national and local designations, developers must demonstrate that the integrity of designated sites is not put at risk. In addition, this policy states that development should not have an adverse effect on protected species, unless this can be appropriately justified.

4.8.27 EALDP Policy ENV6 'Nature Conservation' states that the importance of nature conservation and biodiversity will be fully recognised in the assessment of development proposals. Any development likely to have a significant effect on a Natura 2000, Site of Special Scientific Interest (SSSI) or area of local importance for nature conservation will only be accepted if there will be no adverse effect on the integrity of the site. If there is evidence that protected species may be affected by a development, steps must be taken to establish their presence.

Cultural Heritage

4.8.28 SALDP Policy 'Historic Environment' aims to protect listed buildings, conservation areas and their settings. This policy goes on to state that development negatively affecting Scheduled Monuments or Gardens and Designed Landscapes will not be accepted.

4.8.29 EALDP Policy ENV1 'Listed Buildings' states that the Council will support the retention and preservation of all listed buildings and buildings within conservation areas.

4.8.30 EALDP Policy ENV2 'Scheduled Monuments and Archaeological Resources' states that development that would have an adverse effect on Scheduled Monuments or on their settings shall not be supported unless there are exceptional overriding circumstances.

4.8.31 EALDP Policy ENV3 'Conservation Areas' states that development within or affecting the setting of a conservation area shall preserve and enhance its character and be consistent with any appraisal or management plan.

4.8.32 EALDP Policy ENV4 'Gardens and Designed Landscapes' requires that Gardens and Designed Landscapes included in the National Inventory, and those of regional and local importance, are protected and their enhancement encouraged. Development will not be supported where it will have significant adverse impacts upon the character of a Garden and Designed Landscape, important views to, from and within it and, important features that contribute to its value and that justify its designation, where applicable.

Access, Traffic and Transport

4.8.33 SALDP Policy 'Land Use and Transport' requires that development proposals take measures to keep any negative effects on road traffic to a minimum, align with the

regional and local transport strategies and, where needed, provide interventions to the strategic transport network to maintain efficiency of operation.

4.8.34 SALDP Policy 'Strategic Road Development' states that development will be supported where it does not adversely affect the efficiency and safety of the relevant network and, where applicable, necessary improvements are carried out.

4.8.35 EALDP Policy T1 'Transportation requirements for new development' states *that 'the Council will require developers to ensure that their proposals meet with all the requisite standards of the Ayrshire Roads Alliance and align with the Regional and Local Transport Strategies. Developments which do not meet these standards will not be considered acceptable and will not receive Council support'* (page 88).

4.8.36 EALDP Policy T4 'Development and Protection of Core Paths and Natural Routes' states that the Council will not be supportive of development which disrupts or adversely impacts on any existing or potential core path, right of way, bridle path, or footpath used by the general public for recreational or other purposes. Where such disruption or adverse impact is demonstrated to be unavoidable, the Council will require developers to provide for the appropriate diversion of the route in question elsewhere within the development site or to put in place appropriate measures to mitigate and overcome the adverse impact expected.

Forestry

4.8.37 SALDP Policy 'Preserving Trees' states that proposals involving the loss of trees will require consideration to be given as to how this would affect the local area. Tree removal as a result of development proposals will require to be replaced via compensatory planting measures.

4.8.38 EALDP Policy ENV9 'Trees, Woodland and Forestry' states that 'the Council will support the retention of individual trees, hedgerows and woodlands within both settlements and rural areas, where such trees contribute to the amenity, nature conservation and landscape value of the area. There will be a presumption against the felling of ancient semi-natural woodlands and trees protected by Preservation Orders' (page 110).

Proposed South Ayrshire Local Development Plan 2

4.8.39 As highlighted earlier in this chapter, South Ayrshire Council has now submitted to the Scottish Ministers the version of the Local Development Plan 2 (2022) (Proposed SALDP2), as modified following Examination, that it intends to adopt. The key policies outlined above from the SALDP do not differ substantially in the Proposed SALDP2. Therefore the relevant policies have not been summarised here. The separate Planning Statement considers both the relevant SALDP and SALDP2 policies, highlighting any changes.

Proposed East Ayrshire Local Development Plan 2

4.8.40 As noted earlier in this chapter, at the time of writing, the East Ayrshire LDP2 has been published for comments. As it is a consultation document, it carries much less 'weight' than the adopted LDP. The Planning Statement therefore focuses on the adopted policies.

Supplementary Guidance

South Ayrshire Supplementary Planning Guidance: Wind Energy 2015

4.8.41 The South Ayrshire Supplementary Guidance: Wind Energy was adopted in 2015. This Supplementary Guidance sets out a range of issues the Council will consider when determining wind energy applications. It also includes the Council's spatial strategy for wind turbine development. This document builds on the SALDP renewable energy policies and provides guidance on a number of matters relating to landscape, transportation, peat, cultural heritage and aviation, amongst others.

East Ayrshire Local Development Plan Supplementary Guidance: Planning for Wind Energy 2017

4.8.42 The East Ayrshire Local Development Plan Supplementary Guidance: Planning for Wind Energy was adopted in 2017. This Supplementary Guidance sets the Council's spatial approach to wind energy development and builds on the EALDP renewable energy policy criteria and provides guidance on a number of environmental and technical matters.

4.9 Other Material Considerations

South Ayrshire Landscape Wind Capacity Study 2018

4.9.1 This study aims to 'inform strategic planning for wind energy development in line with Scottish Planning Policy and to also provide guidance on the appraisal of individual wind farm and wind turbine proposals in South Ayrshire' (page 3). The study describes the twenty landscape character types within South Ayrshire and provides guidance on the capacity of each to accommodate wind energy development of various heights. It does not have Development Plan status.

East Ayrshire Landscape Wind Capacity Assessment Planning Guidance 2018

4.9.2 The non-statutory East Ayrshire Landscape Wind Capacity Assessment Planning Guidance was adopted in June 2018. It aims to inform strategic planning for wind energy development in line with SPP and to also provide guidance on the appraisal

of individual wind farm and wind turbine proposals in East Ayrshire. It is similar in scope and content to the South Ayrshire Wind Capacity Study.

4.9.3 This guidance considers the landscape and visual sensitivity of twelve landscape character types within East Ayrshire to a range of wind turbine developments; these are principally categorised on the basis of turbine height. Potential cumulative issues associated with operational and consented wind farm developments are additionally considered. Guidance on the constraints and opportunities for wind energy development within each landscape character type is also included.

Planning Advice Notes

4.9.4 Relevant Planning Advice Notes (PANs)[38] are summarised in Table 4.2 below.

Table 4.2: Relevant PANs

Title	Summary of Document
PAN 1/2013 Environmental Impact Assessment	Provides information on the role local authorities and consultees play as part of the EIA process, and how the EIA can inform development management.
PAN 60 (2000) Planning for Natural Heritage	Advises developers on the importance of discussing their proposals with the planning authority and Scottish Natural Heritage (SNH) (now NatureScot) and use of the EIA process to identify the environmental effects of development proposals and seek to prevent, reduce and offset any adverse effects in ecology and biodiversity.
PAN 61 (2001) Sustainable Urban Drainage Systems	Good practice drainage guidance.
PAN 68 (2003) Design Statements	This PAN covers the importance of design statements, and provides flexible guidance on their preparation, structure, and content. The PAN also outlines the principles underpinning the production of design statements, as expected by the Scottish Government.
PAN 75 (2005) Planning for Transport	The objective of PAN 75 is to integrate development plans and transport strategies to optimise opportunities for sustainable development and create successful transport outcomes.
PAN 3/2010 Community Engagement	This document provides advice on how to engage with local communities through the planning process.
PAN 1/2011 Planning and Noise	This PAN provides advice on the role of the planning system in helping to prevent and/ or mitigate any potential adverse effects of noise. It promotes the principles of good acoustic design and promotes a sensitive approach to the location of new development.
PAN 2/2011 Planning and Archaeology	The PAN is intended to inform local authorities and other organisations of how to process any archaeological scope of works within the planning process.

4.10 Summary

4.10.1 This chapter has set out the legislative background to the Proposed Development, as well as a summary of the renewable energy policy framework, and the national and local planning policies and guidance relevant to the consideration of the Proposed Development. It provides an objective summary of the energy and planning policy considerations that have been taken into account in the preparation of the EIAR in order to ensure that it provides the appropriate information for the consideration of the application.

4.10.2 A separate policy appraisal for the Proposed Development against these various planning and energy policy considerations is contained in a separate Planning Statement.

[38] https://www.gov.scot/collections/planning-advice-notes-pans/

5 Landscape and Visual

5.1 Introduction

5.1.1 This chapter presents the landscape and visual impact assessment (LVIA) for the proposed Sclenteuch Wind Farm ('the Proposed Development'). The assessment considers the likely significant effects on the landscape and visual resources of the Proposed Development Area and the surrounding Study Area, as described in Section 5.5, associated with the construction and operation of the Proposed Development.

5.1.2 Landscape character and resources are considered to be of importance in their own right and are valued regardless of whether they are seen by people. Effects on views and visual amenity as perceived by people are clearly distinguished from, although closely linked to, effects on landscape character and resources. Landscape and visual assessments are therefore separate, although linked, processes.

5.1.3 The specific objectives of the chapter are to:

- describe the current 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 the likely significant effects; and
- assess the residual effects remaining following the implementation of mitigation measures.

5.1.4 The assessment has been carried out by Chartered Members of the Landscape Institute at LUC (Land Use Consultants Ltd).

5.1.5 The chapter is supported by:

- Technical Appendix 5.1 LVIA Methodology;
- Technical Appendix 5.2 Landscape Assessment;
- Technical Appendix 5.3 Visual Assessment;
- Technical Appendix 5.4 Residential Visual Amenity Assessment;
- Technical Appendix 5.5 Aviation Lighting Assessment;
- Technical Appendix 5.6 Wild Land Assessment; and
- Technical Appendix 5.7 Turbine Lighting Analysis by Dr Stuart Lumsden.

5.1.6 Supporting figures are presented in Volume 2b and visualisations in Volume 2c.

5.2 Legislation, Policy and Guidance

5.2.1 Information relating to relevant legislation and national policy is provided in Chapter 4.

5.2.2 The following methodological guidance has informed the approach to this LVIA:

- Landscape Institute and the Institute of Environmental Management and Assessment (2013) Guidelines for Landscape and Visual Impact Assessment, 3rd Edition ('GLVIA3');
- Countryside Agency and SNH (2002), Landscape Character Assessment: Guidance for England and Scotland;
- SNH (2018) A Handbook on Environmental Impact Assessment, Appendix 2: Landscape and Visual Impact Assessment, Version 5;
- SNH (2017) Visual Representation of Wind Farms, Version 2.2;
- NatureScot (2020) Assessing impacts on Wild Land Areas - Technical Guidance;
- NatureScot (2022) Landscape Sensitivity Assessment Guidance;
- Landscape Institute (2019) Technical Guidance Note 06/19 Visual representation of development proposals;
- Landscape Institute (2019) Technical Guidance Note 02/19 Residential Visual Amenity Assessment;
- Nature Scot (2021) Guidance - Assessing the cumulative landscape and visual impact of onshore wind energy developments; and
- Landscape Institute (2021) Technical Guidance Note 02/21 Assessing landscape value outside national designations.

5.2.3 The following policy and guidance has informed development of the Proposed Development, as described in Chapter 3: Design Evolution and Alternatives, and is also addressed within this LVIA:

- SNH (2017) Siting and Designing Wind Farms in the Landscape, Version 3a;
- SNH (2015) Spatial Planning for Onshore Wind Turbines – Natural Heritage Considerations;
- East Ayrshire Council (2017) East Ayrshire Local Development Plan Supplementary Guidance: Planning for Wind Energy;
- Carol Anderson Landscape Associates (2018) East Ayrshire Landscape Wind Energy Capacity Study;
- South Ayrshire Council (2015) South Ayrshire Supplementary Planning Guidance: Wind Energy; and
- Carol Anderson Landscape Associates (2018) South Ayrshire Landscape Wind Energy Capacity Study.

5.3 Consultation

5.3.1 In undertaking the assessment, consideration has been given to the Scoping Opinion, individual scoping responses, and other consultation undertaken as detailed in Table 5.1 below.

Table 5.1: Consultation

Consultee and date	Response	Comment / Action
Scottish Government Energy Consents Unit Scoping Opinion November 2021	Request that any additional viewpoints, wireframes, ZTVs and photomontages as requested by East Ayrshire Council, South Ayrshire Council and NatureScot are considered in full.	All suggested viewpoints have been considered, and further consultation has been carried out.
	The Applicant is advised that the final list of viewpoints and visualisations should be agreed following discussion between the Company, East Ayrshire Council, South Ayrshire Council and NatureScot.	Viewpoints have been agreed through follow up consultation with East Ayrshire Council, South Ayrshire Council and NatureScot. Final viewpoints are presented in Table 5.7.
	Given the maximum blade tip height of turbines exceeds 150 m the LVIA must include a robust Night Time Assessment with agreed viewpoints to consider the effects of aviation lighting and how the chosen lighting mitigates the effects.	A night time assessment as been undertaken and is included in Technical Appendix 5.5.
	Scottish Ministers request that the information provided in the response from South Ayrshire Council, and John Muir Trust is reviewed and that a Wild Land Area Impact Assessment for Merrick Wild Land Area is undertaken.	A Wild Land Assessment has been undertaken and is included in Technical Appendix 5.6.
	Mitigation measures suggested for any significant environmental impacts identified should be presented as a conclusion within the LVIA chapter.	Mitigation of wind farms is primarily through embedded design measures, as set out in Chapter 3: Design Evolution and Alternatives.
South Ayrshire Council Scoping response 8 October 2021	We are in agreement with the methodology to be adopted for the LVIA and with the Study Area being defined as 45 km from the proposal.	Noted
	Detailed consideration should be given to the landscape and visual effects of felling and restocking proposals (both adverse and beneficial) in the LVIA and mitigation and landscape enhancement should be optimised in the design of any Wind Farm Forest Plan and/or compensatory planting. Proposed forest felling areas should be shown in relevant visualisations from nearby LVIA viewpoints.	Consideration has been given to how felling and restocking may influence the potential effects which will result from the Proposed Development.
	The Water of Girvan Valley Local Landscape Area (LLA) will replace the Scenic Area designation in South Ayrshire and	Effects on the qualities of local landscape
	effects on the character and qualities of this designated area should be assessed in the LVIA.	designations are set out in Section 5.8.
	We disagree that the Merrick Wild Land Area (WLA) should be scoped out of the assessment. While the proposal would be seen further away than the operational Dersalloch wind farm, the turbines would be substantially larger and lit at night. An assessment should be undertaken using NatureScot Assessing Impacts on Wild Land Areas – Technical Guidance (October 2020). Particular focus should be on the potential effects of turbine lighting on the WLA and we would wish to see a night-time visualisation from Viewpoint 14 from Cornish Hill, with the cumulative effects of lighting associated with the Clauchrie, Craiginmoddie and Carrick wind farms also considered.	A Wild Land Assessment has been undertaken and is included in Technical Appendix 5.6 and a night-time visualisation from Cornish Hill is provided in Figure 5.2.15.
	We note that no conclusion is reached in paragraph 5.4.10 of the Scoping Report as to whether, or how, potential effects on the Galloway Dark Sky Park will be assessment in the LVIA. Confirmation on the proposed approach is required from the applicant.	Effects on the Galloway Dark Sky Park are considered in Technical Appendix 5.5.
	A detailed ZTV should be provided in the EIA-R based on an OS 1:50,000 scale map base within 15km of the proposal to allow more accurate appraisal of potential visibility.	A detailed ZTV map is included in Figure 5.2c.
	The representative viewpoints listed in Table 5.1 are acceptable to the Council.	Noted
	We agree with the proposed approach to focus the cumulative landscape and visual assessment (CLVIA) on wind farms lying within 25km of the proposal.	Noted
East Ayrshire Council Scoping response 30 September 2021	The Planning Authority agrees that a 45 km study area and 60 km cumulative study area are appropriate in this case given the scale of the proposed turbines. Based on the indicative ZTV provided detailed study areas of 20 km for the project-alone and 25km for cumulative landscape and visual impacts are considered reasonable.	Noted
	The Applicant is advised to keep the cumulative situation under review during the preparation of the EIA Report as this is an evolving situation, particularly in this part of the district where there is considerable wind energy development pressure.	Noted. The cumulative baseline is presented at Section 5.8.
	In addition to the cumulative effects with other wind farms, the Applicant should give consideration to potential effects with other tall structures such as electricity pylons and any nearby mineral extraction sites (or former sites yet to be restored) which could contribute to cumulative landscape and visual impacts.	Existing features within the landscape, such as open cast mines and electricity pylons, are considered as part of the LVIA baseline.
	Regarding the proposed viewpoint locations as set out in Table 5.1, The Planning Authority would agree to these (although relevant neighbouring authorities may wish to clarify if locations in their areas are acceptable to them). A viewpoint from the core path which runs through the Proposed Development Area would be requested in addition.	A viewpoint from the core path crossing the Proposed Development Area was considered but it was concluded that this would be too close to the turbines to convey meaningful information.
	In terms of the night-time photomontage visualisations, the Planning Authority would agree with the viewpoints listed in	A night-time viewpoint from Dalmellington is included in 5.2.11.

	section 5.3.22 of the Scoping Report. In addition we would also request Viewpoint 6 (Dalmellington) be included.	
	Some form of wireline or visual produced to evidence whether or not the turbines would be visible at hub height from the Scottish Dark Sky Observatory (currently damaged by fire but still worth considering in the event this tourist facility be rebuilt and reopened to the public). Lighting impacts on the Dark Sky Park will also need to be assessed. Any measures to reduce the number of lights required should be reported within the EIA Report alongside any details regarding any mitigation of the lighting where available.	A wireline has been produced that shows there will be no visibility of turbines or turbine lighting from the location of the SDSO. Lighting effects are considered in the night time assessment in Technical Appendix 5.5.
	Given the increasing numbers of turbines operational / consented / proposed which have / will require visible aviation safety lighting then the night-time lighting assessment shall also include a cumulative night-time assessment taking into account other wind farms / turbines which have / will require visible aviation lighting and any other tall structures which have visible aviation lighting on them.	Lighting effects are considered in the night time assessment in Technical Appendix 5.5.
	The Planning authority welcomes the addition of a Residential Visual Amenity Assessment and would request that cumulative schemes are shown on separate wirelines to the project-alone wirelines. Additionally photomontages should be considered from some properties to assist the consideration and assessment of impacts from them where the turbines are more prominent.	The residential visual amenity assessment is included in Technical Appendix 5.4. Wirelines include cumulative schemes. Photomontages have not been undertaken from individual properties.
	The Council's East Ayrshire Landscape Wind Capacity Study should be considered when assessing landscape character and visual impacts rather than just those landscape character areas identified by NatureScot.	The Landscape Wind Capacity Studies for East and South Ayrshire have been used as the baseline for assessment.
	The Council welcomes the inclusion of an assessment of the Sensitive Landscape Areas.	Noted, see Section 5.8.
John Muir Trust Scoping response 17th September 2021	Request that impacts on the Merrick Wild Land Area are considered through a Wild Land Assessment, including cumulative impacts of the Proposed Development and Dersalloch Wind Farm on the Wild Land Area.	A Wild Land Assessment has been undertaken and is included in Technical Appendix 5.6.
NatureScot Scoping Response 30th September 2021	The consultee agrees that the location of the Proposed Development behind Dersalloch Wind Farm would likely scope out the requirement for a day time Wild Land Assessment, however the consultee welcome photomontages/ wirelines from Cornish Hill and other viewpoints to clarify and confirm this.	In response to the Scoping Opinion, a Wild Land Assessment has been undertaken and is included in Technical Appendix 5.6.
	The submitted ZTV does not clearly indicate theoretical visibility from the north-eastern part of the Merrick Wild Land Area so this should be clarified and a further viewpoint should be selected from within this interior if necessary.	A detailed ZTV is included in Figure 5.2c
	At 200m the turbines will require night-time lighting. Lights would be seen at dusk and at night from Cornish Hill as well as from other elevated locations in the northern part of the WLA. Accordingly we advise that a night time WLA assessment is carried out for this proposal using Cornish Hill as a representative night time viewpoint. As above, the detailed ZTV for the north-eastern interior and requested indicative wirelines will clarify whether an additional viewpoint should be used to assess night-time lighting impacts on the wild land qualities of the WLA.	A Wild Land Assessment has been undertaken and is included in Technical Appendix 5.6.and a night time visualisation has been from Cornish Hill is provided in Figure 5.2.15. No further viewpoints have been used to illustrate the view from the WLA interior.
	Agreement that a 45km study area is appropriate for the height of proposed turbines and that a more detailed study area (anticipated to be within 15-20km of the Proposed Development Area in the Scoping Report), will be appropriate in focussing the assessment on potentially significant effects. The applicant however should ensure that the detailed study area contains all relevant sensitive receptors likely to have potential for significant effects.	Noted
	Use of Guidelines for Landscape & Visual Impact Assessment: Third Edition (Landscape Institute and IEMA, (2013) ('GLVIA3'), and other good practice guidance issued by the Landscape Institute and NatureScot is considered appropriate.	Noted
	It is noted that the scoping report provides a reasonable spread of viewpoints however it is requested that each is micro-sited to show the worst case scenario. It is noted that the consultee reserves the option to request additional viewpoints as the application progresses should they consider it necessary.	All viewpoints were micro-sited in the field. Further consultation was undertaken with Nature Scot as set out below.
	Consultee welcomes clear numbering of all turbines on at least one visualisation for each viewpoint. It is also suggested that forestry felling is shown in any visualisation from a high level viewpoint that looks down into the Proposed Development Area.	Felling is illustrated in the visualisations for Viewpoint 2 Auchenroy.
	The consultee agrees that the developments shown on Figure 5.5 and listed in Table 5.2 appear to be an accurate representation of existing, consented and application-stage developments within 25km of the Proposed Development. However, the relevant local authorities should be contacted to confirm that this is an up-to-date list of projects.	Noted
	The consultee notes that schemes at scoping stage and which lie near to the Proposed Development, where there is potential for significant effects, will only be included in the cumulative assessment where it is deemed appropriate and when sufficient design information is available in the public domain. In this respect, it is advised that Carrick Wind Farm currently at scoping should be included. It is also advised that the applicant includes any further relevant schemes that are scoped prior to the submission of Sclenteuch.	An application for Carrick Wind Farm has since been included. Knockkippen is included as a scoping scheme.
	The consultee agrees that all relevant landscape or visual receptors have been identified on the basis of the information currently available in the Scoping Report.	Noted
ScotWays Scoping response 22nd September 2021	The consultee anticipates that the applicant will take into account both recreational amenity and landscape impacts in developing their proposals for this Proposed Development	Noted

	Area. The consultee will consider these issues further should this scoping stage lead to a planning application.	
Crosshill, Straiton and Kirkmichael Community Council Scoping response 8th October 2021	In response to question 5.6.3 of the scoping report (cumulative sites), the consultee notes that Carrick, Knockcronal and Knockkippen Wind Farms have been missed.	These wind farms are included in the cumulative assessment, see Table 5.8.
	In response to question 5.6.4 of the scoping report (landscape and visual receptors), the consultee notes that Craigengillan House and estate has not been included.	Effects on designed landscapes are considered in Chapter 6: Cultural Heritage
	In response to question 5.6.5 of the scoping report (consultees), the consultee suggests that Galloway and Southern Ayrshire Biosphere, the Dark Sky Park, Scottish Mountaineering and the Ramblers' Association should be consulted.	These organisations were consulted through the Scoping process.
East Ayrshire Council Post-Scoping consultation response 8th March 2022	With regards to effects on the Dark Sky Park, control over light pollution is an important matter to retain the qualities of the Dark Sky Park designation. Aviation warning light, by its nature, must be visible to aircraft which would be flying overhead. Presumably therefore the lights are directed upwards to a certain extent to enable visibility by aircraft. As such, there is presumably the risk of a degree of light pollution/spill including reflectance against overhead clouds possible as the light is directed / visible above the turbines. Therefore a lack of direct visibility of aviation lights on turbines at hub height from certain locations wouldn't appear to be an appropriate assessment of the potential effects of light pollution on the Dark Sky Park where indirect / spill effects could still affect the night sky above the turbines. As such the Council would not consider this matter can be scoped out of the EIA Report.	Effects on the Dark Sky Park, including consideration of light spill, are considered in the Turbine Lighting Analysis by Dr Stuart Lumsden (Technical Appendix 5.7).
	The Council notes the intended inclusion of Knockkippen in the cumulative assessment and agrees to its inclusion.	Noted
South Ayrshire Council Post-Scoping consultation response 23rd February 2022	South Ayrshire Council welcome the inclusion of a night time photomontage from Cornish Hill. However, while the reasoning behind the scoping out of the Dark Skies Park from detailed assessment is appreciated, I note that the LUC letter to the ECU dated 8th February 2022 does not mention the intended approach for assessing effects on the Merrick Wild Land Area. The Council's Landscape consultant has reviewed the Scoping Opinion and notes that NatureScot, while accepting that day time effects would be likely to be reduced as the proposed turbines lie behind Dersalloch, advise that a night-time Wild Land assessment should be undertaken within the LVIA.	A Wild Land Assessment has been undertaken and is included in Technical Appendix 5.6 and a night time visualisation has been from Cornish Hill is provided in Figure 5.2.15.
	The Council can confirm that we are in agreement with the wind farm developments to be considered in the CLVIA.	Noted
NatureScot Post-Scoping consultation response 11th March 2022	No further comments on the selection of viewpoints, however welcome VP 15 (Cornish Hill) as a night-time viewpoint.	Noted
	Note that there is theoretical visibility of the Proposed Development from various locations within the Merrick WLA and advise that a WLA assessment is carried out. At 200m, the proposed turbines would require aviation lighting so this should be factored into the discussion and assessment of effects on the WLA. The WLA assessment should also consider the likely cumulative effects on the Merrick WLA of the proposal in combination with existing wind farms and with those at application including, in particular, Craiginmoddie, Knockcronal and Carrick. We advise that Clauchrie (at appeal) is also included. The assessment should also consider the cumulative effects of night-time lighting on the WLA.	A Wild Land Assessment has been undertaken and is included in Technical Appendix 5.6.
East Ayrshire Council Post-Scoping consultation response 6th April 2022	The existing consent for Overhill (10 turbines at 149.9m to blade tip) and the consent for Polquhairn (9 turbines at 100m to blade tip) should also be included. In terms of the cumulative assessment as part of the LVIA, ensure that the existing consents for those schemes are assessed cumulatively as well as the pending schemes as either scenario (consented developments progress, or pending developments receive consent) could transpire at this stage.	Where a wind farm proposal is subject to an existing consent as well as a pending application, as in the case of Overhill and Polquhairn, both schemes are considered in the cumulative LVIA. See Section 5.7.

5.4 Methodology

5.4.1 The assessment methodology for the LVIA has been developed in accordance with the principles set out in GLVIA3 and other good practice guidance documents as set out in Section 5.4 above.

Scope of Assessment

5.4.2 The LVIA considers the potential effects of the Proposed Development on:

- the landscape as a resource in its own right (caused by changes to the constituent elements of the landscape, its specific aesthetic or perceptual qualities and the character of the landscape); and
- views and visual amenity as experienced by people (caused by changes in the appearance of the landscape).

Effects Assessed in Full

5.4.3 This assessment considers physical changes to the landscape as well as changes in landscape character. It also considers changes to areas designated for their scenic or landscape qualities, and visual impacts of the Proposed Development as perceived by people.

5.4.4 All potentially significant landscape and visual effects have been examined, including those relating to construction, operation and decommissioning.

5.4.5 Due to the requirement for visible aviation lighting on the turbines, effects on night time views have been examined.

5.4.6 The effects of the Proposed Development, including lighting, on the attributes of the Merrick Wild Land Area have been examined.

5.4.7 The effects of the Proposed Development on the visual component of residential amenity have been examined.

5.4.8 Potentially significant cumulative landscape and visual effects have also been examined.

Effects Scoped Out

5.4.9 On the basis of the desk-based and field survey work undertaken, the professional judgement of the LVIA team, experience from other relevant projects and advice from consultees, the following topic areas have been 'scoped out' of detailed assessment:

- effects on receptors beyond 45km from the nearest turbine, where it is judged that significant effects are unlikely to occur;
- effects on landscape and visual receptors that have minimal or no theoretical visibility (as indicated by the ZTV) and are therefore unlikely to be subject to significant effects;
- effects on locally designated landscapes beyond a 20km radius from the nearest turbines, from where it is judged that potential significant effects on key characteristics and/or special qualities are unlikely to occur;
- effects on receptors travelling along routes beyond 15km from the nearest turbine where it is judged that significant visual effects are unlikely to occur
- effects on receptors within local communities beyond 15km;
- cumulative effects in relation to turbines under 50m to blade tip height, and single turbines beyond 5km from the proposed turbines; and
- cumulative effects in relation to wind farms at scoping stage, other than the proposed Knockkippen Wind Farm which has been included in the CLVIA due to its proximity to the Proposed Development.

Baseline Characterisation

Study Area

5.4.10 Relevant published guidance (SNH, 2017b) states that an initial distance of 45km radius should be considered as a study area for wind farms with turbines over 145m to tip height. In agreement with consultees as noted in Table 5.1, this has been adopted as the Study Area, as shown in Figure 5.1.

Desk Study

5.4.11 Characterisation of the landscape baseline is based on material published in the Landscape Wind Energy Capacity Studies for East and South Ayrshire (Carol Anderson Landscape Associates, 2018a, 2018b). These studies build on the national programme of landscape character assessments originally carried out by SNH and provide more detail on landscape and visual sensitivity to wind turbines.

5.4.12 Information on protected and designated landscapes has been derived from:

- Wild Land Area descriptions published by Nature Scot;
- Local planning documents published by East Ayrshire Council and South Ayrshire Council.

5.4.13 Characterisation of the visual baseline has been informed primarily by field work, supplemented by examination of maps, aerial imagery and street level photography available on line.

5.4.14 The following data sources have informed the assessment:

- Ordnance Survey (OS) Maps at 1:50,000 Scale (Landranger) and 1:25,000 Scale (Explorer);
- Mapping, aerial and street level imagery available on line;
- OS Terrain 5 and 50 height data;
- Data from other wind farm applications; and
- East Ayrshire Council, South Ayrshire Council and the ECU planning portals.

Field Survey

5.4.15 Field survey work was carried out during several visits under differing weather conditions between November 2021 and May 2022, and records were made in the form of field notes and photographs. Field survey work included visits to the Proposed Development Area, viewpoints and designated landscapes, and extensive travel around the study area to consider potential impacts on landscape character and on experiences of views seen from specific viewpoints, settlements and routes.

Assessing Significance

5.4.16 Full details of the LVIA Methodology are presented in Technical Appendix 5.1, with a summary of the key stages below.

Sensitivity

5.4.17 Judgements regarding the sensitivity of landscape or visual receptors require consideration of both the susceptibility of the receptor to the type of development proposed, and the value attached to the landscape or visual resource. Judgements are recorded as high, medium or low.

Magnitude

5.4.18 Judgements regarding the magnitude of landscape or visual change are recorded as high, medium, low or barely perceptible, and combine an assessment of the scale and geographical extent of the landscape or visual effect, its duration and its reversibility.

Significance

5.4.19 The predicted significance of the effect is determined through a standard method of assessment based on professional judgement and guidance, considering both sensitivity and magnitude of change. Effects are assessed as major, moderate, minor or none. Major and moderate effects are considered significant in the context of the EIA Regulations.

5.4.20 Judgements are made on a case-by-case basis. Technical Appendix 5.1 provides full details of the criteria considered in judging the identified aspects of sensitivity (susceptibility and value) and magnitude of change (scale, geographical extent, duration and reversibility), and the grades used to describe each. In terms of the direction of effects (positive or adverse) there is a wide spectrum of opinion with regard to wind energy development. Taking a precautionary stance, effects are assumed to be adverse unless stated otherwise.

5.4.21 Where the magnitude of change that will occur as a result of the introduction of the Proposed Development in the primary LVIA is identified as being low, potential cumulative effects on the relevant landscape or visual receptor are not assessed in the cumulative assessment. In these instances, it is considered that owing to the limited magnitude of change, there will not be potential for significant cumulative effects to arise.

Visualisations and Modelling

5.4.22 The methodology for producing the visualisations (wireframes and photomontages) was based on current good practice guidance as set out by NatureScot (SNH, 2017b). Detailed information about the approach to viewpoint photography, ZTV and visualisation production is included in Technical Appendix 5.1.

5.5 Baseline

5.5.1 This section presents an overview of the landscape and visual baseline of the Study Area and identifies the receptors that will be examined further. It also considers the potential future baseline in terms of other ongoing developments.

Current Baseline – Landscape

The Proposed Development Area and Context

5.5.2 The Proposed Development Area lies around 1 km to the south of the village of Patna and approximately 3 km to the north-east of the village of Straiton and is located within both the East Ayrshire Council and South Ayrshire Council areas. The Proposed Development Area occupies forested moorland to the west of the River Doon. The majority of the Proposed Development Area is over 200 m above Ordnance Datum (AOD), with a high point at Green Hill (306 m AOD).

5.5.3 The Proposed Development Area is forested to the west side of Keirs Hill, with open moorland to the east. A large plantation of Sitka spruce exists to the west of the Proposed Development Area and covers Lambdoughty Hill, Cloncaird Moor and Glenside Hill, from Patna in the north-east to the B741 in the south. Parts of the plantation to the north of the Proposed Development Area have been felled and replanted in 2013. A man-made reservoir, Loch Spallander, lies less than 1 km to the west of the Proposed Development Area, held back by an earth dam. A 275 kV overhead power line runs north-south through a wayleave located in the forestry immediately to the west of the Proposed Development.

5.5.4 To the east, the River Doon meanders through a broad valley, followed by the A713 and a single-track railway. The valley has a history of mineral extraction, which has left its mark on the landscape, most prominently in the former surface mine at Dunston Hill. Patna was established in the early 19th century as a mining town, and an ironworks at Waterside opened in 1848. A heritage railway now operates occasionally at the Scottish Industrial Railway Centre at Waterside. The remains of mineral railways cross the valley sides, and a large bing occupies land to the west of Waterside.

5.5.5 To the south of Dalmellington, the broad Doon Valley becomes narrower, with more intricate hills along the valley sides replacing the smooth slopes around Waterside and Patna. This more intimate part of the Doon Valley is influenced by the designed landscape of Craigengillan. The ground rises to the south of the Proposed Development Area, to a higher plateau with distinct hills including Auchenroy Hill, Turgeny and further west Craigengower which is topped by a monumental obelisk.

5.5.6 To the west of the Proposed Development Area, beyond the broad, forested Sclenteuch Moor, is the valley of the Girvan Water. Within the valley is the conservation village of Straiton overlooked by Craigengower to the south. To the north of the village are the policy woodlands associated with the designed landscape of Blairquhan House.

The Study Area

5.5.7 The study area, shown in Figure 5.1, extends 45 km from the outermost turbines of the Proposed Development in all directions. The majority of the west and south-western part of the study area extends over the South Ayrshire council area, with the Firth of Clyde beyond. Most of the east, north and north-eastern part of the study area lies within the East Ayrshire council are. Some areas beyond 30 km to the north and north-east extend into the fringes of South Lanarkshire, East Renfrewshire and North Ayrshire council areas. The majority of the south and south-eastern part of the study area lies within the Dumfries and Galloway council area. The study area extends from Thornhill in the east to the Firth of Clyde in the west, and from south of East Kilbride in the north to Newton Stewart in the south.

5.5.8 The landscape character of the study area is varied with areas of uplands and rolling hills intersected by valleys to the east within the Southern Uplands, transitioning to lower lying settled areas along the coastline within the western part of the study area. Landscape character includes: rugged uplands, rolling hills and moorland plateau within the central, eastern and southern parts of the study area; lower lying hills and coastal headlands in the west; and plateau farmland and moorland transitioning to lowland farmland in the north.

5.5.9 Within the study area, coniferous forestry is a common feature of the upland areas within the central, eastern and southern parts of the study area, including across the Carsphairn Forest area in the east and Carrick and Galloway in the south. Smaller blocks of forestry and pockets of woodland are scattered throughout the study area, namely along valley floors and on lower slopes including along the Doon Valley and the Nith Valley to the east, and throughout the coastal plateau to the west. Open and forest covered moorland which then transitions to lower lying agricultural land is also a feature within parts of the study area to the south-west and north.

5.5.10 The study area is relatively well-populated, with the closest settlements being Patna, located around 1.5 km to the north of the Proposed Development, and Waterside around 2 km to the north-east. To the east, Dalmellington is approximately 5 km away, and Straiton is approximately 3 km to the south-west. Generally, the study area is more populous in the north and west, and more sparsely settled in the hilly east and south.

5.5.11 The A713 forms part of the Galloway Tourist Route and runs between Ayr in the north-west and Castle Douglas in the south-east (outside of the study area) and is the closest road as it bounds parts of the Proposed Development Area to the north-east. The Doon Valley Railway is located alongside the A713, and functions as a heritage railway. To the south is the B741, which meets the Proposed Development Area boundary in two locations as the road runs between New Cumnock to the north-east and Girvan to the south-west. There are a number of further transport routes within the study area including further A and B class roads, minor road networks and railway lines.

5.5.12 There are numerous core paths within the study area, including a network of core paths and footpaths within 10 km of the Proposed Development Area, two of which pass through the western part of the Proposed Development Area. There is also a number of Scottish Great Trails within the study area, including the Ayrshire Coastal Path, located approximately 14 km to the west of the Proposed Development Area at its closest point, the River Ayr Way, located approximately 14 km to the north of the Proposed Development Area at its closest point and the Southern Upland Way, located approximately 24 km to the south-east at its closest point.

5.5.13 Other recreational routes within the study area include National Cycle Network (NCN) routes. NCN Route 7 is located within 10 km to the west of the Proposed Development Area at its closest point as it runs from North England to Inverness-shire, and NCN Routes 73 and 753 are located over 30 km to the north.

5.5.14 There are several existing large-scale wind farms within the study area. The closest wind farms are Dersalloch, located approximately 1 km to the south of the Proposed Development Area, and Hadyard Hill, located approximately 18.2 km to the south-west. Refer to Table 5.4 for further details of operational wind farms in the study area.

Landscape Character

5.5.15 Landscape character is described in the Landscape Wind Energy Capacity Studies for East and South Ayrshire (Carol Anderson Landscape Associates, 2018a, 2018b). These studies build on the national programme of landscape character assessments originally carried out by SNH, and provide more detail on landscape and visual sensitivity to wind turbines. The Dumfries and Galloway Wind Farm Landscape Capacity Study (Carol Anderson Landscape Associates, 2017) provides similar information for the south-east part of the study area. Landscape Character Types (LCTs) across the study area are shown in Figure 5.1.4, and are shown overlaid with the ZTV in Figure 5.1.5.

5.5.16 Theoretical visibility of the Proposed Development, as indicated by the ZTV (Figure 5.2), is used as a means of identifying which LCTs require further assessment, and which LCTs can be scoped out because they are unlikely to experience significant

effects. LCTs beyond 15 km from the Proposed Development Area are not considered further within the assessment as significant effects on their underlying character are unlikely to arise as a result of the Proposed Development. The LCTs within 15 km of the Proposed Development Area are listed in Table 5.2, which presents an initial appraisal of whether significant effects are likely. Where no significant effects are likely, no further assessment is undertaken.

Table 5.2: Landscape Character Types

Landscape Character Type	Theoretical visibility of the Proposed Development to determine if LCT carried forward for detailed assessment
17b Foothills with Forest west of Doon Valley	The Proposed Development is within this LCT. Considered in the assessment.
4b Brown Carrick Hills	Some theoretical visibility at 10-15 km. Considered in the assessment.
5 Coastal Valley with Policies	Limited theoretical visibility over 12 km. Not considered in the assessment.
7c East Ayrshire Lowlands	Some theoretical visibility at 5-15 km. Considered in the assessment.
7d South Ayrshire Lowlands	Some theoretical visibility at 5-15 km. Considered in the assessment.
9 Lowland River Valley (River Doon)	Some theoretical visibility at 5-15 km. Considered in the assessment.
9 Lowland River Valley (River Ayr)	Limited theoretical visibility over 12 km. Not considered in the assessment.
10 Upland River Valley (River Doon)	Extensive theoretical visibility. Considered in the assessment.
12 Middle Dale (Girvan Water)	Extensive theoretical visibility. Considered in the assessment.
13 Intimate Pastoral Valley (Girvan Water)	Although within c.5 km, theoretical visibility from this enclosed valley is limited. Not considered in the assessment.
13 Intimate Pastoral Valley (River Stinchar)	Very limited theoretical visibility. Not considered in the assessment.
15 Upland Basin	Very limited theoretical visibility. Not considered in the assessment.
17a Foothills with Forest & Opencast Mining	Theoretical visibility around 5 km. Considered in the assessment.
17d Maybole Foothills	Extensive theoretical visibility. Considered in the assessment.
17c Foothills with Forest & Wind Farm	Some theoretical visibility at 5-10 km. Considered in the assessment.
20a East Ayrshire Southern Uplands	Limited theoretical visibility over 12 km. Not considered in the assessment.
20c Southern Uplands & Forestry	Some theoretical visibility at 7-10 km. Considered in the assessment.
21 Rugged Uplands, Lochs & Forest	Some theoretical visibility at 5-15 km. Considered in the assessment.
DGC 19a Southern Uplands with Forest	Limited theoretical visibility over 12 km. Not considered in the assessment.
DGC 9 Upper Dale	Limited theoretical visibility over 12 km. Not considered in the assessment.
DGC 21 Rugged Granite Upland	Limited theoretical visibility over 12 km. Not considered in the assessment.
DGC 21a Rugged Granite Upland with Forest	Limited theoretical visibility over 12 km. Not considered in the assessment.

Landscape Capacity

5.5.17 The East Ayrshire Landscape Wind Energy Capacity Study and the South Ayrshire Landscape Wind Capacity Study (Carol Anderson Landscape Associates, 2018a, 2018b) consider the landscape and visual sensitivity of the LCTs noted in Table 5.2, as well as potential cumulative issues.

5.5.18 The notion of landscapes having a fixed 'capacity' is increasingly questioned, as policy imperatives such as the declared climate emergency imply that greater levels of landscape change must be accepted. Nature Scot state on their website that: "*wind energy studies should not be referred to as 'capacity studies' as no local or regional targets are available on which to determine the 'capacity' for development*."[1] However, the capacity studies do provide helpful guidance on the underlying sensitivity of the landscape, which does not change with policy.

5.5.19 The Proposed Development Area forms part of LCT 17b Foothills with Forest west of Doon Valley. This LCT is identified as being of high sensitivity to very large turbine typology (>130 m).

5.5.20 The studies state that "Although the scale and generally simple landform and land cover of these uplands could relate in principle to some larger turbine typologies, the limited extent of these uplands increases sensitivity as they lie relatively close to settled valleys and hills popular with walkers." The studies provide key challenges and opportunities for LCT 17b, which have informed the wind farm design and are discussed in Technical Appendix 5.2: Assessment of Effects on Landscape Receptors.

[1] See https://www.nature.scot/professional-advice/landscape/landscape-tools-and-techniques/landscape-sensitivity-studies

Designated and Protected Landscapes

5.5.21 There are no National Parks or National Scenic Areas within the study area.

Galloway Dark Sky Park

5.5.22 The Galloway Dark Sky Park is located within the southern part of the study area. A Dark Sky Park (DSP) is described as a place with exceptionally dark night skies and limited light pollution. The presence of the Proposed Development would not affect this designation, with the exception of aviation lighting.

5.5.23 The Core Area of the DSP is around 11 km from the turbines. A buffer zone extends beyond this to include the Craigengillan area, approximately 2 km at its closest to the turbines. Figure 5.1.7 shows theoretical visibility of turbine hubs (where aviation lighting will be mounted) across the DSP. Within the Core Area, theoretical visibility is limited to north-facing hillsides in the north, and limited areas of high ground around Merrick Summit. Within the buffer zone, there is theoretical visibility of hubs from high ground around 10km from the Proposed Development Area, and from limited areas closer to the Proposed Development Area, including Auchenroy Hill.

5.5.24 The Scottish Dark Sky Observatory, located at Craigengillan, is currently closed due to fire. At the request of SAC, a wireline is provided at Figure 5.2.17 with a viewer height of 9 m above ground to reflect the height of the Observatory. The wireline shows no visibility of turbine hubs from this location. Forestry and Land Scotland (FLS) has published a guide to viewing the night sky within the DSP, which recommends ten locations for stargazing. Analysis of the aviation lighting ZTV (Figures A5.5.1a and A5.5.1b) has shown that the aviation warning lights would not be visible from any of these.

5.5.25 Effects on the DSP are considered in Technical Appendix 5.5 Aviation Lighting Night Time Assessment and Technical Appendix 5.7 Turbine Lighting Analysis by Dr Stuart Lumsden.

Wild Land Areas

5.5.26 Wild Land Areas (WLA) are not designated but have been mapped and described by Nature Scot (SNH, 2014), and are considered sensitive to development. There is one WLA within the study area, shown on Figure 5.1.6. WLA 1 Merrick is located approximately 12 km to the south of the Proposed Development Area. The ZTV (Figure 5.1.7) identifies that theoretical visibility, including of aviation lighting, is limited to some north-facing hillsides in the north, and limited areas of high ground around Merrick Summit. The Proposed Development will be visible directly behind the operational turbines of Dersalloch Wind Farm.

5.5.27 As required by the Scoping Opinion, an assessment of effects on wild land has been carried out using relevant Nature Scot guidance (Nature Scot, 2020), and this is presented in Technical Appendix 5.6.

Locally Designated Landscapes

5.5.28 East Ayrshire Council identifies Sensitive Landscape Areas (SLA) in its LDP. The Doon Valley SLA extends from Dalrymple in the north to the hills above Loch Doon in the south and includes the eastern part of the Proposed Development Area. The River Ayr SLA is located approximately 9 km to the north and the Southern Uplands SLA is located approximately 11 km to the east. No detailed citations for these SLAs appear to be available, other than brief descriptions in an LDP background paper (East Ayrshire Council, 2015).

5.5.29 South Ayrshire Council identifies Scenic Areas (SA) in its LDP. SAs are extensive particularly across the southern part of South Ayrshire. SAC intend to replace the SA designation with Local Landscape Areas (LLA) and based on advice from SAC (see Table 5.1) these designations have been considered in the LVIA. There are ten LLAs within the study area, two of which are located to the north and north-west of the Proposed Development Area within 15 km, and the remaining eight located to the south-west of the Proposed Development Area at distances ranging between <5 km to over 35 km. The citations for the LLAs are presented in the South Ayrshire Local Landscape Designation Review (Carol Anderson Landscape Associates, 2018c).

5.5.30 There are two relevant Dumfries and Galloway local landscape designations, referred to as Regional Scenic Areas (RSAs). The Galloway Hills RSA is located approximately 11 km to the south-east and the Thornhill Uplands RSA is located approximately 30 km to the east.

5.5.31 There are further local landscape designations beyond 35 km in the study area, including within the North Ayrshire Council area and to the north-east within the South Lanarkshire Council area. Due to distance from the Proposed Development Area these have not been considered further.

5.5.32 Locally designated landscapes are listed in Table 5.3, which presents an initial appraisal of whether significant effects are likely based on the ZTV. Locally designated landscapes beyond 15 km from the Proposed Development Area are not considered further within the assessment as significant effects on their special qualities are unlikely to arise as a result of the Proposed Development. Where no significant effects are likely, no further assessment is undertaken.

Table 5.3: Locally Designated Landscapes

Area	Theoretical visibility of the Proposed Development to determine if carried forward for detailed assessment
East Ayrshire Sensitive Landscape Areas (SLA)	
Doon Valley SLA	Includes part of the Proposed Development Area and widespread theoretical visibility within 10 km. Considered in the assessment.
River Ayr SLA	Little or no theoretical visibility within 15 km. Not considered in the assessment.
Southern Uplands SLA	Limited theoretical visibility at over 12 km. Not considered in the assessment.
South Ayrshire Local Landscape Areas (LLA)	
Water of Girvan Valley LLA	Widespread theoretical visibility within 15 km. Considered in the assessment.
High Carrick Hills LLA	Some theoretical visibility within 15 km. Considered in the assessment.
Doon Valley LLA	Some theoretical visibility within 15 km. Considered in the assessment.
Brown Carrick Hills & Coast LLA	Widespread theoretical visibility within 15 km. Considered in the assessment.
Culzean LLA	Limited theoretical visibility, over 12 km. Not considered in the assessment.
Ayr Valley LLA	Limited theoretical visibility, over 13 km. Not considered in the assessment.
Stinchar Valley LLA	No theoretical visibility. Not considered in the assessment.
Dumfries and Galloway Regional Scenic Areas (RSA)	
Galloway Hills RSA	Limited theoretical visibility. Not considered in the assessment.

Other designations

5.5.33 There are a number of Gardens and Designed Landscapes (GDL) within the study area some of which are open to members of the public. While the presence of a GDL may affect the value assigned to the landscape resource, effects on the setting of GDLs are considered in Chapter 6: Cultural Heritage.

Existing Wind Farm Development

5.5.34 There are a number of wind farms that are operational or under construction across the Study Area. The assessment focuses on schemes within 25 km of the Proposed Development and these are listed in Table 5.4 below and shown on Figure 5.1.8. These wind farms are included as part of the current baseline for the LVIA and considered as part of the primary LVIA assessment. A cut-off date of 1st March 2022 was applied for the inclusion of developments within the cumulative assessment. Planned and consented wind farms are considered in the cumulative LVIA and are discussed in the Future Baseline section.

Table 5.4: Wind Farms in the Current Baseline

Name	Status	No of Wind Turbines	Blade Tip Height (m)	Distance from Proposed Development Area (km)
Dersalloch	Operational	23	125	3.2
South Kyle	Under Construction	50	149.5	14.4
Chapelton Farm, Turnberry	Under Construction	3	67	17.3
Hadyard Hill	Operational	52	111	18.2
Brockloch Rig 2 (formerly Windy Standard 2)	Operational	30	120	18.7
Brockloch Rig 1 (formerly Windy Standard 1)	Operational	36	62.5	20.6
Afton	Operational	27	120	21.4
Windy Rig	Operational	12	125	21.9
Tralorg	Operational	8	100	22.2
Assel Valley	Operational	11	110	23.4
Hare Hill Phase 1	Operational	20	63.5	24.2
Hare Hill Phase 2	Operational	35	91	25.1

Current Baseline – Visual

Analysis of Visibility of the Proposed Development

5.5.35 Figure 5.2 and Figure 5.3 show the theoretical visibility of the Proposed Development to blade tip height (up to 200 m) and hub height (up to 125 m) respectively. The ZTV indicates that across the Study Area theoretical visibility of the Proposed Development is relatively widespread within approximately 15km of the Proposed Development Area, becoming more localised beyond this distance, except for the north and west, particularly in the Firth of Clyde where theoretical visibility appears to be widespread.

5.5.36 Within 5 km of the Proposed Development Area there is theoretical visibility from the majority of the Doon Valley to the east, including from Waterside and the A713. To the north, there is theoretical visibility from Patna, the B730 and minor roads. There is theoretical visibility to the south, including from the B741 and the north facing slopes of the hills to the south. There is also theoretical visibility from Straiton and Blairquhan Castle to the south-west. To the west there is theoretical visibility across Cloncaird Moor, and intermittent theoretical visibility from the B7045.

5.5.37 Between 5 km and 10 km from the Proposed Development Area there is theoretical visibility from Dalmellington to the south-east and intermittent visibility from the slopes of the Doon Valley. There is no theoretical visibility from the valley floor, including from most of A713 at this distance. To the south of the Proposed Development Area theoretical visibility is scattered across both the open and forest covered north facing slopes between Big Hill of Glenmount to the south-east and Cairn Hill to the south-west. To the west, theoretical visibility is relatively widespread across the lower lying topography, including from hamlets such as Crosshill and parts of Kirkmichael and Aitkenhead. To the north and north-east, there is theoretical visibility from Dalrymple, Hollybush and the B7034, while elsewhere theoretical visibility is limited to scattered areas on the south facing slopes to the north and east of these settlements, with some larger areas of no theoretical visibility on north facing slopes.

5.5.38 Between 10 km and 20 km from the Proposed Development Area, theoretical visibility is generally more intermittent, and is most widespread across the lower lying coastal land to the west and north. This includes Maybole to the west and Ayr and Prestwick to the north-west, as well as the A77 which connects these settlements. From much of the coastline to the west there is no theoretical visibility due to intervening landform. To the south, there is scattered theoretical visibility across the Galloway uplands, including across parts of the Carrick Forest and the Galloway Forest Park. In other directions, theoretical visibility is limited to scattered areas on Proposed Development Area-facing slopes.

5.5.39 Between 20 km and 30 km from the Proposed Development Area, theoretical visibility is limited, with the exception of intermittent visibility to the north and north-east, and parts of the Firth of Clyde to the west. To the north, there is theoretical visibility from the coastal town of Troon, with intermittent visibility extending inland across Proposed Development Area-facing slopes to the north-east of the Proposed Development Area.

5.5.40 Beyond 30 km, theoretical visibility is limited to areas to the north around Ardrossan, Kilmarnock and Stewarton, and to the west across the Firth of Clyde, as well as some scattered patches on the south-eastern coast of Arran. Actual visibility from these locations will be limited in practice due to the distance from the Proposed Development Area.

Key Visual Receptors

5.5.41 Potential visual receptors include:

- People within local communities;[2]
- People travelling on roads (including recognised tourist routes);
- People engaged in recreational activities (e.g. hill walkers and cyclists); and
- People visiting areas of interest such as visitor attractions or viewpoints.

Local communities

5.5.42 Theoretical visibility of the Proposed Development from communities across the study area is illustrated by Figure 5.2 and described in Table 5.5 below. The ZTV does not take account of any screening or filtering of views by built form or vegetation, which will substantially reduce visibility from the majority of settlements. In order to focus on potentially significant effects, settlements from which there is no theoretical visibility are not considered further in this assessment (see ZTV in Figure 5.1.2). In addition, settlements with limited visibility over a longer distance (i.e. beyond 15 km from the Development), where views of the surrounding landscape (including the Proposed Development Area) are not important

[2] Individual residential properties are being dealt with separately through a Residential Visual Amenity Assessment (RVAA) which is presented in Technical Appendix 5.4.

to setting, and where it is unlikely that significant effects could occur, are not considered further in the assessment.

Table 5.5: Communities

Area	Theoretical visibility of the Proposed Development to determine if carried forward for detailed assessment
Within 5km	
Patna	Extensive theoretical visibility across the settlement, potential for close-range views of turbines. Considered in the assessment.
Waterside	Extensive theoretical visibility along this linear settlement, potential for close-range views of turbines across the Doon Valley. Considered in the assessment.
Straiton	Theoretical visibility from the settlement, potential for views of turbines across Sclenteuch Moor. Considered in the assessment.
5-10 km	
Dalmellington	Extensive theoretical visibility across Dalmellington, potential for views along the Doon Valley. Considered in the assessment.
Bellsbank	Theoretical visibility across the northern part of the settlement, potential for views along the Doon Valley. Considered in the assessment.
Kirkmichael	Limited theoretical visibility from the village itself, potential for views of turbines from the edges of and approaches to the village. Not Considered in the assessment.
Crosshill	Theoretical visibility across the centre of the settlement, potential for views from the east of the village. Considered in the assessment.
Hollybush	Intermittent theoretical visibility across this small settlement, potential for views from the north side of the village. Considered in the assessment.
Dalrymple	Some theoretical visibility from the northern part of the village, though few open locations which could have views of the Proposed Development. Significant effects unlikely and not considered further.
10-15 km	
Drongan	Limited theoretical visibility, significant effects unlikely and not considered further.
Coylton	Limited theoretical visibility from the northern fringes of the settlement, significant effects unlikely and not considered further.
Ayr	Extensive theoretical visibility, though few open locations where the Proposed Development would be seen. Significant effects unlikely and not considered further.
Alloway	Extensive theoretical visibility, though few open locations where the Proposed Development would be seen. Significant effects unlikely and not considered further.
Maybole	Extensive theoretical visibility across this elevated settlement, located on an eastward facing slope. Considered in the assessment.
Dailly	Some theoretical visibility, though few open locations with views towards the Proposed Development. Significant effects unlikely and not considered further.

Routes

5.5.43 Visibility from a route is not uniform along its entire length. This is because views of the surrounding landscape change as one moves along the route depending on the surrounding topography, buildings, structures and tree cover alongside the route. Theoretical visibility of the Proposed Development from routes across the Study Area is illustrated in Figure 5.2. They include a hierarchy of roads, railways and recreational routes (promoted long distance footpaths, Core Paths and cycle routes). Road and rail routes tend to follow low lying areas or valleys, but walking routes are more variable and can pass over hills and along ridges.

5.5.44 Based on an analysis of theoretical visibility and potential views, Table 5.6 provides information on which routes have been carried forward for detailed assessment. Due to the lower susceptibility of receptors typically using roads and railways, those beyond 10 km from the Proposed Development Area have been scoped out of the assessment, as significant effects are judged to be unlikely. Minor roads beyond 5 km have been scoped out of the assessment as they tend to be less frequently used by large numbers of road users. Due to the higher susceptibility of receptors using promoted long-distance footpaths and cycle routes, these have been included at up to 15 km from the Proposed Development Area. Where there is limited theoretical visibility, or where actual visibility from a route is likely to be limited due to localised screening, these routes are not considered further in this LVIA, as the likelihood for significant sequential effects is limited.

Table 5.6: Routes

Area	Theoretical visibility of the Proposed Development to determine if carried forward for detailed assessment
Roads and railways within 10 km	
Minor roads within 5 km of the Proposed Development Area	Some visibility from minor roads to the north and west of the Proposed Development Area. Considered in the assessment.
A713	Part of Galloway Tourist Route and follows part of the north-eastern boundary of the Proposed Development Area. Extensive theoretical visibility within 5 km of the Proposed Development Area. Considered in the assessment.
A77	Approximately 9 km north-west of the Proposed Development Area at its closest point. Theoretical visibility limited to a 2 km section north of Maybole. Not considered in the assessment.
B741	Meets the southern boundary of the Proposed Development Area. Extensive theoretical visibility within 5 km of the Proposed Development Area. Considered in the assessment.
B7045	Approximately 2 km west of the Proposed Development Area at its closest point. Intermittent theoretical visibility within 10 km of the Proposed Development Area. Considered in the assessment.
B730	Approximately 3.5 km north of the Proposed Development Area at its closest point. Limited theoretical visibility within 10 km and beyond. Not considered in the assessment.
Glasgow Ayr Stranraer railway	Approximately 8 km north-west of the Proposed Development Area at its closest point. Intermittent theoretical visibility to the north of Maybole. Not considered in the assessment.
Recreational routes within 15 km	
Patna to Straiton Core Path	Theoretical visibility from most of this route between Patna and Straiton, passing the Proposed Development Area. Considered in the assessment.
Core Paths within the Doon Valley	Theoretical visibility from routes on the east side of the Doon Valley above Patna and Waterside, within 5 km of the Proposed Development Area. Considered in the assessment.

Core Paths around Straiton	Theoretical visibility from routes south and west of Straiton, within 5 km of the Proposed Development Area. Considered in the assessment.
National Cycle Network Route 7	Approximately 6.3 km west of the Proposed Development Area at its closest point. Extensive theoretical visibility within 15 km of the Proposed Development Area. Considered in the assessment.
Ayrshire Coastal Path	Approximately 14 km north-west of the Proposed Development Area at its closest point. Limited theoretical visibility along a small stretch through Ayr. Not considered in the assessment.
River Ayr Way	Approximately 14 km north of the Proposed Development Area at its closest point. Intermittent theoretical visibility. Not considered in the assessment.
Hill routes in the Southern Uplands	Theoretical visibility from several summits within 25 km and occasional high points within 15 km, likely to be accessed by walkers. Considered in the assessment.

Residential Visual Amenity Assessment

5.5.45 Views from residential properties within approximately 2 km of the nearest wind turbine locations have been assessed as part of a Residential Visual Amenity Assessment (RVAA). The RVAA is presented in Technical Appendix 5.4: Residential Visual Amenity Assessment.

Selection of Viewpoints for Assessment

5.5.46 This section sets out the viewpoints that are used to represent and assess the visual effects of the Proposed Development. The viewpoint list is a representative selection of locations agreed with the statutory consultees; it is not an exhaustive list of locations from which the Proposed Development will be visible.

5.5.47 A total of 16 viewpoints were selected through desk study, site work and discussions with statutory consultees (as detailed in Table 5.7), and drawing initially on the viewpoints used for the Keirs Hill Wind Farm LVIA in 2015 (RES, 2015). The viewpoints are all publicly accessible as advocated by GLVIA3 and include:

- Locations selected to represent the experience of different types of receptor;
- Locations at different distances to provide a representative range of viewing angles and distances (i.e. short, medium and long distance views);
- Locations which illustrate key cumulative interactions with other existing, consented and/or proposed wind farms (i.e. either in combined or successive views);
- Locations which represent a range of viewing experiences (i.e. static views and points along sequential routes);
- Specific viewpoints selected because they represent promoted views or viewpoints within the landscape; and
- Illustrative viewpoints chosen specifically to demonstrate a particular visual effect or specific issue or those requested by key consultees (which could include restricted visibility in particular locations).

5.5.48 The viewpoints used to assess the visual effects are listed in Table 5.7 below and their locations are shown on Figure 5.2.

Table 5.7: Representative Viewpoints

No.	Name	Easting	Northing	Distance from closest turbine	Reasons for Selection
1	B741 at Gass	241782	605869	850 m	Represents close-range views from the road to the south of the Proposed Development Area. The road connects Straiton and Dalmellington and the viewpoint is located on the high point of the road (285 m AOD).
2	Waterside, Doon Valley Railway	243994	608395	2.0 km	Represents views experienced by residents of Waterside to the east of the Proposed Development Area, and visitors to the Doon Valley Railway. Dusk view included.
3	Waterside, north end	243599	608855	2.1 km	Represents views experienced by residents of Waterside to the east of the Proposed Development Area.
4	Patna	241958	610075	2.1 km	Represents views experienced by residents and road users. The viewpoint is adjacent to the A713. Dusk view included.
5	Auchenroy Hill	244545	605595	2.4 km	Represents views experienced by walkers. The hill is marked by a trig point and accessible from the Doon Valley to the east.
6	Lethanhill	242847	610391	2.9 km	Represents views experienced by walkers on paths providing access to the valley slopes east of Patna, including the site of Lethanhill.
7	Colonel Hunter Blair's Monument, Craigengower	239169	603968	3.1 km	Represents views experienced by walkers adjacent to a historic monument which is in a prominent location south-east of Straiton.
8	Straiton	237980	604931	3.2 km	Represents views experienced by residents of Straiton from the more open north end of the village.
9	Minor road west of Straiton	236987	604445	4.3 km	Represents views experienced by road users approaching Straiton from the south-west on a minor road, looking across the Girvan valley.
10	Blairquhan	235915	605761	4.8 km	Represents views experienced by visitors on the drive to Blairquhan. The viewpoint is in the grounds of Blairquhan House, included on the

					Inventory of Historic Gardens and Designed Landscapes in Scotland.
11	Dalmellington	248030	606079	5.6 km	Represents views from the settlement of Dalmellington. The viewpoint is at a high point on Knowehead, by the church. Dusk view included.
12	B7045 near Kirkmichael	233760	608819	6.8 km	Represents views experienced by road users Viewpoint is adjacent to the road approaching Kirkmichael from the west.
13	Maybole	230391	610372	10.4 km	Represents views experienced by residents and road users. The viewpoint is elevated on a railway bridge on the B7024 Alloway Road.
14	B741 near Ruglen	230403	604292	10.5 km	Represents views experienced by residents and road users. The viewpoint is adjacent to the B741, in the Girvan Valley.
15	Cornish Hill	240530	594265	12.5 km	Represents views experienced by walkers at the edge of Merrick Wild Land Area. The viewpoint is on a hilltop, accessible from the walkers' car park at Stinchar Bridge. Dusk view included.
16	Cairnsmore of Carsphairn	259441	597991	19.1 km	Represents views experienced by walkers and at this open hill summit, marked by a trig point, accessed via paths from the south-west.

Future Baseline

Cumulative Assessment Baseline

5.5.49 In line with Nature Scot guidance (Nature Scot, 2021), the scope for the assessment of cumulative landscape and visual effects begins with a 60 km radius 'search area' around the Proposed Development, to identify the distribution of wind energy development in the wider area.

5.5.50 The assessment of cumulative effects focuses on developments that are likely to give rise to significant cumulative effects and concentrates on the relationships between the Proposed Development and other consented and proposed developments (i.e. developments with a valid application or awaiting determination following appeal/public inquiry). In this instance the assessment focuses on schemes within 25 km of the Proposed Development, because of the limited scope for significant cumulative effects beyond this distance. This was agreed with consultees (see Table 5.1). Cumulative schemes within 25 km are listed in Table 5.8 below and shown on the wireframes in Figures 5.2.1 – 5.2.16 in order to illustrate the wider cumulative context.

5.5.51 Single turbines were given consideration where it was judged that potential interactions with the Proposed Development may give rise to significant cumulative effects; this was judged to be within 5 km of the Development.

5.5.52 Wind energy developments located within the 25 km radius study area, which are considered likely to give rise to significant cumulative effects and therefore included in the CLVIA have been selected as follows:

- Single wind turbines of ≥50 m blade tip height within a 5 km radius of the proposed outermost wind turbines; and
- Wind farms (e.g. clusters of 2 or more wind turbines) with wind turbines of ≥50 m blade tip height within a 25 km radius of the proposed outermost wind turbines.

5.5.53 Consented wind farms and wind farms currently in the planning system are considered as part of the assessment of potential future cumulative effects and included in the CLVIA. Proposals that have not yet progressed beyond scoping stage are not normally considered due to the uncertainty associated with these schemes. However, at the request of consultees, Knockkippen Wind Farm is included due to its proximity to the Proposed Development Area.

5.5.54 A cut-off date of 1st March 2022 was applied for the inclusion of developments within the cumulative assessment. These developments are listed in Table 5.8 below and shown on Figure 5.1.8. It should be noted that the baseline situation is constantly changing, and there may be changes to the status or list of wind energy developments considered between carrying out the assessment and the determination of the application. Unless there are substantial changes to proposals that will materially alter the pattern of cumulative development (such as the addition of a large wind farm located within a 10 km radius of the Proposed Development), it is considered that the cumulative assessment undertaken for the relevant landscape and visual receptors will remain relevant.

Table 5.8: Wind Farms in the Cumulative Baseline

Name	Status	No. of wind turbines	Max. blade tip height (m)	Distance from Proposed Development Area centre (km)
Knockkippen	Scoping	12	180	4.5
Knockshinnoch	Consented	2	126.5	6.3
Knockcronal	Application Submitted	9	200	8.7

Polquhairn[3]	Application Submitted	9	145	9.4
Carrick	Application Submitted	13	200	9.9
North Kyle Energy Project	Consented	49	149.9	11.1
Overhill[4]	Appeal / Public Inquiry	10	180	11.5
Craiginmoddie	Application Submitted	14	200	12.9
Benbrack Variation[5]	Consented	18	149.9	13.8
Enoch Hill	Consented	16	149.9	15.2
Kirk Hill – Kirkoswald	Consented	8	115.5	15.4
Greenburn Wind Park	Application Submitted	16	149.9	15.5
Brockloch Rig 3 (former Windy Standard 3)	Consented	20	177.5	17.5
Pencloe	Consented	19	149.9	19.0
Clauchrie	Appeal / Public Inquiry	18	200	21.9
Shepherds Rig	Appeal / Public Inquiry	17	149.9	24.7

5.5.55 Given the varied status, and therefore certainty, associated with unbuilt wind farms across the Study Area the CLVIA is structured to report on two potential development scenarios:

- Scenario 1: Higher level of certainty: the addition of the Proposed Development to a landscape with operational, under construction and consented wind farms; and
- Scenario 2: Lower level of certainty: the addition of the Development to a landscape with operational, under construction and consented wind farms, as well as all proposals listed in Table 5.8.

5.5.56 There are some sites, noted in Table 5.8, where there is an existing consent and also a further application for an alternative development. The consented developments will be assessed as part of the CLVIA in Scenario 1. The application stage developments will be assessed as part of the CLVIA in Scenario 2.

5.5.57 The CLVIA is focused on the assessment of 'additional' cumulative effects, i.e. the effect of adding the Proposed Development to a baseline of other built or unbuilt wind farms. Where 'total' cumulative effects (i.e. assessment which considers the effects if all current, past and future proposals are deemed present, including the Proposed Development) are significant, then reference is also made to these.

5.5.58 Combined ZTVs (Figures 5.1.9a-c) for other wind farms have been prepared to show where ZTVs overlap and where cumulative effects may arise.

5.5.59 Figure 5.1.8 illustrates the distribution and status of wind energy developments with the 25 km Study Area. General observations on the location, pattern and scale of existing wind energy development can be made. Operational wind farms are located on the Carrick uplands, with groups of wind farms west of Girvan, and south of New Cumnock. Consented wind farms largely build on this pattern, with a number of consented schemes located on the hills between Dalmellington and New Cumnock. This will expand the presence of wind farms north-east across the interior of these hills. In addition, smaller schemes have been consented north of the Girvan Valley, and at Knockshinnoch and Polquhairn to the north of Dalmellington.

5.5.60 Wind farms currently in the planning system are also mainly located within the same parts of the Carrick hills. This includes a group of schemes south of the Girvan Valley, and schemes to the north of Dalmellington (including applications for tip height increases of consented schemes). As such, the location of the Proposed Development, within the northern Carrick hills, fits in to the established pattern

The 'Do Nothing Scenario'

5.5.61 In the absence of the Proposed Development, it is likely that the land would continue under the same land use, and the character of the Proposed Development Area is therefore unlikely to change notably. Felling of the forestry within the Proposed Development Area would occur at some stage in the next few years, and trees may or may not be replanted.

5.5.62 The surrounding landscape and visual amenity is likely to be influenced by a number of 'forces for change'. Forces for change are those factors affecting the evolution of the landscape and which may, consequently, affect the perception of the study area in the near or distant future. Although prediction of these is necessarily speculative, those of particular relevance are discussed briefly below.

5.5.63 The Landscape Institute's Position Statement on Climate Change (Landscape Institute, 2008) acknowledges that changes in average temperatures, precipitation and extreme weather events will have an effect on the landscape. However, whilst a change in rainfall and rising temperatures are anticipated, it is not considered that this will appreciably change the baseline landscape conditions.

[3] Polquhairn has consent for a scheme of nine turbines with 100m blade tip height.
[4] Overhill has consent for a scheme of ten turbines with 149.9 m blade tip height.
[5] Benbrack Variation is now at early stage construction. At the time of the assessment (undertaken following the cut-off date of 1st March 2022) construction had not started.

5.5.64 Wind farm development is a clear force for change and is likely to continue within the study area. There are currently twelve wind farms within 25 km of the Proposed Development which are operational or under construction, and consent has been granted for another ten wind energy developments. There are also a considerable number of proposals for further wind farms. In addition, there are an increasing number of operational, consented and proposed domestic and farm-scale wind turbines of varying heights and rotor diameters, and it is likely that interest in this type of development will continue.

5.5.65 Open-cast mining of coal is a historic activity in the area and although extraction is now complete, restoration and regeneration of land will continue to change the appearance of the Doon Valley at the locations of the Dunston Hill and Chalmerston surface mines. Future uses for this land could include forestry and renewable energy generation.

5.5.66 Agriculture within the study area, including land management practices, pastoral grazing and arable farming, and commercial forestry plantations, are likely to remain important land uses, but may experience some pressures from expansion of residential areas on the fringes of settlements.

5.6 Assessment of Potential Effects

5.6.1 This section describes the potentially significant effects on landscape and visual receptors which may occur as a result of the Proposed Development.

Construction Effects

Landscape Effects

5.6.2 During the proposed 18 months construction phase, there will be potential short-term landscape effects arising from the presence of partially constructed infrastructure and construction activities on the Proposed Development Area (as described in Chapter 2: Proposed Development). Effects occurring during the construction phase are considered to be reversible unless otherwise stated.

5.6.3 Landscape effects during construction will be largely limited to the host LCT(s), as effects beyond the extents of the Proposed Development Area will be indirect and largely related to the construction of the partially erected turbines. As such, effects on the wider LCTs are not considered to be any greater than operational effects.

5.6.4 The changes arising from the construction of the Proposed Development, as described in Chapter 2: Proposed Development, will include:

- erection of wind turbines of up to 200 m tip height.
- construction of wind turbine foundations;
- construction of hardstand areas for erection cranes at each wind turbine location;
- construction of access tracks including passing bays, watercourse crossings and a site entrance from the A713;
- construction of a substation compound including a communications mast;
- construction of a battery energy storage system compound;
- excavation of trenches and laying of cables;
- creation of borrow pits;
- installation of signage;
- felling and replanting of approximately 113.5 ha forestry;
- construction of temporary construction compounds, working areas and laydown areas;
- installation of improved and new walking trails (Keir Glen Trail), footbridges and pass through gates for pedestrian access;
- habitat management and biodiversity enhancement (see Chapter 7: Ecology for details); and
- temporary lighting.

Visual Effects

5.3.1 In terms of visual effects during the construction phase, beyond those experienced at the site level where low level construction activity will be apparent in certain views, these will largely relate to views of tall cranes and turbine construction experienced from the wider study area. These effects will be transient and short term, and will change throughout the construction phase as wind turbines are gradually constructed in sections. As such, visual effects during the construction phase are unlikely to exceed the level of effect associated with operational visual effects.

Operational Effects

Landscape Effects

5.3.2 The main potential effects of the Proposed Development on the landscape once operational will be associated with the presence of the wind turbines, turbine transformers and related development including access tracks, onsite substation and main site access track, as described in Chapter 2: Proposed Development.

5.3.3 The key permanent components of the Proposed Development of relevance to this assessment include:

- nine wind turbines of up to 200 m tip height.

- at each wind turbine, associated low to medium voltage transformers and related switchgear;
- hardstand areas for maintenance cranes at each wind turbine location;
- a network of access tracks including passing bays, watercourse crossings and a site entrance from the A713;
- a substation compound including a communications mast;
- a battery energy storage system compound;
- a network of buried cables located adjacent to access tracks; and
- Aviation safety lighting (Aviation Lighting Night Time Assessment provided in Technical Appendix 5.5).

5.6.5 The presence of the wind farm will physically affect the landscape of the Proposed Development Area, potentially altering its character. Beyond the immediate surroundings of the Proposed Development Area, the Proposed Development may influence the character of adjacent landscapes. These effects may be significant where the Proposed Development affects views that are critical to the experience of another landscape. For the most part, the presence of the Proposed Development in views from a particular LCT is unlikely lead to a significant effect on the character of that LCT. Section 5.7 sets out those LCTs where significant effects could potentially occur.

5.6.6 The Proposed Development may affect local landscape designations by altering the qualities for which they have been designated. It is considered that these qualities are only likely to be significantly affected, where significant effects are identified on the LCTs within the designation.

Visual Effects

5.6.7 The main potential effects of the Proposed Development on visual amenity arise from presence of the wind turbines in views. The theoretical visibility of the turbines is indicated in the ZTV (Figure 5.2.1), and effects could potentially occur across this area. Effects are only likely to be significant where the wind turbines are closer to the viewer or form a prominent feature in a valued view.

5.6.8 The other elements of the Proposed Development may give rise to significant effects on views where the Proposed Development Area itself is a key feature in the outlook. This is likely to be limited to local views, and other project elements (e.g. tracks, substation, borrow pits) are unlikely to affect wider views.

5.6.9 Section 5.7 sets out the locations of visual receptors where significant effects could potentially occur. A list of representative viewpoints has been agreed as a basis for the assessment of visual effects.

5.6.10 Views of the wind turbines may affect the outlook from residential properties to the extent that the residential visual amenity of the occupants may be affected. Based on established approaches, it is not considered likely that such effects would occur beyond 2 km from the turbines, and so a focused assessment of effects on properties within this distance is carried out (see Technical Appendix 5.4).

Decommissioning Effects

5.6.11 Potential decommissioning activities are detailed in Section 2.5 of Chapter 2: Proposed Development. Decommissioning activities will be short term and generally less intrusive than construction, and as such, effects of decommissioning are not separately considered in this LVIA. At the end of the decommissioning, all landscape and visual effects of the Proposed Development will cease.

5.7 Mitigation

Mitigation by Design

5.7.1 Landscape and visual considerations, including the appearance of the Proposed Development from key locations, played a key role in the progression of the layout design of the proposed wind farm development, as described in Chapter 3 Design Evolution and Alternatives. Large scale upland landscapes such as the Proposed Development Area are generally considered better able to accommodate wind turbines than valleys and valley edges. The forested moorland plateau in the interior of the hills between the Doon Valley and the Girvan Valley therefore forms the focus of wind farm.

5.7.2 The adjacent valley landscapes, by contrast, were identified as being more sensitive to wind farms. The Doon and Girvan Valleys were also identified as the main locations of sensitive visual receptors, particularly in relation to the settlements of Patna, Waterside and Straiton. Turbines have therefore been set back from the edges of these valleys.

5.7.3 The previous application on this Proposed Development Area, Keirs Hill Wind Farm, was designed on similar principles. Whilst the reporter found that the Proposed Development Area was a suitable one for wind farm development, consent was refused due partly to the impacts of the 17-turbine scheme on views from the Doon Valley, including Waterside and Patna. The reporter's findings served as the basis for subsequent landscape-led design advice which has informed the current nine-turbine application.

5.7.4 The reporter attributed the adverse effect of Keirs Hill Wind Farm to the height and proximity of the turbines to the Doon Valley. Advances in turbine technology mean that larger, more efficient turbines are now deployed. Recent changes in policy have increased the demand for renewable energy generation as discussed in Chapter 4: Approach to EIA Climate Change, Legislative and Policy Context.

5.7.5 Although the Proposed Development includes taller turbines than were proposed for Keirs Hill Wind Farm, fewer are required to achieve a similar energy output. Fewer turbines in the Proposed Development also results in more even and consistent spacing between turbines and reduces stacking of turbines. The Proposed Development now occupies a smaller overall footprint, and the turbines generally occupy a smaller angle of the view than was the case with Keirs Hill. To reduce effects on the Doon Valley, turbines have been set further west within the plateau, and further from the settlements, while at the same time having regard to views from the Girvan Valley.

5.7.6 Through detailed visual studies, it was decided to reduce the height of certain turbines in the Proposed Development from 200 m to 180 m blade tip height so as to reduce their visibility in key views from the Doon Valley. As a result, while the Proposed Development will still be clearly visible from the Doon Valley, the turbines will be fewer in number, will be set lower on the skyline, and will occupy a smaller angle of view, than the Keirs Hill Wind Farm.

5.7.7 The design evolution of the Proposed Development is described in more detail in Chapter 3: Design Evolution and Alternatives.

Mitigation during Construction

5.7.8 The construction of the turbines and associated infrastructure will be undertaken in line with the Construction Environmental Management Plan (CEMP), which sets out arrangements for implementation of various aspects of the works such as vegetation and soil removal, storage and replacement; vegetation restoration; and stream crossings, which will help to mitigate potential adverse effects during the works.

5.7.9 Following construction, with the implementation of post-construction restoration measures, disturbed areas will be restored or new planting established as appropriate. Restocking of areas of felled forestry will take place, using a mix of conifer with native broadleaves (see Chapter 10: Forestry).

5.8 Assessment of Residual Effects

5.8.1 The assessment of effects on landscape and visual receptors is set out in Technical Appendices 5.2 and 5.3, and the findings are summarised in the following paragraphs.

Effects During Construction

5.8.2 During construction of the Proposed Development, it is concluded that there would be significant effects on the landscape of the Proposed Development Area. These would arise from the direct effect of construction works. Effects would be limited to the Proposed Development Area itself, and would cease after the 14 month construction period.

5.8.3 As noted above, temporary effects on visual amenity arising from construction works are unlikely to exceed those of operational effects, and have not been separately assessed. There will be limited locations, such as the core path between Straiton and Patna, where closer views of construction activity are apparent. Viewers elsewhere, such as within the Doon Valley and Girvan Valley, will have no view of construction works other than cranes and partly-constructed turbines. Effects will cease once the wind farm is operational.

Operational Effects on the Landscape

5.8.4 During operation, significant effects on the landscape character are predicted to extend across the Proposed Development Area and the immediately surrounding landscape. There will be Major and significant effects on the local area of the ‘host’ LCT (LCT 17b Foothills with Forest west of Doon Valley), affecting the Proposed Development Area and the areas to the north and north-east. Elsewhere within the LCT, effects will reduce to minor and not significant as the Proposed Development due to the existing presence of Dersalloch Wind Farm and the more limited theoretical visibility of the Proposed Development. There will also be Moderate and significant effects locally within LCT 10 Upland River Valley (River Doon) and LCT 12 Middle Dale (Girvan Water) due to direct effects and close proximity views of the Proposed Development which may alter outward views from these LCTs. Within LCT 10, Moderate and significant effects are predicted across the area between Patna and Waterside. Within LCT12, Moderate and significant effects will only occur across the eastern transitional part of the LCT formed by the edge of Sclenteuch Moor.

5.8.5 The area across which significant effects on landscape character will occur can therefore be described as extending north to Carclout Hill and Patna Hill; north-east to Lethan Hill and Green Hill; south-east to Green Hill and Auchenroy; south to Turgeny and Largs Hill; and west to the edge of Sclenteuch Moor and Cloncaird Moor.

5.8.6 Elsewhere within the above LCTs, and within the remaining LCTs, effects are considered to be not significant due to either limited theoretical visibility of the Proposed Development, distance from the Proposed Development and/or the existing presence of Dersalloch and other wind farms.

5.8.7 Significant effects were identified on parts of the LCTs located within locally designated landscapes. It is concluded that despite these effects, the Proposed Development will not significantly affect the special qualities of the designated landscapes, and will not affect their overall integrity.

Operational Effects on Visual Amenity

5.8.8 During operation, significant visual effects are predicted on nine of the 16 representative viewpoints. Significant effects are predicted for sensitive receptors up to 7 km from the Proposed Development. Major and significant effects are predicted from the closest viewpoints including: from the B741 (Viewpoint 1); and from surrounding elevated viewpoints in close proximity where the whole of the Proposed Development will be visible (Viewpoints 5, 6 and 9). More screened views from within the Doon Valley will be affected by a lesser magnitude of change, and high sensitivity receptors in and around Waterside and Patna (Viewpoints 2, 3 and 4) will experience moderate and significant effects. Moderate and significant effects are also predicted where the Proposed Development is close but does not occupy the primary view (Viewpoint 7) or where it occupies a smaller extent of the view (Viewpoint 11). Effects on views from the other viewpoints examined are not predicted to be significant. This is due either to the screening effect of topography (e.g. views from Straiton (Viewpoint 8)) or due to the distance to the Proposed Development (e.g. views from Cornish Hill at the edge of the Merrick WLA (Viewpoint 15).

5.8.9 There will be moderate and significant effects on views from the settlements of Patna and Waterside, within the Doon Valley. There may be moderate and significant effects on specific views from within other settlements, such as Viewpoint 11 within Dalmellington, but overall effects on views from this and other settlements are not predicted to be significant.

5.8.10 Significant effects are predicted on sections of a number of routes within approximately 5 km of the Proposed Development Area. This includes moderate and significant effects on local minor roads and the B741, where these have clear views of the Proposed Development. Moderate and significant effects are also predicted to affect sections of local core paths within the Doon Valley and Girvan Valley, and from core path between Patna and Straiton. No significant effects are predicted for more distant viewers in the Southern Uplands, or for users of the A713 Galloway Tourist Route, who will experience only passing views of the Proposed Development set well back from the valley edge.

Effects on Residential Visual Amenity

5.8.11 The Residential Visual Amenity Assessment (RVAA) in Technical Appendix 5.4 describes the change in views likely to be experienced by residents of properties within approximately 2 km of the Proposed Development, including the settlements of Patna and Waterside. The Landscape Institute's RVAA Technical Guidance Note 2/19 (LI TGN 2/19) explains that: "*the purpose of RVAA is to provide an informed, well-reasoned answer to the question: "is the effect of the development on Residential Visual Amenity of such nature and / or magnitude that it potentially affects 'living conditions' or 'Residential Amenity'?*" (LI TGN 2/19, Page 5, Para. 2.1). Views of the Proposed Development by day and night, including the effects of aviation lighting, were considered in the RVAA.

5.8.12 Although receptors at a number of locations assessed in the RVAA have the potential to experience a significant visual effect, none of these receptors will be subject to effects on residential visual amenity which are judged to breach the Residential Visual Amenity Threshold described in LI TGN 2/19. That is, none of the locations would be affected to such a degree that it would be widely regarded as an unattractive place in which to live.

Effects of Aviation Lighting

5.8.13 Civil Aviation Authority (CAA) guidance[6] requires that structures of ≥ 150m, including wind turbines, require steady red visible aviation lighting. As such, the Proposed Development will require visible aviation lighting which may be perceptible to receptors (people) from locations across the Study Area. Landscape and visual effects of the aviation lighting on the Proposed Development are assessed in Technical Appendix 5.5: Aviation Lighting Night Time Assessment.

5.8.14 No significant effects on landscape character are anticipated as the Proposed Development will introduce lights in views where other light sources are often visible.

[6] Civil Aviation Authority (2016) CAA Policy and Guidelines on Wind Turbines – CAP 764

5.8.15 Effects on views are considered for a maximum brightness scenario, where lights are at their fullest intensity, and a reduced scenario, where lights are dimmed to 10% intensity during clear weather conditions. The latter scenario is considered more likely to be seen by receptors.

5.8.16 Four representative viewpoints were assessed. No significant visual effects are predicted for Viewpoints 2, 4 and 11 as these locations have already been influenced by close proximity artificial lighting within these settled low lying areas. Significant effects were identified in the context of the darker outlook from Viewpoint 15: Cornish Hill. The effect would only be significant in the less likely maximum brightness scenario. This means that significant effects on views from Cornish Hill and other locations within the Galloway Dark Sky Park and Merrick WLA are unlikely in practice, and would only be experienced by a small number of visual receptors visiting this location at dusk and by night.

Effects on Wild Land

5.8.17 Effects on the Merrick WLA are assessed in Technical Appendix 5.6 Assessment of Effects on the Key Attributes and Qualities of the Merrick Wild Land Area. There will be no direct effects on the key attributes and qualities of the WLA, as set out in the published description (SNH, 2017c). The WLA's "*strong perception of naturalness*" may be slightly altered at night to the small number of visual receptors that may be present in the WLA at night due to the introduction of aviation lighting in views to the north. However, existing distant sources of artificial light are visible in this direction, as well as existing artificial light in surrounding settled areas that are visible in other directions from parts of the WLA. The visibility of existing human development during the day and existing artificial lighting at night results in the effects on the key attributes of the Merrick WLA to be judged as not significant.

5.9 Assessment of Cumulative Effects

5.9.1 The aim of a Cumulative Landscape and Visual Impact Assessment (CLVIA) is to "describe, visually represent and assess the ways in which a proposed windfarm would have additional impacts when considered together with other existing, consented or proposed windfarms" (Para. 55, SNH, 2012).

5.9.2 The cumulative assessment therefore focuses on the 'additional' cumulative change which may result from the introduction of a proposed wind farm to a future baseline. The cumulative assessment also makes reference to 'total' (also referred to as combined) cumulative effects, where these have the potential to be significant.

5.9.3 Existing wind farms and those under construction have been assessed as part of the LVIA baseline (these are listed in Table 5.4). Cumulative assessment considers effects arising from the addition of the Proposed Development to a potential future landscape in which proposed wind farms are assumed to be present. The future scenarios that serve as the baseline for CLVIA are described in Section 5.7, and the list of consented and proposed wind farms that are considered is given in Table 5.8.

5.9.4 As with an LVIA, a CLVIA deals with cumulative landscape and visual effects separately.

Cumulative Operational Effects on the Landscape

5.9.5 Moderate and Significant cumulative effects are predicted within LCT 10 Upland River Valley (River Doon) under Scenario 2 as the Proposed Development will be seen in successive views with the proposed Knockkippen Wind Farm (scoping) and together these wind farms will result in the LCT being overlooked by turbines in both the east and west, introducing a large scale change within the LCT. The additional effect on LCT 12 Middle Dale will remain Moderate and Significant in both Scenario 1 and 2, though only affecting the easternmost transitional part of this LCT.

Cumulative Operational Effects on Visual Amenity

5.9.6 There will be significant cumulative visual effects under both Scenario 1 and 2 from viewpoints within and around the Doon Valley (Viewpoints 1 to 6) due to visibility of the Proposed Development as well as nearby consented and proposed schemes. The interaction of the scoping-stage Knockkippen with the Proposed Development, on opposite sides of the Doon Valley, is likely to make the greatest contribution to cumulative effects in Scenario 2, affecting views from within the valley and from Patna in particular. Cumulative effects from other viewpoints will be the same as for the LVIA, where there is either partial visibility of the Proposed Development and cumulative schemes or where they occupy a smaller extent of the view.

5.10 Summary

5.10.1 Table 5.9 below summarises the predicted effects of the Proposed Development on the landscape and visual amenity of the study area, with significant effects shaded.

Table 5.9: Summary of Residual Effects

Receptor	Sensitivity	Magnitude	Level of Effect	Level of Cumulative Effect (Scenario 1)	Level of Cumulative Effect (Scenario 2)
Landscape of the Proposed Development Area					
Landscape of the Proposed Development Area (Construction)	Medium	High	Major	N/A	N/A
Landscape of the Proposed Development Area (Operation)	Medium	High	Major	None	None
LCTs (Operation)					
17b Foothills with Forest west of Doon Valley	Medium	High (reducing to Low)	Major (reducing to Minor)	None	None
10 Upland River Valley (River Doon)	Medium-High	Medium (Reducing to Low)	Moderate (reducing to Minor)	None	Moderate (reducing to Minor)
4b Brown Carrick Hills	Medium	Low	Minor	None	None
7c East Ayrshire Lowlands	Medium	Low	Minor	Minor	Minor
7d South Ayrshire Lowlands	Medium	Low	Minor	None	None
9 Lowland River Valley (River Doon)	Medium-High	Low	Minor	None	None
12 Middle Dale (Girvan Water)	Medium-High	Medium (Reducing to Low)	Moderate (reducing to Minor)	Moderate (reducing to Minor)	Moderate (reducing to Minor)
17a Foothills with Forest & Opencast Mining	Medium-Low	Medium (Reducing to Low)	Minor	Minor	Minor
17d Maybole Foothills	Medium	Low	Minor	Minor	Minor
17c Foothills with Forest & Wind Farm	Medium-Low	Low	Minor	None	Minor
20c Southern Uplands & Forestry	Medium-Low	Low	Minor	Minor	Minor
21 Rugged Uplands, Lochs & Forest	Medium-High	Low	Minor	Minor	Minor
Views and Visual Amenity (Operation)					
Viewpoint 1: B741 at Gass	Medium	High	Major	Major	Major
Viewpoint 2: Waterside, Doon Valley Railway	High	Medium	Moderate	Moderate	Moderate
Viewpoint 3: Waterside, north end	High	Medium	Moderate	Moderate	Moderate
Viewpoint 4: Patna	High	Medium	Moderate	Moderate	Major
Viewpoint 5: Auchenroy Hill	High	High	Major	Major	Major
Viewpoint 6: Lethanhill	High	High	Major	Major	Major
Viewpoint 7: Colonel Hunter Blair's Monument, Craigengower	High	Medium	Moderate	Moderate	Moderate
Viewpoint 8: Straiton	High	Low	Minor	Minor	Minor
Viewpoint 9: Minor road west of Straiton	Medium	Medium	Moderate	Moderate	Moderate
Viewpoint 10: Blairquhan	High	Low	Minor	Minor	Minor
Viewpoint 11: Dalmellington	High	Medium	Moderate	Moderate	Moderate
Viewpoint 12: B7045 near Kirkmichael	Medium	Low	Minor	Minor	Minor
Viewpoint 13: Maybole	Medium	Low	Minor	Minor	Minor
Viewpoint 14: B741 near Ruglen	Medium	Low	Minor	Minor	Minor
Viewpoint 15: Cornish Hill	High	Low	Minor	Minor	Minor
Viewpoint 16: Cairnsmore of Carsphairn	High	Low	Minor	Minor	Minor
Settlements (Operation)					
Patna	High	High	Moderate	Moderate	Major

Waterside	High	High	Moderate	Moderate	Moderate
Straiton	High	Low	Minor	Minor	Minor
Dalmellington	High	Medium	Minor	Minor	Minor
Bellsbank	High	Medium	Minor	Minor	Minor
Crosshill	High	Low	Minor	Minor	Minor
Hollybush	High	Low	Minor	Minor	Minor
Maybole	High	Low	Minor	Moderate	Moderate
Routes (Operation)					
Minor roads within 5 km of the Proposed Development Area	Medium	Medium	Moderate	Moderate	Moderate
A713	Medium	Medium	Minor	Minor	Moderate
B741	Medium	Medium	Moderate	Moderate	Moderate
B7045	Medium	Low	Minor	Minor	Minor
Patna to Straiton Core Path	High	Medium	Moderate	Moderate	Moderate
Core Paths within the Doon Valley	High	Medium	Moderate for core paths around Patna, Waterside and Dalmellington Minor for the core paths to the south-east of Auchenroy Hill	Moderate for core paths around Patna, Waterside and Dalmellington Minor for the core paths to the south-east of Auchenroy Hill	Moderate for core paths around Patna, Waterside and Dalmellington Minor for the core paths to the south-east of Auchenroy Hill
Core Paths around Straiton	High	Medium	Moderate locations where the turbines are clearly visible Minor for other locations	Moderate locations where the turbines are clearly visible Minor for other locations	Moderate locations where the turbines are clearly visible Minor for other locations
National Cycle Network Route 7	High	Low	Minor	Minor	Minor
Hill routes in the Southern Uplands	High	Low	Minor	Minor	Minor

5.11 References

- Carol Anderson Landscape Associates (2017) Dumfries and Galloway Wind Farm Landscape Capacity Study.
- Carol Anderson Landscape Associates (2018a) East Ayrshire Landscape Wind Energy Capacity Study.
- Carol Anderson Landscape Associates (2018b) South Ayrshire Landscape Wind Energy Capacity Study.
- Carol Anderson Landscape Associates (2018c) South Ayrshire Local Landscape Designations Review.
- Countryside Agency and SNH (2002), Landscape Character Assessment: Guidance for England and Scotland.
- Landscape Institute and the Institute of Environmental Management and Assessment (2013) Guidelines for Landscape and Visual Impact Assessment, 3rd Edition.
- Landscape Institute (2008) Landscape architecture and the challenge of climate change: Position Statement.
- Landscape Institute (2019a) Technical Guidance Note 02/19 Residential Visual Amenity Assessment.
- Landscape Institute (2019b) Technical Guidance Note 06/19 Visual representation of development proposals.
- Landscape Institute (2021) Technical Guidance Note 02/21 Assessing landscape value outside national designations.
- NatureScot (2020) Assessing impacts on Wild Land Areas - Technical Guidance.
- NatureScot (2021) Guidance - Assessing the cumulative landscape and visual impact of onshore wind energy developments.
- NatureScot (2022) Landscape Sensitivity Assessment Guidance.
- RES (2015) Keirs Hill Wind Farm Environmental Statement.
- SNH (2014) Wild Land Areas map and descriptions 2014 [https://www.nature.scot/doc/wild-land-areas-map-and-descriptions-2014].
- SNH (2015) Spatial Planning for Onshore Wind Turbines – Natural Heritage Considerations.
- SNH (2017a) Siting and Designing Wind Farms in the Landscape, Version 3a;
- SNH (2017b) Visual Representation of Wind Farms, Version 2.2.
- SNH (2017c), Description of Wild Land Area – 01. Merrick Wild Land Area.
- SNH (2018) A Handbook on Environmental Impact Assessment, Appendix 2: Landscape and Visual Impact Assessment, Version 5.
- South Ayrshire Council (2015) South Ayrshire Supplementary Planning Guidance: Wind Energy.

6 Cultural Heritage

6.1 Introduction

6.1.1 This section presents the impact assessment for Cultural Heritage. The purpose of the assessment is to identify the potential effect of the Proposed Development on the historic environment and its heritage significance within the area in which the development is proposed. This assessment follows policy and best practice guidance in order to establish a robust and transparent analysis of the issue.

6.1.2 The heritage assets which form the historic environment constitute a finite and non-renewable resource. Direct physical impacts on assets are permanent and irreversible. Some indirect setting impacts are temporary and/or reversible, particularly with respect to those due to construction activity

6.1.3 This chapter considers the likely significant effects on the historic environment associated with the construction and operation of the Proposed Development. The specific objectives of the chapter are to:

- describe the current 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 the likely significant effects;
- assess the residual effects remaining following the implementation of mitigation measures.

6.1.4 The assessment has been carried out by Dr Steve Lancaster, of AMS Consulting Ltd. The Assessor undertaking this chapter is an Associate of the Chartered Institute for Archaeologists, has 19 years of professional experience in the cultural heritage sector, including twelve years undertaking EIA.

6.1.5 The chapter is supported by:

- Technical Appendix 6.1: Gazetteer

6.1.6 Figures 6.1-6.2 (maps) and 6.3–6.11 (wireline visualisations) are referenced in the text where relevant.

6.2 Legislation, Policy and Guidance

Legislation

6.2.1 The key pieces of legislation that cover the historic environment with respect to terrestrial planning are as follows:

- Historic Buildings and Ancient Monuments Act 1953;
- Ancient Monuments and Archaeological Areas Act 1979;
- Planning (Listed Buildings and Conservation Areas)(Scotland) Act 1997; all acts as amended by the Historic Environment (Amendment)(Scotland) Act 2011; and
- Statutory Instrument No. 102 Town and Country Planning (EIA Scotland) Regulations 2017.

National Policy

6.2.2 The key national policies are as follows:

- Scottish Planning Policy 2020, paragraphs 123-151;
- Historic Environment Policy for Scotland 2016;
- Historic Environment Circular 1: Policies and Procedures 2016.

Local Planning Policy

6.2.3 The South Ayrshire Local Development Plan (adopted 2014) has two main policies relevant to this assessment: 1) historic environment, covering listed buildings, conservation areas, scheduled monuments and gardens and designed landscapes, which outlines the importance of protecting, conserving and improving these assets (including setting). 2) archaeology, which covers non-scheduled archaeological sites. The policy states that development which negatively affect a known archaeological site will only be allowed if the benefits of the scheme will clearly outweigh the archaeological value of the site. These two policies are expanded on by South Ayrshire Supplementary Guidance: Historic Environment (adopted 2014).The East Ayrshire Council Local Development Plan (adopted 2017) contains the following policies relevant to this assessment; ENV 1: Listed Buildings; ENV 2 Scheduled Monuments and Archaeological Resources; ENV 3: Conservation Areas; ENV 4: Gardens and Designed Landscapes.

Guidance

6.2.4 The key guidance documents referred to are:

- *Managing Change in the Historic Environment: Setting*. Historic Scotland 2016; and

- *Standard and Guidance for Historic Environment Desk Based Assessment*. Chartered Institute for Archaeologists 2014 updated 2020.

6.2.5 Due cognisance has also been taken of the *Environmental Impact Assessment Handbook*, Scottish National Heritage and Historic Environment Scotland 2018

6.3 Consultation

Table 6.1: Consultation Summary

Consultee	Summary of Key Issues	Response
Historic Environment Scotland Scoping Report Response (04/10/2021)	Search area of 10km noted: suggest that this is not finalised until ZTV analysis undertaken.	ZTV analysis indicates that 10km study area for setting impacts is appropriate: possibility of visual impacts beyond 10km have been considered but are not a realistic prospect in this case.
	Concern respecting cultural heritage assessment being undertaken after design freeze: mitigation by design is best option.	Design mitigation already noted in Scoping Report. Design freeze is referenced with respect to full assessment of proposed design.
	Non-exhaustive list of designated heritage assets for consideration provided.	List noted and taken into account in preparing the EIA.
East Ayrshire Council Scoping Report Response (30/09/2021)	Proposed study areas seem reasonable.	Noted.
	Non-inventory Gardens and Designed Landscapes should also be considered.	Shapefiles of these have been obtained and are considered where appropriate.
	Setting of Scheduled Monuments and Conservation Areas should be assessed.	These have been assessed as appropriate, in accordance with the approach set out in the Scoping Report
South Ayrshire Council Scopng Report Response (08/10/2021)	Broadly content with approach. Viewpoint from Straiton Conservation Area would assist in assessment.	Viewpoint from Straiton included in LVIA.
West of Scotland Archaeology Service (WoSAS) Response to HER data request (29/04/2022)	Noted that WoSAS would generally look for sites included on the Non-Statutory Register (NSR) to be considered as potentially nationally or regionally important.	Noted: NSR site records have been examined and those with a realistic prospect of significant impacts assessed.

6.4 Methodology

Baseline Characterisation

Study Areas

6.4.1 The cultural heritage assessment has employed two study areas. The Inner Study Area (ISA) comprised the Proposed Development Area and an area of 500 m surrounding it. This study area has allowed the development of the local historic environment to be understood and on this basis the assessment of the value of known heritage assets located in proximity to the Proposed Development. This in turn has facilitated the assessment of the potential for currently unknown assets to be present within the area of the Proposed Development.

6.4.2 An Outer Study Area (OSA) comprising the area from the boundary of the ISA to 10 km from the locations of the proposed turbines is used to identify heritage assets of national importance for the purpose of assessing potential impacts on these assets resulting from changes in their setting. Indirect impacts on designated heritage assets of regional importance were also assessed in an area up to 5 km from the locations of the proposed turbines. The OSA dimensions have been adopted to reflect the realistic prospect of significant impacts on heritage assets of different values.

6.4.3 Assessment of the potential effects resulting from setting change has been carried out on all with assets within the ISA.

6.4.4 The extents of the Study Areas are shown in Figures 6.1 and 6.2.

Data Sources

6.4.5 The baseline study that provides an overview of the historic environment within the Study Areas is based on the following:

- Consultation with the West of Scotland Archaeology Service Historic Environment Record (HER);
- Consultation of the National Record of the Historic Environment (NHRE) (Canmore);
- Historical map regression using historical map sources covering the ISA to identify changes in development of the historic landscape;
- Review of available Historic Landscape Characterisation of the ISA;
- Review of relevant geotechnical and geological data;

- Readily available published sources;
- Online data on designated assets held by Historic Environment Scotland (HES)
- Walkover survey.

6.4.6 The records from these various sources have been combined to form a single gazetteer of heritage assets within the ISA. The full gazetteer forms Technical Appendix 6.1.

Site Inspection

6.4.7 A walkover inspection of the Proposed Development including the proposed access track, was undertaken on 01 July 2022. The locations of the proposed track upgrades, and the southern proposed borrow pit search area were examined. The southern proposed borrow pit search area has already been subject to quarrying and ground disturbance in the immediate vicinity, so there is no potential for archaeological remains to survive at this location. Two turbine locations were also examined, Turbine 9, and Turbine 5. These are located in areas of felled forestry, which made observation of the ground difficult. No heritage features were found in these areas. Other elements of the Proposed Development could not be accessed, mainly due to the presence of dense plantation forestry.

Assessment of Effects

Introduction

6.4.8 Assessment of effects has been assessed in the following stages:

- Description of asset (baseline) (where appropriate, where appropriate assets have been addressed in related groups);
- Assessment of value, and for indirect effects, how the setting of the asset contributes to its value;
- Assessment of the magnitude of effects caused by the Proposed Development, taking into account the sensitivity of the asset to that form of change; and
- An assessment of the significance of the effects.

6.4.9 The assessments have been carried out using professional judgement, taking into account designations and the value of the heritage assets as assessed against standards derived from national policy (see Section 6.2.2). Significance of effect has been assessed on the basis of a combination of the value of the heritage asset and the magnitude of impacts.

6.4.10 Impacts are considered to be caused by the Proposed Development where it changes the baseline conditions of either the asset itself or its setting. In accordance with The Electricity Works (Environmental Impact Assessment)(Scotland) Regulations 2017 the assessment identifies impacts as either direct or indirect, adverse or beneficial, and short-term, long term or permanent. Direct impacts are those which physically alter an asset and therefore its value for the purposes of this assessment indirect impacts are those which affect the value of asset by causing change within its setting.

6.4.11 Indirect impacts on the heritage assets due to setting change have been identified and the effect assessed with reference to guidance from HES (see 6.2.2). Assessment has been carried out in the following stages:

- Initial consideration of intervisibility and other factors leading to the identification of potentially affected assets;
- Assessment of the value of potentially affected assets;
- Assessment of the contribution of the setting to the value of the assets;
- Assessment of the magnitude of impact of the Proposed Development due to causing change within the setting of the assets; and
- Prediction of the significance of the effect.

Assessment of Value

6.4.12 Heritage asset value has been assessed using professional judgement, with reference to Table 6.1 which has been devised with reference to HES policy and guidance. The value of a heritage asset is based on its qualities, including intrinsic, contextual and associative characteristics, such as age, state of preservation and level of supporting knowledge. These characteristics are independent of the differing potential impacts on the heritage assets. Table 6.2 sets out the potential levels of value of an asset related to current designation criteria, using a scale of Highest to Negligible value. These values are used in the exercise of professional judgement and provides transparency in evaluating the conclusions reached in this assessment.

Table 6.2: Value Categories of Heritage Assets

Term	Definition
Highest	Heritage assets of international value. World Heritage Sites.
High	Heritage assets of national value such as: • Scheduled Monuments; • Category A Listed Buildings; • Gardens and Designed Landscapes included on the national inventory; Non-designated assets of equivalent value.
Medium	Heritage assets of regional value such as: • Category B Listed Buildings; • Most Conservation Areas;

	Non-designated assets of equivalent value.
Low	Heritage assets of local value such as: • Category C Listed Buildings; Non-designated assets of equivalent value
Very Low	Sites of minor importance or with little of the asset remaining to justify a higher value.
Unknown	Further information needed to assess the value of these assets.

6.4.13 The criteria for assigning value include the archaeological period to which the heritage asset belongs, its rarity, the level of documentation concerning the asset, potential to contribute to our understanding of the past, the value of association with other sites, the preservation condition, and the chronological and typological diversity of the asset.

Contribution of Setting to Value

6.4.14 Setting is the way the surroundings of a historic asset or place contribute to how it is understood, appreciated and experienced (HES 2016).

6.4.15 The surroundings of each heritage asset or heritage asset groups is described, considering aspects such as location and orientation of the heritage asset, obvious views or vistas, both towards and from an asset, additional screening through small scale topographic variation, buildings and vegetation, how much changed to the historic setting has occurred, integrity of the setting, topography, land use (including currently operational roads, railways, other wind farms and other sources of visual movement nearby, and modern intrusive conifer plantations) and intervisibility to other contemporaneous and related heritage assets. All of the aspects are considered in relation to how they affect the understanding, appreciation and experience of the heritage asset.

6.4.16 Once the setting of each heritage asset or heritage asset group has been defined, the aspects of the setting which contribute to the value of the heritage asset are identified. A professional judgement is then made as to the magnitude of impact of the Proposed Development on the heritage asset due to a change in setting.

Magnitude of Effect

6.4.17 The changes could potentially include direct change (e.g. ground disturbance) and/or indirect change (the latter could include visible change, noise, vibration). Resulting impacts may be beneficial or adverse, and may be short term, long term or permanent. The scale and mass of the Proposed Development would form part of this potential change. Magnitude of impact has been assessed with reference to the criteria set out in Table 6.3.

Table 6.3: Magnitude of Impacts on Heritage Assets

Magnitude/Type	Explanation
High	The Proposed Development would considerably alter the value of the affected asset, or the ability to appreciate it.
Medium	The Proposed Development would alter to a clearly discernible extent the value of the affected asset, or the ability to appreciate it.
Low	The Proposed Development would alter to a minor extent the value of the affected asset, or the ability to appreciate it.
Very Low	The Proposed Development would alter to a very minor extent the value of the affected asset, or the ability to appreciate it.
Neutral/Nil	The Proposed Development would not affect or would have harmful and enhancing effects of equal magnitude on the value of the affected asset or the ability to appreciate it.

Significance Of Effect

6.4.18 The significance of effect is presented in Table 6.4. This provides a matrix that relates the magnitude of impact to the value (incorporating contribution from setting where relevant), in order to establish the likely significance of effect. This assessment is undertaken separately for direct effects and indirect effects, the latter being principally concerned with effects on setting.

Table 6.4: Significance of Effects on Heritage Assets

		Heritage Asset Value				
		Highest	High	Medium	Low	Very Low
Impact Magnitude	High	Major	Major	Moderate	Minor	Very Minor
	Medium	Major	Moderate	Minor	Very Minor	Negligible
	Low	Moderate	Minor	Very Minor	Very Minor	Negligible
	Very Low	Minor	Very Minor	Negligible	Negligible	Negligible
	Neutral /Nil	Neutral/None	Neutral/None	Neutral/None	Neutral/None	Neutral/None

Zone of Theoretical Visibility (ZTV) Analysis

6.4.19 Assessment of visual impact has been assisted with the use of a Zone of Theoretical Visibility (ZTV) model, prepared principally for the Landscape and Visual Impact Assessment (Chapter 5). In summary, it maps the predicted degree of visibility of the Proposed Development from all points within a study area around the Proposed Development Area, as would be seen from an observer's eye level 1.6 m above the ground.

6.4.20 The ZTV's were modelled using a computer-based visibility analysis package compiled using Ordnance Survey Digital Terrain Model (DTM) data. The ZTV produced is a bare ground scenario, based on landform only, which takes no account of the screening effects of local features such as buildings or vegetation.

6.5 Baseline

Designated Heritage Assets

6.5.1 There are no inventoried Battlefields, Properties in Care, inventoried Gardens and Designed Landscapes or World Heritage Sites within the ISA.

6.5.2 Within the ISA there is one Conservation Area, three Scheduled Monuments, one Category A Listed Buildings, three Category B Listed Buildings and two Category C Listed Buildings (Table 6.5).

Table 6.5: Designated Heritage Assets within the Inner Study Area

Title	Designation	Index Number	Category
Waterside Bing, Iron Slag Bing, Dalmellington Ironworks	Scheduled Monument	SM7544	-
Waterside, Dalmellington Ironworks	Scheduled Monument	SM4345	-
Waterside, miners' villages & mineral railways N of,	Scheduled Monument	SM7863	-
Waterside	Conservation Area	CA50	-
Waterside Engine House	Listed Building	LB1092	A
Palace Bar, Waterside Village	Listed Building	LB6623	B
Waterside Institute, Waterside Village	Listed Building	LB6595	B
Ardoon House, Waterside Village	Listed Building	LB1094	B
War Memorial, Waterside Village	Listed Building	LB6596	C
Chapel of Ease, Waterside Village	Listed Building	LB1093	C

6.5.3 Within the OSA there are no inventoried Battlefields, Properties in Care or World Heritage Sites. There are six Conservation Areas, four inventorised Gardens and Designed Landscapes, twelve Scheduled Monuments, and eight Category A Listed Buildings. Within 5 km of the proposed turbines there are twelve Category B Listed Buildings (Table 6.6).

Table 6.6: Designated Heritage Assets within the Outer Study Area

Title	Designation	Index Number	Category
Lyonston,standing stone 250m ESE of	Scheduled Monument	SM5787	-
Munteoch, settlement and field systems	Scheduled Monument	SM5200	-
Martnaham Castle	Scheduled Monument	SM5280	-
Dalmellington,motte	Scheduled Monument	SM3009	-
Knockinculloch,enclosures on E slope of,600m NW of Glenalla	Scheduled Monument	SM3357	-
Mote Knowe,dun,Monkwood	Scheduled Monument	SM2865	-
Dowan's Hill,dun,Dunree	Scheduled Monument	SM2886	-
Lindston,moat	Scheduled Monument	SM2932	-
Laight Castle	Scheduled Monument	SM7690	-
Knockdon, enclosure 700m NE of	Scheduled Monument	SM7491	-
Dalnean Hill, farmstead and field system	Scheduled Monument	SM4390	-
Bogton Loch airfield, 175m SSE of Buchan's Bridge, Dalmellington	Scheduled Monument	SM13693	-
Dalrymple	Conservation Area	CA44	-
Kirkmichael	Conservation Area	CA88	-
Straiton	Conservation Area	CA92	-
Waterside	Conservation Area	CA50	-
Crosshill	Conservation Area	CA84	-
Dalmellington	Conservation Area	CA43	-
Drumfad Dovecot	Listed Building	LB7558	A
Cassillis House	Listed Building	LB13655	A
Craigengillan	Listed Building	LB18793	A
Stable Block, Craigengillan	Listed Building	LB18794	A
Straiton Parish Church, Main Street, Straiton	Listed Building	LB19089	A

Churchyard, Straiton Parish Church, Main Street, Straiton	Listed Building	LB19089	A
Blairquhan House	Listed Building	LB19094	A
St John's Cottage, Maybole	Listed Building	LB37718	A
Lodge, Craigengillan	Listed Building	LB1086	B
Bridge, Craigengillan	Listed Building	LB1087	B
Patna Bridge	Listed Building	LB1090	B
Doon Bridge, River Doon, Straiton Road, Dalmellington	Listed Building	LB1113	B
Cloncaird Castle	Listed Building	LB7557	B
Traboyack House, Straiton	Listed Building	LB19090	B
Black Bull Hotel, Main Street, Straiton	Listed Building	LB19093	B
Stables, Blairquhan	Listed Building	LB19095	B
The Kennels, Blairquhan	Listed Building	LB19097	B
Old Bridge Of Blairquhan	Listed Building	LB19102	B
Colonel Hunter Blair's Monument	Listed Building	LB19104	B
Telephone Call Box, Dalmellington Road, Straiton	Listed Building	LB19106	B
Skeldon House	Garden and Designed Landscape	GDL	-
Kilkeran	Garden and Designed Landscape	GDL	-
Blairquhan	Garden and Designed Landscape	GDL	-
Craigengillan	Garden and Designed Landscape	GDL	-

Potential High Value Non-Designated Heritage Assets

6.5.4 The West of Scotland Archaeology Service (WoSAS)(archaeological advisers to the planning authority) use the results of an assessment carried out in conjunction with Historic Scotland (now HES) in order to identify assets of sufficient importance to be considered for scheduling, which would be of high value under the terms of the assessment used for this EIA. These assets were compiled in the Non-Statutory Register (NSR). Two main classes of such assets are identified by WoSAS as being of interest in this respect: those that have been identified as being of probable schedulable quality (referred to as class C), and those that may of this quality, but require a site visit to assess this (referred to as class V).

6.5.5 Heritage assets recorded in the HER within the study areas that belong to these classes have been identified. The information relating to the NSR is somewhat variable in quality, and the classification of assets is inconsistent. The heritage asset records have been filtered to remove entries where the grounds for inclusion in these classes are outdated, equivocal or incorrect.

6.5.6 Within the ISA, two assets have been identified as having the potential to be scheduled, and therefore be of high value. These are Assets 4 and 7 (both class V). Assessment of the available evidence, including a site visit, has indicated that these two assets are not of high value, but rather of medium value.

Known Heritage Assets Within the Inner Study Area

6.5.7 There are 95 heritage assets recorded within the local HER and NRHE in the ISA once duplicate records are accounted for (see Appendix 6.1 Cultural Heritage Gazetteer).

6.5.8 Two of the recorded heritage assets within the ISA are definitely or tentatively dated to the Prehistoric period, though only one of these is within the Proposed Development Area. One of these assets (Asset 15) is a burnt mound (an accumulation of fire cracked rock, often associated with dug troughs for heating water), generally dated to the Bronze Age. The asset within the Proposed Development Area (Asset 54) is a possible hut platform, that is a small level area dug into a hill slope, often the location of round house, generally dating to the Iron Age.

6.5.9 Three of the heritage assets may date to the early medieval or medieval periods. The early medieval heritage asset is a tentative record based place name evidence (Asset 3), suggesting the possible presence of a church dating to the 9-10th century, though surface survey and examination of aerial photographs have not revealed anything on the site. Wallace Moor (Asset 2) is also a place name record, lacking any material evidence. Keirs Castle (Asset 7), thought to be the remains of a medieval tower house, appears to survive as partial wall foundations, with the remaining upstanding walls removed in the 19th century and possibly some of the foundations blown up. None of these assets are within the Proposed Development Area.

6.5.10 Eleven of the assets are tentatively or definitely dated to the post-medieval period (1550-1800). Six of these (Assets 1, 9, 37, 69, 70, 87) are within the Proposed Development Area. The assets across the ISA mainly reflect the predominantly agricultural economy of the area during this period, with assets including ditches and drainage (Asset 1), farmsteads (Assets 6, 37, 87) and associated structures such as huts (Assets 5, 8, 9, 69, 70). Continued higher status settlement in the area is reflected in the dedicatory stone at High Keirs (Asset 67), near the site of the medieval Keirs Castle and its associated garden (Asset 65), possibly laid out originally in the 17th Century (no obvious physical traces of the garden are extant).

6.5.11 There are 27 heritage assets that are dated to either the post-medieval or modern periods (from 1800). None of these are within the Proposed Development Area. This set of assets largely reflects the predominantly agricultural nature of the area during these periods, particularly in the form of stock management structures such as rees, sheepfolds and shieling huts (Assets 12, 63, 64, 71-79, 85, 88, 93), but also local fuel sources in the form of peat cutting (Assets 89, 90, 91), and other local resource extraction in the form of quarrying (Assets 44, 45, 48, 58, 60, 86, 92, 94, 95).

6.5.12 There are 45 heritage assets that are definitely or tentatively dated to the modern period within the ISA. Some of these relate to the agricultural activity in the area in the form of sheepfolds (Assets 38, 51), farmsteads (Assets 39, 40), a horse gang (Asset 66) and some of the rural cottages (Asset 26). In this period, however, more of the heritage assets relate to industrial activity and associated settlement, with industrial facilities, mining, and waste sites (Assets 10, 11, 17, 53, 18), mainly clustered in the southern part of Waterside, together with associated miners' rows and cottages (Assets 24, 25, 27, 80, 81, 82, 83, 84), other housing associated with industrial settlement for all levels of employee, mainly at Waterside (Assets 23, 28, 30, 31, 32,34, 43), together with other civic and commercial facilities, mainly clustered in the northern part of Waterside, including a chapel (Asset 19), church hall (Asset 20), the Dunaskin Institute (Asset 21), school (Asset 29), street light (Asset 33), railway and station (Assets 42 and 22). The improvements to transport from this period are further represented by three bridges (Assets 41, 52, 96). Smaller scale rural industry is represented by a scatter of quarries, lime works and peat cuttings (Assets 13, 16, 46, 50, 59, 55, 68, 56, 49).

Historic Mapping

6.5.13 Available online historic mapping from the National Library of Scotland has been reviewed. Maps dating back to the mid Seventeenth Century have been considered.

6.5.14 The earliest maps (Gordon, 1636-52, Blaeu, 1654), Adair, 1685, and Moll, 1745) do not show the Proposed Development Area in sufficient detail for the purposes of this assessment. The earliest map that shows a useful level of detail is the Roy Map (1755). This survey is a detailed sketch rather than an accurately surveyed map. Precise locations of features are not completely accurate, and the depiction of many features is illustrative rather than precise. This applies particularly with regard to the layout of field systems, such as enclosed fields near the Doon, demonstrating that enclosed fields were present in the area, rather than their actual extent. The majority of the land in the area is depicted as being open moorland. Keirs Castle is labelled as Keir's House, and is enclosed in an area of woodland.

6.5.15 Also on this map there are two small settlements called Burnfoot. On the basis of the location, one is probably the settlement later mapped as Low Keir. The modern village of Burnfoot probably correlates with the other settlement of that name noted on the map, though this would indicate that the river shifted at some stage between the 1750's and 1857, when the First Edition OS mapping depicts a course that conforms to that that persists today. Dunaskin is the only settlement to the north east of the Doon. There are no indicators of the industrial development at Waterside seen on the OS maps, nor a particular settlement location preceding this development.

6.5.16 A New Map of Ayrshire was published in 1775 by Andrew Armstrong. This does depict a settlement at Waterside, which may indicate the early stage of the industrial complex at this location, but no further details can be obtained.

6.5.17 Ainslie's Map of Southern Scotland (1821) is a small scale map and contains relatively little detail. It appears to show a track which passes approximately north to south through the the area of the Proposed Development, but is not extant today, and is also not mapped on the earlier Military Survey. This map also shows the settlement of Waterside. As with the previous map, the level of detail is not sufficient to identify whether any industrial activity was taking place at this date.

6.5.18 The First Edition Ordnance Survey for the area was surveyed in 1857, being published in 1860. This map depicts the majority of the area of the Proposed Development as open moorland or rough grazing, with very few land divisions. The road seemingly depicted on the 1821 Ainslie's map is not shown on this map. The land immediately adjacent to the Doon is enclosed, with the fields having the relatively large size and more regular shapes associated with Improvement Era land division. The woodland surrounding Keirs Castle is depicted as covering a slightly larger extent than that seen in later mapping. To the southeast of this there is a collier's row, no longer extant, beyond that a building in the area of Keirshill, which is also no longer extant, and Keirs Lime Works. The iron works at Waterside are known to have been established by the survey date, but the large waste bing to the south of the complex (now a scheduled monument) does not appear to be of great extent on this map. A no longer extant field boundary is shown bisecting the current area of the scheduled monument.

6.5.19 The Second Edition Ordnance Survey map of the area was surveyed in 1894 and published in 1897. Over most of the Proposed Development Area there are very few

changes shown on this map. The majority of the boundaries are unchanged between editions, and rough open grazing and moorland continues to dominate the area. The area of woodland around Keirs Castle appears smaller in the Second Edition than the First Edition It also appears to have taken the shape that currently exists and is shown in modern mapping. The settlement at Low Kiers is still named as Burnfoot. The collier's row is no longer extant and the building mapped at Keirshill appears to be smaller than mapped in the First Edition. The lime works appears to no longer be active by the time of the Second Edition. The iron works at Waterside has extended and become more complex, with more buildings within the area of the iron works. The bing appears to occupy a very similar area to that of the current scheduled monument.

6.5.20 Very few changes are noticeable between the 1894 OS map and the next edition dating to 1908.

6.5.21 The Ordnance Survey 1:25 000 mapping published in 1957 shows the area of the Proposed Development as an area of moorland. The building at Keirshill is no longer depicted. The name of the Waterside Ironworks has changed to 'Dunaskin Brick Works'.

Aerial Photography

6.5.22 An assessment of vertical aerial photographic coverage held by HES and available from on-line sources was conducted. Images dating back to 1945 were inspected. The aerial photographs show that the Proposed Development Area was rough grazing for most of the period from 1945. The current forestry appears to have been initially planted some years prior to 1988. Drainage channels appear to have been cut across the Proposed Development Area; areas of parallel ditch drainage cut across the central and south to south-eastern parts are clearly evident.

6.5.23 The only potential cultural heritage asset that is not recorded in the HER or NRHE noted in the aerial photographs is a circular structure on the north side of Keirs Hill. This matches the location of a sheepfold on modern and historic maps.

Historic Land Use Assessment

6.5.24 The Historic Land use Assessment mapping of the ISA has been reviewed. This shows that the majority of the ISA, particularly the main area of the Proposed Development is mapped as plantation. The eastern portion of the ISA includes areas of rough grazing, and rectilinear fields and farms and small areas of managed woodland. These elements are all the current land uses, though the areas of rough grazing reflect longer term historic land use as well. There are small areas of relict land use including former quarries, post-medieval settlement and agricultural usage (these being found in the modern rectilinear field areas) and former industrial use (the iron works slag bing).

Potential for unknown historic assets

6.5.25 Within the Proposed Development Area there is the potential for unknown archaeological sites that could be affected by construction activities. The currently known sites largely belong to more recent historic periods, and are largely associated with agriculture and mining, with some industrial elements in Waterside. This pattern in part reflects the survival of upstanding heritage assets and the availability of historic maps recording these features. The relatively low level of recorded heritage assets from earlier periods (prehistoric through to the medieval period) may potentially reflect a relative lack of archaeological work in the area as much as a genuine absence of past human activity.

6.5.26 The parts of the Proposed Development Area that are either rough grazing or are afforested appear to be largely covered by blanket peat. While blanket peat can preserve organic material, it has little intrinsic paleoenvironmental interest. It can bury archaeological sites that predate the inception of peat growth. This can make such remains more difficult to detect from the surface. Although the initiation of peat growth is not uniform across the Scottish uplands, there is a high probability that where such sites survive they would date to the early Bronze Age or earlier prehistoric periods.

6.5.27 The records of heritage assets from the prehistoric and Roman periods in the wider region in which the ISA is located are limited. There are, however, some records, mainly consisting of isolated finds such as stone tools, as well as undated cairns and enclosures that might date to these periods. The limited numbers of assets dating to the earlier prehistoric, particularly in comparable environments indicate that there is a low potential for unrecorded earlier prehistoric remains. The presence of potential hut circles from this period and nearby finds of forts and a potential cist burial indicate that there is a low to moderate potential for the presence of unrecorded heritage assets dating to later prehistory. With respect to the Roman period, the line of a putative Roman road runs near Kirkmichael, within approximately 4km of the Proposed Development area. There is a also a stray find of a Roman coin from Crosshill. These records indicate there is a very low to low potential for Roman remains to be present within the Proposed Development Area.

6.5.28 While the number of records of heritage assets definitively dated to the medieval period within the ISA is relatively low, there are still a number. In particular, there are enclosures and banks, plus the presence of Keirs Castle. Such an elite residence site implies the presence of a supporting population, and the potential for sites

associated with the non-elite population to be present within the Proposed Development area. Sites associated with rural settlement and agriculture are the most likely types of sites within this area. It is assessed that there is a moderate potential for the presence of medieval heritage assets within the Proposed Development area.

6.5.29 The majority of heritage asset records within the ISA relate to the post-medieval and modern periods. These mainly relate to agriculture and mining/quarrying activity. Although many assets dating from the later 18th century onwards are known through historical mapping, not all elements would have been surveyed, and early post-medieval features may never have been surveyed. During this period there would have been considerable changes in patterns of land holding and use, and growth of population that would resulted in a relatively dynamic landscape during this period. It is assessed that there is a moderate potential for the presence of unrecorded post-medieval heritage assets within the Proposed Development Area. Although heritage assets from the modern period form a substantial proportion of the recorded heritage assets within the ISA, it is likely that through the existence of historic mapping and other historical sources that the majority of these have already been identified. It is therefore assessed that there is a low potential for the presence of unrecorded modern heritage assets within the Proposed Development Area.

6.6 Assessment of Potential Effects

6.6.1 The potential types of impacts that could result from the proposed development can be divided into construction effects and operational effects.

Construction Effects

6.6.2 Construction effect types would mainly consist of partial or total removal of heritage assets, recorded or unrecorded, through groundworks (permanent or temporary), disturbance and/or compaction of archaeological deposits by construction traffic and structures. The physical construction effects would in general be permanent and irreversible.

6.6.3 A single recorded heritage asset has the potential to be impacted by the proposed development. This consists of post-medieval drainage ditches and banks (Asset 1). The recorded location of this asset intersects with the area of a borrow pit search area. The current record is relatively imprecisely located. The asset is assessed to be of very low value. If the entire asset was removed by quarrying, the magnitude of impact would be high, resulting in an adverse significance of effect of **very minor** significance.

6.6.4 Asset 14 is a small enclosure of unknown date, probably relating to post-medieval sheep rearing activity in the area, but potentially the remains of an older asset. While this asset is not in the footprint of the Proposed Development, it is close to the proposed crane hardstand at Turbine 9(approximately 20m). Preventative mitigation in the form of fencing is therefore proposed to ensure there will be no construction impacts (see 6.7).

Operational Effects

Operational Effects: Inner Study Area

6.6.5 All the non-designated heritage assets within the ISA are modelled in the ZTV as having at least some degree of intervisibility with the Proposed Development.

6.6.6 42 of the non-designated heritage assets that are within the ZTV of the Proposed Development are of asset types and/or in a sufficiently poor state of preservation that they have been assessed to be of very low value. Under the assessment methodology used, the significance of effect of impacts on such assets cannot be more than very minor, which is not significant in EIA terms . Impact on these assets due to setting change are therefore not further assessed. These are Assets 1, 2, 3, 5, 8, 9, 13, 14, 15, 16, 31, 33, 38, 43, 44, 45, 46, 47, 48, 49, 50, 51, 55, 56, 57, 58, 59, 60, 61, 64, 68, 69, 70, 86, 88, 89, 90, 91, 92, 93, 94, 95. Similarly, assets with a value that is assessed as low (of which there are 35) cannot be subject to impacts with a significance of effect that is greater than minor, which is also not significant in EIA terms. Impacts on these assets due to setting change are therefore not further assessed. These are Assets 6, 12, 19, 21, 24, 25, 26, 28, 29, 30, 37, 39, 40, 41, 52, 53, 63, 65, 66, 67, 71, 72, 73, 74, 75, 76, 77, 78, 79, 82, 83, 84, 85, 87, 96.

6.6.7 The cairn at Red Burn Bridge (Asset 4), is one of the non-designated heritage assets that WoSAS has suggested may be of national importance on the basis of the Non-Statutory Register. The recorded condition of the asset, which is heavily robbed, comparison with other cairns that have been scheduled or determined to be of schedulable quality, and the limited information available on the asset all suggest that the asset cannot be regarded as being of high value (i.e. national importance). The asset has been assessed to be of medium value. The location of the cairn on a low hill, in a position with relatively limited visibility in the landscape, suggests that longer distance views were not key in the location selection for the construction of

the cairn, though views from the lower lying land immediately adjacent to the hill might have been a consideration. The wider landscape is a mixture of open moorland and blocks of modern plantation forestry, which form a dominant element in the landscape. The turbines of the existing Dersalloch Wind Farm and existing overhead power cables form other notable modern elements in the wider landscape. The main setting contribution to the value of the asset comes from the views between the immediate landscape, in the area a few hundred metres northwards and the cairn. This makes a medium contribution to the understanding and appreciation of the asset, as it is already compromised by the modern landscape elements including severance by the road, and distraction and dominance by the modern forestry and the existing turbines. The proposed turbines would form a new set of elements beyond this element of the setting, and would form a distracting element, resulting in an impact of medium magnitude, resulting in an adverse effect with a **low** significance.

6.6.8 The location of Keirs Castle, a medieval tower house (Asset 7) near High Keirs is on the edge of a steep stream valley. The remains of the asset are not visible on the ground at the recorded location. The location of the asset is close to Twentieth Century farm buildings located to the north, which block views down the stream valley. On the other sides the asset is hemmed in by permanent woodland. The original location of the asset was probably based in part on having longer distance views, particularly northwards to the Doon Valley. These views are now essentially blocked. The contribution of the setting to the understanding and appreciation of the asset is assessed to be of very low value. ZTV modelling indicates that two turbines would be visible from this asset, though this does not take account of the screening effects of the permanent woodland close to the asset (Figure 6.2). The proposed turbines are not located within the main element of the setting of the asset described above, and would have limited visibility. The magnitude of impact on the setting of the asset is therefore assessed to be low, resulting in an effect of **negligible** significance.

6.6.9 The possible house platform identified at Keirs Hill (Asset 54) is situated in an area of open moorland, on the boundary with an area of improved pasture. Plantation forestry forms an important visual element in the nearby landscape, with the A713 and Waterside village forming other notable modern elements in wider landscape to the north and northeast. To the south the turbines of the Dersalloch Wind Farm form another notable modern element in the landscape. As the presumed location of an agricultural settlement, the immediate landscape setting is the key area in terms of understanding the asset. The open landscape in the immediate vicinity of the asset makes very little contribution to the understanding and appreciation of the asset: the value of the contribution is assessed to be of very low value. The proposed turbines would constitute a notable new element in the landscape, and would form a distracting element from the setting. The magnitude of this impact is assessed to medium, resulting in an effect with a **negligible** significance.

6.6.10 The portion of the village of Waterside within the ISA contains 27 heritage assets, including a number of designated heritage assets (see Table 6.4). The various receptors in Waterside village and the Waterside bing (SM7544, Asset 18) are assessed together. These consist of most of the village, which is designated as a conservation area (CA50), within which there are two scheduled monuments (SM4345, 7863), one of which is also a Category A listed building (LB1092), three Category B listed buildings(LB1094, LB6595, LB6623) and two Category C listed buildings (LB1093, LB6596). All these assets relate to the functioning of the settlement with respect to the Dalmellington Iron Works; Waterside was essentially a company village, that came into being because of the presence of the ironworks and the associated coal mining.

6.6.11 The industrial and related elements of the village are concentrated in the south-eastern part of the settlement, and include the ironworks (Assets 10, 80, 81), brickworks and engine house (Asset 11), locomotive repair shops (Asset 17), railway and station (Assets 43 and 22 respectively) and offices (Asset 36), together with a limited number of domestic structures (Asset 27). The north-western portion of the village contains most of the domestic and civic structures, and some commercial buildings such as the store and public house(Asset 35), a range of housing covering the range of social positions in the village (Assets 23,24, 25, 26, 27, 28, 30, 31, 82, 84), ornamental lamp posts (Asset 33) the church/chapel of ease (Asset 19), church hall (Asset 21), institute (Asset 20) and school (Asset 29). The two parts of the village are separated by an area of open land, the result of the loss of the buildings depicted in the Ordnance Survey 1st and 2nd Edition 6 Inch maps. The north-western part of the village has also lost a considerable number of houses, including two rows depicted on historic OS mapping called Clover Park (Asset 27) and Barley Park (Asset 25), four rows of buildings between the Ayr and Dalmellington railway (the route still in operation today) and the road (current A713) and two rows south west of the road, where there are now no buildings at all.

6.6.12 The setting of the south eastern portion of the village is relatively constrained, being focussed internally between the main elements of the former industrial area and nearby housing (Plate 6.1), and the spatial and visual relationships between these different elements is the aspect of the setting that makes the greatest contribution to the understanding and appreciation of these heritage assets: the value of this contribution is assessed to be medium. The proposed turbines would

have limited visibility within this area, and would not directly interfere in these visual and spatial relationships. Where they are visible they may form a distracting element in the visual setting. The magnitude of this impact is assessed to be low, resulting in an effect of **very minor** significance. In the landscape beyond this, the visual and spatial relationship with the Waterside Bing Scheduled Monument (SM7544, Asset 18), formed from the waste products of the industrial processes within the south eastern part of the village also makes a setting contribution to the aforementioned heritage assets. The spatial and visual relationship between the former industrial sites and the bing is somewhat compromised by the removal of the bridge that linked them and the construction of the modern A714 which severs the spatial relationship. Visibility between the industrial structures and the bing is limited due to the scale of the surviving buildings and the presence of permanent woodland in and around the iron works. The clearest view is from the approach to the former road bridge (Plate 6.2, Figure 6.3). This element of the setting is assessed to be of low value. From the selected viewpoint (Figure 6.3), the proposed turbines would not further directly interfere or sever the visual connection between the scheduled monuments (SM4345, SM7544). Most of the proposed turbines would be clearly visible, and would form a distracting element in the visual field. The magnitude of this impact is assessed to be medium, resulting in an effect with a **very minor** significance. The wider landscape makes very little contribution to the understanding and appreciation of this collection of heritage assets, as the historically linked elements such as the scheduled monument that consists of the miners' villages and mineral railways to the north of Waterside (SM7863) have very limited intervisibility with the heritage assets throughout Waterside. The wider landscape setting contribution to the value of the assets in the south eastern part of the village is assessed to be very low. The proposed turbines would form a new, potentially distracting element, but are not located in any of the areas of the wider landscape that have functional links to the ironworks, and do not directly block or interfere with the line of sight to such areas. The magnitude of impact is therefore assessed as very low, leading to an effect of **negligible** significance.

Plate 6.1 View northwest from within Waterside, Dalmellington Ironworks Scheduled Monument (SM4345, Asset 11)

Plate 6.2 View west from Waterside, Dalmellington Ironworks Scheduled Monument (SM4345) toward Waterside Bing, Iron Slag Bing, Dalmellington Ironworks Scheduled Monument (SM7544)

6.6.13 Although the Dalmellington Ironworks Scheduled Monument does extend slightly into the north western part of the village, the majority of the heritage assets in this part of the village are not within the scheduled area. As noted above the north western part of the village contains the domestic, civic, commercial and religious elements of the settlement. This part of the village has a much sparser density of buildings than it would have originally had in nineteenth century (see 6.6.11). This would have included buildings either side of the A713, where two rows of houses would have faced the current row called New Cottages (Asset 24). The current setting of the surviving structures is open in ground plan, which belies the original structuring of the settlement. The heavy growth of trees and hedgerows, often in locations where there had been buildings gives this part of the village a secluded and screened off visual setting, which is at odds with the original setting of the village and appears to have evolved relatively recently: photographic evidence from the early 1980's available on HES's Canmore website shows a more treeless environment. The current immediate setting of the northern part of the village is the visual and spatial relationship of the surviving buildings. These do assist in understanding and appreciating the changing character of the settlement after its industrial decline rather than its layout during its heyday. The contribution this aspect of the setting makes to the heritage assets within the north western part of the village is assessed to be of low value. The majority of the proposed turbines would be at least partially visible within most of the north western part of the village, as would portions of the proposed access track (Figure 6.4). Although they would not directly interfere with this element of the setting, they would create a new feature in the landscape that could be visually distracting. The magnitude of impact is assessed to be low, resulting in an effect of **very minor** significance.

6.6.14 The wider landscape setting contribution to the value of the assets in the north western part of the village is assessed to be very low. The elements of the wider landscape that are linked to the historical function of the village, such as the mineral railway, mining villages and remains of mines are generally not intervisible with the north western part of the village, due to a combination of topography and the permanent woodland on the north eastern edge of the village. The proposed turbines would form a new, potentially distracting element, but are not located in any of the areas of the wider landscape that have a functional link to the history of the village as an industrial settlement, and do not directly block or interfere with the line of sight to such areas. The magnitude of impact is therefore assessed as very low, leading to an effect of **negligible** significance.

6.6.15 A small section of the Scheduled Monument consisting of the miners' villages and mineral railways north of Waterside (Asset 42, SM7863) lies within the ISA, therefore the potential for effects resulting from setting change to this complex are considered in this section. The Scheduled Monument comprises the former route of the mineral railways used to transport coal and mining waste, as well as three, now deserted, villages that lay adjacent or close to the railway: Corbie Craigs, Benquhat and Lethanhill. A number of associated non-designated heritage assets such as former mines are also located close to the railway, however, these do not lie within the ISA and are therefore are not individually considered here. As an extensive Scheduled Monument, one element of the setting is the spatial and visual relationship between different sections of the asset. These are generally local, as topography and occasionally areas of woodland mean that most of the asset is not visible from any particular point in the extent of the asset. This element of the setting can contribute to the understanding and appreciation of the asset in terms of its original function of the asset as an industrial transport route across a rural

landscape, and the way it also connected otherwise isolated communities. The value of this element of the setting is highly variable across the asset as visibility between different parts of the asset are very variable, and in some locations the setting has been heavily compromised, such as the site of Lethanhill village which is entirely planted over with conifers. The contribution this element of the setting makes to the asset value varies between nil, (e.g. in the area near Waterside where the asset is entirely enclosed in woodland and no visual connection can be made with the rest of the asset) and medium (e.g. in the approaches to the location of Benquhat where the juxtaposition of the former colliery, the village and the railway can be appreciated and understood in terms of the how the landscape at this point functioned). The ZTV model indicates that all of the turbines will be visible at least at tip height across the area of the Scheduled Monument, though it is likely that this does not take full account of local topographic variations, including historic spoil bings at various points in and around the scheduled area, some areas of permanent woodland and some small scale local topographic variation. The route of the railway as it passed Lethanhill village has been selected as the location for an indicative wireframe visualisation (Figure 6.5). At this location the proposed turbines would be highly visible to the south west, and while visually overlapping the current array of turbines at Dersalloch, would extend the horizontal extent of visible turbines. The setting of the asset discussed above is already considerably compromised at this location due to the forestry plantation on the Lethanhill village site, and the somewhat longer distance views along the route of the railway are somewhat limited here. The contribution that this element of setting makes to the value of the asset is therefore assessed to be very low. While the proposed turbines are highly visible from this location, they form an incremental extension of the horizontal visual field that is already occupied by the Dersalloch turbines, albeit one at a larger scale than these existing turbines. The proposed, and current, turbines do not directly interfere with the line of sight to other parts of the asset. In comparison to the design of the previous application the proposed turbines are fewer in number, with a lower visual density and the lay out would have a narrower horizontal extent when viewed from Waterside. Although the currently proposed turbines are higher than those of the previous application they are located further away, and therefore do not appear appreciably higher on the skyline than the previous design. As large elements in the landscape turbines would have a distracting effect on the appreciation of the asset. The magnitude of this impact is assessed to be low, resulting in a negative effect of **negligible** significance. In terms of greatest likely impact on this element of the setting of the asset, the section of the railway route on the mid slopes of Lethan Hill would be subject to the greatest magnitude of impact, as this is the area of the Scheduled Monument in which they would be most clearly discernible and have the greatest distracting effect. In this area the magnitude of impact is assessed to be medium. The contribution of the setting to the value of the asset in this section is assessed to be low, based on relatively limited views along the route, with the section nearest Waterside being screened by woodland (as is the village itself). This would result in a negative effect of **very minor** significance.

6.6.16 The wider landscape setting of the contribution to the value of the asset is assessed to be very low. The elements of the wider landscape that are intervisible with the area of the asset do not have notable links to the historical function of the mineral railway and mining villages, and are largely dominated by modern conifer forestry rather than the more open moorland that would have existed during the working lifetime of the asset. The proposed turbines would form a new, potentially distracting element, but only form a relatively small part of the wider landscape visible from the asset The magnitude of impact is therefore assessed as very low, leading to an effect of **negligible** significance.

Operational Effects: Outer Study Area

6.6.17 Designated heritage assets consisting of Scheduled Monuments, Category A Listed Buildings, Category B Listed Buildings (within 5km of the proposed turbines), inventory Gardens and Designed Landscapes and Conservation Areas have been considered in the assessment. All the asset listed in Table 6.5 have been considered. Sites that WoSAS considers to have the potential to be Scheduled Monuments have also been considered. Assets have only been assessed where there is a realistic prospect of a significant effect due to setting change. Methods of selection have included applying a ZTV model to exclude assets where there is no intervisbility with the proposed development, and taking account other effects such as screening or separation from the local landscape in built up areas.

6.6.18 The Bogton Loch Airfield Scheduled Monument (SM13693) is located on the outskirts of Dalmellington. The asset was an airfield during World War I, forming part of the Loch Doon Gunnery School. While the foundations of structures associated with the airfield are known to survive in the scheduled area these are not readily discernible beyond the boundaries of the asset. The current setting of the asset includes roads that border the asset on three sides, the boggy land to the south west and the local sports field and structures on the outskirts of Dalmellington. The asset is surrounded by hedgerows, is cut by overhead powerlines and has a number of clumps of shrubs growing within it. These landscape elements make a very low contribution to the understanding and appreciation of the asset. The proposed turbines would form a

relatively distant element in the landscape, partially screened by the intervening high ground around Auchenroy Hill. While the proposed turbines would be visible, their distance and partial screening would have nil magnitude of impact on the setting of the asset, resulting in **no** effect significance.

6.6.19 Auchenroy Hill Cairn (WoSASPIN 7112, Canmore ID 42554) is a non-designated asset that WOSAS has identified as potentially being of national importance on the basis of the Non-Statutory Register. It is situated within Craigengillan GDL (GDL00111), with Auchenroy Hill forming the one of the few small areas of the GDL that is modelled as being intervisible with the proposed turbines. The cairn is described as being 14.5 m in diameter and 0.6 m high. The observable cairn on the summit of Auchenroy Hill is much smaller than this and has the appearance of a modern walkers' cairn. Examination of the surrounding ground indicated that there may be more sub-surface stone, and the size of the stones in the potentially modern cairn, combined with the considerable distance downslope to the nearest ready source of stones of this size suggest that the visible stone cairn may have been formed of material robbed from a pre-existing cairn at this location. Assuming a prehistoric cairn to be present under the modern cairn, the setting of the cairn may be described as follows. The cairn is on the lower of the two summits of Auchenroy Hill, and approximately 600m to the south west is the higher summit of Auldcraigoch Hill, so although in a prominent location the cairn is not the highest place in the immediate landscape, and views in this direction are the most constrained from this location. These sense of relative visual constraint is currently heightened be the plantation forestry on Auldcraigoch Hill. Views over the Doon Valley are extensive, with the north eastern valley edge forming the limit of visibility. From the east to the south there are views of successive ranges of hills. Prominent elements in the current landscape include the settlements of Dalmellington and Bellsbank, with Waterside being less readily discernible. The river Doon and Bogton Loch can also be seen, with a partial view of Loch Doon also being visible. Modern conifer plantations form a dominant element in the current views in many directions. The Dersalloch windfarm also forms an element in the view to the south west, though topographic constraints reduce the visibility of the turbines. Although the cairn is situated in a relatively prominent location, the cairn and its precise position are not readily discerned from the lower lying land around Auchenroy Hill and along the Doon Valley. At the current level of information and apparent state of preservation the cairn is assessed to be of medium value. The location of the cairn towards the south eastern brow of the hill suggests that the original intent in constructing the cairn would have been for the cairn to be visually dominant in views over the area to the south east (Plate 6.3). This element of the setting of the is assessed to be of medium value. The proposed turbines would not be visible in the views to and from the asset along this axis, and therefore are assessed to have no impact on this element of the setting and thus **no** effect significance. While views over much of the rest of the wider landscape are impressive, they add little to our understanding and appreciation of the asset in cultural heritage terms, and therefore are assessed to make a low contribution to the value of the asset. The proposed turbines would constitute a moderate extension of the visual range in which turbines are visible from the asset, though this would be in the direction in which views from the asset are most topographically constrained (Figure 6.6). The additional distracting effect of the proposed turbines would lead to an impact which is assessed to have a very low magnitude leading to a negative effect of **negligible** significance.

6.6.20 Auchencroy Hill is located towards the north western edge of the Craigengillan inventory Garden and Designed Landscape (GDL00111). The GDL boundaries respect those of the old Craigengillan estate. However, the core designed element is in the south east of the GDL, in the vicinity of Craigengillan (a Category A Listed Building, LB18793) in an area with very limited intervisibility with Auchenroy Hill. The landscape character of Auchenroy Hill is more similar to the other rough grazing land around it, both within and outwith the GDL. The core designed area of the GDL is not intervisible with the Proposed Development. Auchenroy Hill forms part of the wider landscape setting of the GDL, similar to that of the other areas of upland rough grazing land interspersed with plantation forestry, both within and outwith the GDL. This element of the setting makes a contribution to the understanding and appreciation of the GDL that is assessed to be of low value. As noted above, the proposed turbines would constitute a moderate extension of the visual range in which turbines are visible from the asset, though this would be in the direction in which views from the asset are most topographically constrained (Figure 6.6). The additional distracting effect of the proposed turbines would lead to an impact which is assessed to have a very low magnitude leading to a negative effect of **negligible** significance.

6.6.21 Blairquhan House is a Category A Listed Building (LB19094) set within grounds that are a designated Garden and Designed Landscape (GDL00063). The main setting of the house is the immediately surrounding designed landscape, including other nearby buildings particularly the stable block to the east of the house, which is a Category B Listed Building (LB19095). Views to the north include the parkland that extends from the Water of Girvan to King's Hill. To the south, from the main entrance of the house, views are towards a triple avenue of trees and woodland beyond that. The contribution to the understanding and appreciation of the asset is assessed to be high.

6.6.22 The setting of the Blairquhan GDL can be split into two main elements. The first is the internal configurations and designed spatial and visual relationships within the GDL. This includes the areas of parkland and woodland mentioned above, but also the long main drive to the house that extends to the Kirkmichael road (B7045). Views to east and west from the drive are screened by woodland along most of the route, although there are more open sections (see Figure 6.7 and VP 10 photomontage in LVIA Chapter). The internal configuration and design of the GDL is assessed to make a high contribution to the value of the asset. The second main element of the setting of the GDL is the visual relationship with the wider landscape, including the Sclenteuch Moor Littleton Glen and Spec plantations that have an historic connection to the wider Blairquhan estate. Although these historic plantation areas survive, they are now incorporated into much larger areas of plantation forestry, making the original relationship difficult to discern. This element of the setting is assessed to make a low contribution to the value of the asset.

6.6.23 The main views from Blairquhan house are to the north and south, away from the proposed turbines. Figure 6.8 is a wireline visualisation of the proposed turbines, in combination with those already operational at Dersalloch. This view would only be possible from the limited number of windows on the eastern side of the house, and does not take account of the considerable screening by trees and other buildings. The proposed turbines would not directly interpose between the asset and the main elements of the setting in terms of the designed landscape. Being visible, they would form a distracting element in more distance views from the limited location where this view would be possible. The magnitude of this effect is assessed to be very low, leading to a negative effect of **very minor** significance.

6.6.24 While the ZTV model indicates that nine turbines will be visible at tip height across the extent of the GDL, it should be noted that this does not take account of the effect screening by small topographic variation, structures and, most relevant to the GDL, permanent woodland would have over much of the GDL. A considerable portion of the GDL is covered by woodland or screened by woodland. In particular, the main approach to Blairquhan House largely runs through permanent woodland. Comparison of the wireline and photomontage for the selected Viewpoint location on the drive, which is one of the more open sections, demonstrates how important this screening may be.In terms of the element of the setting consisting of the internal configurations and designed spatial and visual relationships within the GDL The proposed turbines would not directly interpose between the main components of the setting in terms of the designed landscape. Being visible, they would form a distracting element in more distance views from those locations where this view would be possible. The magnitude of this effect is assessed to be low, leading to a negative effect of **minor** significance. The proposed turbines would form a notable new element in the landscape, and would backdrop to some views to the wider landscape, particularly the Sclenteuch Moor Littleton Glen and Spec plantations. The distraction from these areas of the wider landscape is assessed to be an impact of medium magnitude, resulting in an effect of **very minor** significance.

6.6.25 Colonel Hunter Blairs Monument is a Category B Listed Building (LB19104). The monument was erected to the memory of Lieutenant Colonel James Hunter Blair who died in 1854 of wounds sustained at the Battle of Inkerman. Hunter Blair was also the local MP, and the family seat was at Blairquhan House. The monument is located toward the northern brow of Highgate Hill. It is intervisible with the main street in Straiton and the surrounding area, including intermittently along the B741, and some parts of the Blairquhan GDL, but not the house or the grounds immediately surrounding it. The intervisibility between the monument and Straiton and its immediately surrounding area forms the most important element of the setting. Its contribution to the value of the asset is assessed to be medium. There are long distance views in most directions from the monument, with the exception of the east. While these wider views are impressive, they do not contribute to the understanding and appreciation of the monument as a heritage asset. The wireline visualisation for this asset (Figure 6.9) indicates that seven of the proposed turbines would be visible from the monument. In comparison to the design of the previous application the proposed turbines are fewer in number, with a lower visual density and the lay out would have a slightly narrower horizontal extent when viewed from the monument. While these would not directly interpose in the main axis of intervisibility between the monument and Straiton, they would form a new large scale element on that would constitute a visual distraction from views from the monument. The turbines would not be visible from many locations on lower ground where the monument is visible due to screening from built up areas and woodland. The magnitude of effect on the views from the monument is assessed to be a negative effect of **minor** significance.

Decommissioning Effects

6.6.26 Physical decommissioning effects are not predicted to occur, as any potential impacts will already have occurred during construction, and will already have been mitigated as far as possible. Full decommissioning would reverse any operational effects on heritage assets resulting from setting change.

6.7 Mitigation

6.7.1 No significant construction effects are predicted to occur. The limited non-significant potential construction effects can be mitigated through the fencing off of Asset 14 prior to construction activity to avoid accidental damage. Potential impacts on Asset 1 can be either avoided through initial investigations to establish the extent of the asset and fencing off to avoid impacts, or through a programme of investigation and mitigation such as a watching brief or strip map and sample programme as deemed appropriate.

6.7.2 The precise programme of mitigation would be agreed with WoSAS as the local authority archaeological advisers and recorded in an Written Scheme of Investigation WSI) that would lay out the methods and standards of investigation and reporting to be adhered to.

6.7.3 No additional mitigation if proposed for operational effects beyond the mitigation through the iterative design process to reduce intervisibility with heritage assets where possible.

6.8 Assessment of Residual Effects

6.8.1 Mitigation of the potential impacts on Asset 1 through a programme of archaeological investigation would provide information on the nature of the archaeological remains and enhance local archaeological knowledge, specifically with regard to pot-medieval upland rural settlement. This would reduce the impact to an effect of **negligible** significance.

6.8.2 The protective measures proposed for Asset 14 would prevent accidental impacts on the asset, ensuring **no** effects.

6.8.3 As no additional mitigation is proposed for the operational effects, the residual effects are the same as those already assessed above.

6.9 Assessment of Cumulative Effects

6.9.1 Other wind farm developments within the area near the Proposed Development have the potential to have impacts on heritage assets. Those wind farms that are already operational, are under construction or have been consented for construction have been taken into account in the main assessment. Proposed wind farm developments that have active planning proposals or planning appeals have been considered in terms of cumulative impacts. The developments considered are those that are within 10km of those assets that have been assessed, are potentially intervisible with those assets, and where those assets are predicted to receive a perceptible effect from the Proposed Development. The developments that meet these criteria are Knockcronal, Carrick, Craiginmoddie and Greenburn Wind Park.

6.9.2 The two heritage assets that have the potential to be subject to cumulative impacts are the miners' villages and mineral railways north of Waterside (Asset 42, SM7863) and Auchenroy Hill Cairn (WoSASPIN 7112, Canmore ID 42554).

6.9.3 The wireline visualisation for the potential cumulative effects on the miners' villages and mineral railways north of Waterside (Asset 42, SM7863) shows Knockcronal, Carrick, Craiginmoddie wind farms as being just visible (Figure 6.10). It should be noted that the wireline is a ‘bare earth’ model. Taking into consideration the extensive areas of forestry much closer to the asset than these three wind farms, there is no realistic prospect that these wind farms will be intervisible with the asset, and therefore it is predicted that there will be no cumulative impact.

6.9.4 The wireline visualisation for the potential cumulative effects on Auchenroy Hill Cairn (WoSASPIN 7112, Canmore ID 42554) shows Knockcronal, Carrick, Craiginmoddie wind farms as being just visible (Figure 6.11). It should be noted that the wireline is a ‘bare earth’ model. Taking into consideration the extensive areas of forestry much closer to the asset than these three wind farms, it is predicted that the wind farms at Craiginmoddie and Knockcronal would not be intervisible, and that only a small portion of the turbines at the Carrick wind farm would be partially visible, creating a further small ‘island’ of turbines in views in this direction. This would to a limited extent increase the distracting effect already noted, resulting in a predicted cumulative impact with a very minor effect significance.

6.10 Summary

6.10.1 It has been assessed that no residual construction effects that are significant in EIA terms will occur as a result of the Proposed Development. Effects on Asset 1 can be reduced by mitigation to either none or negligible, dependent on the outcome of the initial investigatory phase of mitigation, resulting in either avoidance of impacts or mitigation through recording archaeological remains prior to their removal.

6.10.2 As no further suitable mitigation has been identified for operational effects, the residual effects will be as per the main assessment. None of the operational effects have been assessed to be significant in EIA terms. The assessed operational effects range between none and minor significance.

7 Ecology

7.1 Statement of Competence

7.1.1 This Environmental Impact Assessment Report (EIAR) chapter has been prepared by suitably qualified and experienced ecologists and all data were collected by suitably qualified and experienced surveyors. The assessment has been carried out by Nicole Dunn, of Natural Power Consultants Ltd. Detailed professional qualifications and any relevant code of practice have been followed.

7.1.2 The author of this chapter has eight years of experience in environmental consultancy and has been working as an Ecological Consultant for the last seven years. During this time, she has been involved with design, implementation and management of ecological assessments, production of EIAR chapters, scoping reports, technical baseline reports and operational monitoring reports as well as client and consultee liaison. The author was assisted by a Principal Environmental Consultant who is a MSc graduate in Wildlife Science with 30 years' experience working in the environmental/conservation sector and 12 years of experience in Ecological Impact Assessment (EcIA) and EIAR compilation for a renewable energy consultancy, and a Technical Director with 12 years of experience in EcIA and EIAR compilation.

7.2 Introduction

7.2.1 This chapter considers the likely significant effects on non-avian ecology associated with the construction and operation of the Proposed Development. The specific objectives of the chapter are to:

- describe the current 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 the likely significant effects;
- assess the residual effects remaining following the implementation of mitigation measures.

7.2.2 The chapter is supported by:

- Technical Appendix 7.1
- Confidential Appendix 7.2

7.2.3 Figures 7.1 – 7.6 are referenced in the text where relevant.

7.3 Legislation, Policy and Guidance

7.3.1 The following framework of international, national and local legislation and planning policy guidance that exists to protect habitats and specific species has been considered as part of the assessment. Ecological baseline surveys have been conducted following recognised guidelines and the ecological impact assessment takes account of the CIEEM guidelines (CIEEM, 2018)[1].

Legislation

- Water Environment and Water Services (Scotland) Act 2003;
- Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive);
- The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (the Habitats Regulations), which transposes the Habitats Directive into law in Scotland; and
- The Conservation of Habitats and Species Regulations 2017 (as amended), relating to reserved matters in Scotland including the granting of consent under Section 36 of the Electricity Act (together, "the Habitats Regulations");
- Wildlife and Countryside Act 1981 (as amended);
- Protection of Badgers Act (1992);
- The Nature Conservation (Scotland) Act 2004;
- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017; and
- The Wildlife and Natural Environment (Scotland) Act 2011.

Policy

7.3.2 The following policies are relevant to this chapter in a national context:

- UK Post 2010 biodiversity framework;
- The Scottish Biodiversity Strategy comprising:
- Scotland's Biodiversity: It's in Your Hands (Scottish Executive, 2004)[2];
- The 2020 Challenge for Scotland's Biodiversity;

[1] CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal. Chartered Institute of Ecology and Environmental Management, Winchester.

[2] Scottish Executive (2004) Scotland's Biodiversity it's in your hands: A strategy for the conservation and enhancement of biodiversity in Scotland. Scottish Executive, Edinburgh.

- PAN 60: Planning for Natural Heritage (Scottish Government, 2000)[3]; and
- Nature Conservation: Implementation in Scotland of the Habitats and Birds Directives: Scottish Executive Circular 6/1995 as amended (June 2000).

Guidance

7.3.3 Particular attention has also been given to the guidance documents listed below that are applicable to assessing the effects of wind farm developments on ecology. Reference has also been made to these guidance documents throughout this chapter where relevant:

- Chanin (2003)[4]. Ecology of the European Otter;
- CIEEM (2018)[1]. Guidelines for Ecological Impact Assessment in the United Kingdom and Ireland;
- Cresswell *et al*. (2012)[5]. UK BAP Mammals Interim Guidance for Survey Methodologies, Impact Assessment and Mitigation;
- Dean *et al*. (2016)[6]. The Water Vole Mitigation Handbook;
- Harris & Yalden (2008)[7]. Mammals of the British Isles: Handbook;
- Scottish Executive (2001)[8] European Protected Species, Development Sites and the Planning System: Interim guidance for local authorities on licensing arrangements;
- SEPA (2014)[9] Land Use Planning System SEPA Guidance Note 4: Planning Guidance on Windfarm Developments;
- SNH (2012)[10] Assessing the cumulative impact of onshore wind energy developments;
- NatureScot *et al*. (2021)[11] Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation;
- Scottish Renewables (SR), SNH, Scottish Environmental Protection Agency (SEPA), Forestry Commission Scotland (FCS) (2019)[12] Good Practice during Wind Farm Construction;
- Strachan *et al*. (2011)[13] The Water Vole Conservation Handbook;
- Scottish Biodiversity List (SBL)[14]; and
- International Union for Conservation of Nature (IUCN) Red List (IUCN, 2021)[15].

7.4 Consultation

7.4.1 As per good practice guidelines (CIEEM, 2018)[1], a Scoping Report for the Proposed Development was issued to a range of consultees in August 2021. This document contained details of the proposed assessment methodology and Important Ecological Features (IEFs) proposed for full impact assessment and those features to be scoped out (agreed with consultees) of impact assessment on the basis that construction and operation of the Proposed Development would not likely result in significant adverse effects to them. Details of the feedback from consultees on the Scoping Report and the resulting actions are provided in Table 7.1. Only aspects of the scoping responses with relevance to ecology have been included, other aspects will be addressed in the relevant chapters.

Table 7.1: Summary of consultation

Consultee	Issues raised and recommendations	Scoping response addressed
• East Ayrshire Council	• Impacts on Local Nature Conservation Sites (LNCS) and Ancient Woodland should be assessed.	• A search was carried out for LNCS and ancient woodland. No significant impacts were predicted for LNCS within 5 km of the Proposed Development Area or ancient woodland within 1 km of the Proposed Development Area.
• Ayrshire Rivers Trust	• Requested that impact of obstructions to fish migration should be assessed	• All watercourse crossings will be designed so as to not impede fish or their food sources. See Section 7.7 for more information about the embedded mitigation for the project.
	• Requested that baseline fish population, macroinvertebrate and freshwater pearl mussel surveys are undertaken – including electro-fishing surveys.	• Baseline fish and freshwater pearl mussel (FWPM; *Margatifera margatifera*) habitat surveys were undertaken. An assessment has been undertaken on these species based on this information. Embedded mitigation includes protection measures for watercourses, fish and FWPM. Additionally, a Water Quality and Fish Management Plan (WQFMP) is proposed, which includes pre-

[3] Scottish Government (2000 updated 2008) Planning for Natural Heritage: Planning Advice Note 60 (PAN 60).

[4] Chanin, P. (2003a) Ecology of the European Otter. Conserving Natura 2000 Rivers Ecology Series No. 10. English Nature, Peterborough.

[5] Cresswell, W. J., Birks, J. D. S., Dean, M., Pacheco, M., Trewhalla, W. J., Wells, D. and Wray, S. (2012) UK BAP Mammals Interim Guidance for Survey Methodologies, Impact Assessment and Mitigation. Published by The Mammal Society.

[6] Dean, M., Strachan, R., Gow, D. and Andrews, R. (2016) The Water Vole Mitigation Handbook (The Mammal Society Mitigation Guidance Series). Eds Fiona Mathews and Paul Chanin. The Mammal Society, London.

[7] Harris, S. and Yalden, D.W. (eds). (2008) Mammals of the British Isles: Handbook, 4th Edition. The Mammal Society, Southampton.

[8] Scottish Executive (2001, updated 2006) European protected species, development sites and the planning system: Interim guidance for local authorities on licensing arrangements. Scottish Executive, Edinburgh.

[9] Scottish Environmental Protection Agency (SEPA) (2014) Land Use Planning System (LUPS), SEPA Guidance Note 4. Planning guidance on on-shore windfarm developments. Version 7. LUPS-GU4.

[10] SNH (2012) Assessing the cumulative impact of onshore wind energy developments. SNH, Scotland.

[11] NautreScot, Natural England, Natural Resources Wales, RenewableUK, Scottish Power Renewables, Ecotricity Ltd., the University of Exeter, and Bat Conservation Trust (BCT) (2021) Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation.

[12] Scottish Renewables, SNH, SEPA, Forestry Commission Scotland (2019) Good practice during windfarm construction. 4th edition.

[13] Strachan, R., Moorhouse, T. and Gelling, M. (2011) The Water Vole Conservation Handbook. Third Edition, Wildlife Conservation Research Unit, University of Oxford, Abingdon.

[14] https://www.nature.scot/doc/scottish-biodiversity-list

[15] IUCN (2021) The IUCN Red List of Threatened Species. Version 2021-2. Available at: https://www.iucnredlist.org

		construction, construction and post-construction fish, macro-invertebrate and FWPM population surveys (including electro-fishing).
	• Highlighted that they occasionally encounter live water voles within the watercourse study area and request that water voles are not scoped out of assessment.	• Embedded mitigation includes protection measures for water voles (*Arvicola amphibius*) in the event that they re-colonise the Proposed Development Area prior to construction. Pre-construction surveys will be undertaken in suitable water vole habitat within relevant construction buffers to update information on the water vole population in the Proposed Development Area. If water vole signs are found suitable protection measures will be put in place for water vole. See Paragraph 7.7.17 for more information about embedded mitigation relating to water voles.
• NatureScot	• Agree that the five nearby sites designated for habitat features are not hydrologically linked to the Proposed Development. They therefore advise that it is unlikely that the proposal will have a significant effect on any of the objectives of designation and the overall integrity of the qualifying interests of the SSSIs, either directly or indirectly. • Also agree that there is unlikely to be any impact on Bogton Loch SSSI due to the Proposed Development being sited downstream from the SSSI.	• Acknowledged.
	• Consider the embedded mitigation measures identified in the Scoping Report to be appropriate. However, the applicant should also consider the direct and indirect impact any proposed forestry mitigation may have for protected species prior to scoping these out of detailed assessment. Where particular species are scoped out of the assessment, this should be fully justified in the EIA Report.	• No specific forestry mitigation is proposed (for further information see Chapter 12: Forestry). Direct and indirect impacts on protected species have been considered in the IEF table (Table XX) when scoping features out of full assessment.
• RSPB	• No comments.	• -
• SEPA	• Map and assessment of impacts upon Groundwater Dependent Terrestrial Ecosystems (GWDTE)	• NVC survey was carried out and results are included in this chapter. Impacts on GWDTE are fully assessed in Chapter 9: Geology, Hydrology and Hydrogeological Assessment
	and buffers, including carrying out NVC survey.	

7.5 Methodology

Scope of Assessment

7.5.1 The Proposed Development presents a potential risk for species and habitats via a number of mechanisms:

- Direct impacts associated with habitat loss and/or mortality;
- Direct impacts on protected species associated with resting place destruction;
- Indirect impacts on habitats and species associated with dust, siltation, leaks and spillages;
- Indirect impacts on protected species associated with disturbance and displacement; and
- Indirect impacts on species through pollution of habitats/watercourses affecting food sources.

7.5.2 These issues are considered in this assessment (Chapter 7.8).

7.5.3 The potential key ecological issues relating to the Proposed Development are as follows:

- The potential to adversely affect defined habitats afforded the highest level of statutory protection via inclusion in Annex I of the Habitats Directive, or habitats included on the Scottish Biodiversity List (SBL) and therefore considered to be a priority for conservation. Such an effect may arise through direct habitat loss, or indirect effects such as pollution; and
- The potential to adversely affect defined populations of species afforded the highest level of statutory protection from inclusion in the Wildlife and Countryside Act 1981 (as amended), or the Protection of Badgers Act (1992). Such an effect may arise through direct habitat loss, disturbance or displacement, more directly through collisions with the wind turbines (in relation to bats only), or indirectly through cumulative impacts.

Study Area

7.5.4 Surveys undertaken in 2020 were carried out within 250 m of the original wind turbine layout. Surveys undertaken in 2021 were carried out within 250 m of the access track, plus areas within 250 m of the updated layout that were not covered during the 2020 surveys. Areas out with the Proposed Development Area were surveyed from the boundary where possible. Great crested newt surveys were undertaken within 500 m of the Proposed Development.

7.5.5 Further details of survey extents can be found in Figure 7.1.

Desk Study

7.5.6 Records of relevant ecology data within a 10 km radius of the Proposed Development were requested from South West Scotland Environmental Information Centre (SWSEIC) but no response was received. Instead, a search was carried out using NBN Gateway[16] for records of the protected species considered as part of this assessment between 2011 and 2021 within 10 km of the Proposed Development.

7.5.7 A search was undertaken for Local Nature Conservation Sites (LNCS) within 5 km of the Proposed Development Area using the publicly available GIS layer of Wildlife Sites in South Ayrshire[17] and the East Ayrshire State of the Environment Report[18].

7.5.8 Additionally, a search was undertaken for ancient woodland within 1 km of the Proposed Development Area using the Ancient Woodland Inventory (AWI).

7.5.9 For information about other designated sites see the Technical Appendix 1.1: Scoping Report.

Previous Data - Keirs Hill

7.5.10 Baseline ecological surveys including: Phase 1 habitat, National Vegetation Classification (NVC), protected mammal, great crested newt and bat activity surveys were conducted by Natural Power at the Proposed Development in 2012 and 2013. These surveys were undertaken to inform the Keirs Hill Wind Farm application. This application was rejected in 2016. The results of these surveys were used to inform the scope of the survey programme for the Proposed Development. These results are considered to be relevant because the Keirs Hill Wind Farm application included land entirely within the Proposed Development Area which provides recent context and information on ecological receptors at the Proposed Development. A summary of the survey results is provided within the relevant results section, where relevant to the assessment.

Field Surveys

7.5.11 An overview of the field surveys used to inform this chapter is provided in Table 7.2 below. The table provides summary information of the dates, methodologies and survey extents of the field surveys. Additional information regarding dates and locations for bat activity surveys is given below.

7.5.12 Detailed information including exact dates and methodologies for the surveys can be found in Technical Appendix 7.1.

Table 7.2: Summary of field surveys undertaken

Survey	Method/Guidance followed	Date	Survey Area
• Phase 1 Habitat survey	• Joint Nature Conservation Committee (JNCC) (2010)[19]	• August 2020 • July and August 2021	• 250 m buffer of original wind turbine layout • 250 m buffer of access track plus additional areas within 250 m buffer of 2021 layout
• National Vegetation Classification (NVC) survey	• Rodwell (2006)[20] Averis *et al.* (2004)[21]	• August 2020 • July and August 2021	• 250 m buffer of original wind turbine layout • 250 m buffer of access track plus additional areas within 250 m buffer of 2021 layout
• Bat activity survey - static detectors	• NatureScot *et al.* (2021)[11]	• April-August 2021	• 250 m buffer of 2021 wind turbine layout (see Figure 7.3 and Table 7.3 for detector locations)
• Preliminary bat roost assessment	• Collins (2016)[22]	• April 2020 • July 2021	• 250 m buffer of original wind turbine layout • 250 m buffer of access track plus additional areas within 250 m buffer of 2021 layout
• Otter (*Lutra lutra*) and water vole survey	• Sargeant & Morris (2003)[23]; Chanin (2003)[4]; Dean *et al.* (2016)[6] and Bang & Dahlstrøm (2001)[24]	• April and August 2020 • June 2021	• 250 m buffer of original wind turbine layout • 250 m buffer of access track plus additional areas

[16] https://nbn.org.uk/the-national-biodiversity-network/archive-information/nbn-gateway

[17] South Ayrshire Council. ArcGIS map of areas depicting wildlife sites South Ayrshire. https://gis.south-ayrshire.gov.uk/arcgis/rest/services/Inspire/OpenData/FeatureServer/13

[18] East Ayrshire Council (2016) State of the Environment Report, Chapter 3: Ecology and Nature Conservation.

[19] Joint Nature Conservation Committee (JNCC) (2010) Handbook for Phase 1 Habitat survey: a technique for environmental audit. JNCC, Peterborough.

[20] Rodwell, J. S. (2006) National Vegetation Classification: Users' handbook. JNCC, Peterborough.

[21] Averis, A., Averis, B., Birks, J., Horsfield, D., Thomson, D., and Yeo., M. (2004) An Illustrated Guide to British Upland Vegetation. JNCC, Peterborough.

[22] Collins, J. (ed) (2016) Bat Surveys for Professional Ecologists: Good practice Guidelines (3rd edition). The Bat Conservation Trust, London.

[23] Sargeant, G. and Morris, P. (2003) How to Find and Identify Mammals. The Mammal Society, London.

[24] Bang, P. and Dahlstrøm, P. (2001) Animal Tracks and Signs. Oxford University Press, Oxford.

			within 250 m buffer of 2021 layout
• Badger (*Meles meles*) and pine marten (*Martes martes*)	• Bang & Dahlstrøm (2001)[24]; Harris & Yalden (2008)[7]; Sargeant and Morris (2003)[23]	• April and August 2020 • June 2021	• 250 m buffer of original wind turbine layout • 250 m buffer of access track plus additional areas within 250 m buffer of 2021 layout
• Great crested newt (*Triturus cristatus*) Habitat Suitability Index (HSI) and eDNA	• ARG UK (2010)[25]; Biggs *et al.* (2014)[26]	• July 2021	• 500 m buffer of Proposed Development (see Figure 7.2 for pond locations)
• Freshwater pearl mussel habitat survey	• Skinner *et al.* (2003)[27]	• September 2021	• Watercourses within the Proposed Development Area
• Fish habitat survey	• Scottish Fisheries Co-ordination Centre (SFCC; 2007)[28]	• July 2021	• Keirs Burn, River Doon, Red Burn, Lochhead Burn and Lambdoughty Burn

Bat Activity Surveys

7.5.13 Bat surveys were undertaken in 2021 following standard guidance (NatureScot *et al.*, 2021)[11]. Based on this guidance and the number of proposed wind turbines, ten static detectors were placed within the Proposed Development area near to wind turbine locations proposed at the time of deployment (where possible) and in locations representative of habitats within the Proposed Development Area, with all detectors being placed along a woodland edge, mostly where there was a break in the trees caused by clear-fell, a track or a watercourse (see Table 7.3 and Figure 7.3).

Table 7.3: Bat detector locations

Bat detector	Grid reference	Nearest wind turbine	Distance from wind turbine (m)	Location description/linear features
• 1	• NS4069606725	• T1	• 150	• Ditch, woodland edge (clear-fell), track
• 2	• NS4024307721	• T2	• 181	• Woodland edge, track
• 3	• NS4072007179	• T3	• 228	• Woodland edge (clear-fell)
• 4	• NS4134906573	• T4	• 346	• Woodland edge (edge of bog)
• 5	• NS4072408017	• T5	• 293	• Woodland edge (ride)
• 6	• NS4125307861	• T6	• 118	• Woodland edge, track
• 7	• NS4170607449	• T7	• 345	• Woodland edge (clear-fell), track, quarry
• 8	• NS4223406803	• T8	• 227	• Woodland edge, track, ditch
• 9	• NS4261207056	• T9	• 100	• Edge of plantation, fence
• 10	• NS4138506466	• T4	• 441	• Woodland edge, track

7.5.14 Static detectors were deployed on the following dates in spring, early summer and autumn for 14 nights duration per deployment:

- 23 April – 7 May 2021 (Survey 1),
- 2 – 16 June 2021 (Survey 2); and
- 16 – 30 August 2021 (Survey 3).

Survey Limitations

7.5.15 The following survey limitations were experienced:

7.5.16 During the bat activity survey, detector 3 produced no audio files during the summer deployment or on the nights of 27 and 28 August 2021. The two missing nights in August were likely due to battery failure but no detector issues were recorded by surveyors during the summer deployment. This data was removed from the assessment.

7.5.17 Sub-optimal weather conditions according to NatureScot guidance[11] were recorded during bat activity surveys as follows:

- During the spring deployment sub-optimal conditions were recorded on eight out of 14 nights:
  - the dusk temperature was below 8 °C on six nights; and
  - the median wind speed was above 5 m/s on four nights.
- During the summer deployment sub-optimal weather conditions were recorded on 12 out of 14 nights, when the median wind speed was above 5 m/s. The dusk temperature was above 8 °C on all survey nights; and
- During the autumn deployment sub-optimal weather conditions were recorded on three out of 14 nights, when the median wind speed was above 5 m/s. The dusk temperature was above 8 °C on all survey nights.

[25] Amphibian and Reptile Groups of the United Kingdom (ARG UK) (2010) ARG UK Advice Note 10: Great Crested Newt Habitat Suitability Index.

[26] Biggs, J., Ewald, N., Valentini, A., Gaboriaud, C., Griffiths, R. A., Foster, J., Wilkinson, J., Arnett, A., Williams, P. & Dunn, F. (2014) Analytical and methodological development for improved surveillance of the Great Crested Newt. Appendix 5. Technical advice note for field and laboratory sampling of great crested newt (*Triturus cristatus*) environmental DNA. Freshwater Habitats Trust, Oxford.

[27] Skinner, A., Young M. and Hastie, L. (2003). Ecology of the Freshwater Pearl Mussel. Conserving Natura 2000 Rivers Ecology Series No. 2. English Nature, Peterborough.

[28] Scottish Fisheries Co-ordination Centre (2007) Habitat Surveys Training Course Manual. Scottish Fisheries Co-ordination Centre, Edinburgh.

7.5.18 As a result of sub-optimal weather conditions survey data for three survey nights (26 and 27 April and 3 May) were removed from the assessment as no bat passes were recorded and both the mean nightly temperature and the median wind speed were recorded as sub-optimal. All other nights have been included within the assessment.

7.5.19 It is considered that the weather conditions experienced during the survey were likely to be representative of the general conditions within the Proposed Development Area as it is located in an upland environment, where inclement weather is common. The average night time temperature in Dalmellington in April is 5 °C. The average wind speed in Dalmellington is approximately 5 m/s in April, 4 m/s in June and 4 m/s in August (World Weather Online, 2022). The average wind speed recorded during the spring survey period was approximately 4 m/s, 11 m/s during the summer deployment and 3 m/s during the autumn deployment. The Proposed Development Area is in a more exposed location than Dalmellington and windy conditions are considered to be representative of the general conditions at the Proposed Development due to the exposed nature of the Proposed Development Area.

7.5.20 The infrastructure layout was changed between the 2021 Phase 1/NVC habitat surveys and the design freeze, which resulted in 125 ha of the 250 m buffer of infrastructure not being surveyed in 2020 or 2021 (equating to 25 % of the 250 m buffer of the Proposed Development). However, 97 ha of the area not surveyed in 2020 or 2021 was surveyed in 2012 or 2013 as part of the baseline for the previous application for Keirs Hill Wind Farm (equating to 19 % of the 250 m buffer of the Proposed Development). Therefore 28 ha (6 %) of the 250 m buffer of the Proposed Development was not surveyed for Phase 1/NVC habitats. This is not considered to represent a significant deficit in habitat information. The majority of the areas surveyed in 2012/13 but not in 2020/21 were heavily modified habitats with little to no conservation value, such as conifer plantation, improved grassland or urban areas, which are unlikely to have changed significantly between 2012 and 2021. Aerial imagery from Google Earth and Bing maps (dated 2018) has been used to assess the likelihood of habitat change in these areas. Additionally, the habitat loss calculations have been compared against the total habitat recorded within the Proposed Development Area, of which 373.6 ha was surveyed in 2012 or 2013 but not in 2020 or 2021.

Habitat Loss Calculations

7.5.21 The construction of the Proposed Development will result in some permanent habitat loss to the infrastructure footprint (e.g., access tracks, wind turbine foundations, crane hardstands, and substation and battery energy storage system compound). Habitat loss calculations are used to quantify the extent of this loss. Some construction areas will be reinstated following construction (for example the construction compounds and borrow pits) and therefore only represent temporary loss. Figures have been provided for both temporary and permanent loss, but only permanent habitat loss calculations have been used within the assessment. Percentage habitat loss is based on the total area of each Phase 1 habitat type within the Proposed Development Area.

Fish Habitat Suitability Assessment

7.5.22 An assessment of the suitability of the watercourses potentially impacted by the Proposed Development for migratory fish (Atlantic salmon (*Salmo salar*), brown/sea trout (*Salmo trutta*), river lamprey (*Lampetra fluviatilis*) and European eel (*Anguila anguila*)) was carried out based on the results of the fish habitat surveys. This assessment was based on the habitat requirements of these fish species as outlined in SFCC (2007)[28], Hendry & Cragg-Hine (2003)[29], Maitland (2003)[30] and Degerman *et al.* (2019)[31]. Table 7.4 outlines the basic habitat requirements for the three species at different life stages compiled from the sources outlined above.

Table 7.4: Habitat requirements for protected fish

Life stage	Atlantic salmon	Brown/sea trout	River lamprey	European eel
• Spawning/eggs	• Pebble/cobble substrate • Shallow gradient (<3%) • Water depth 17-76 cm • Moderate/fast flowing • Typical spawning sites in transition between pool and riffle	• Gravel/pebble/ cobble substrate • Water depth 20-150 cm	• Gravel with some sandy substrate • Typical spawning sites at tails of pools where gravels have been deposited •	• NA (spawning sites at sea)
• Nursery areas/	• Pebble/cobble substrate	• Pebble/cobble substrate • Shallow depth	• High organic content composed of	• Pebble/cobble/ boulder substrate

[29] Hendry, K. & Cragg-Hine, D. (2003) Ecology of the Atlantic salmon. Conserving Natura 2000 Rivers Ecology Series No. 7. English Nature, Peterborough.

[30] Maitland, P. S. (2003) Ecology of the river, brook and sea lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

[31] Degerman, E., Tamario, C., Watz, J., Nilsson, P. A. & Calles, O. (2019) Occurrence and habitat use of European eel (*Anguilla anguilla*) in running waters: lessons for improved monitoring, habitat restoration and stocking. Aquatic Ecology. 53, 639-650.

young fish	• Water depth <20 cm • Fast flowing • Vegetation/substrate/turbulence cover	• Slow to medium flow	mud, silt or silt and sand Water depth 10-100 cm • Shallow gradient	• Water depth 30-50 cm • Vegetation/substrate cover
• Yearling/older	• Cobble/boulder substrate • Water depth 20-40 cm • Fast flowing	• Variety of substrate • Deeper water • Slow flowing • Vegetation/bank/ substrate cover	• NA – in estuary	• Pebble/cobble/ boulder substrate • Water depth 20-90 cm • Vegetation/substrate cover
• Reproducing adults	• Deep pools • Vegetation/bank/ substrate/turbulence cover	• Deep areas of water • Moderate, sustained flow • Vegetation/bank/ substrate cover	• No significant obstacles to migration • Relatively slow flow	• NA

Approach to Impact Assessment

Sensitivity of Features

7.5.23 In accordance with CIEEM guidelines (CIEEM, 2018)[1], the importance of an ecological feature is based upon its respective elements relating to biodiversity and ecosystem services. The importance of an ecological feature is determined within a geographical frame of reference as detailed in Table 7.5.

Table 7.5: Geographical context relating to the evaluation of an IEF

Level of Value	Example
• International •	• An internationally designated site (e.g., Special Area of Conservation (SAC)), or site meeting criteria for international designations such as a World Heritage Site (WHS) or United Nations Educational Scientific and Cultural Organisation (UNESCO) Biosphere Reserve.
	• Species populations/habitat areas present with sufficient conservation importance to meet criteria for SAC selection.
• National •	• A nationally designated site such as a Site of Special Scientific Interest (SSSI), or a National Nature Reserve (NNR), or sites meeting the criteria for national designation (such as the JNCC guidelines).
	• Species populations/habitat areas present with sufficient conservation importance to meet criteria for SSSI selection.
• Regional	• Species populations/habitat areas at present falling short of SSSI selection criteria but with sufficient conservation importance to likely meet criteria for selection as a local site e.g., important in the context of SNH Natural Heritage Zone (NHZ) populations/habitat extents.
	• Sites designated as local nature reserves such as Scottish Wildlife Trust (SWT) Reserves or Local Biodiversity Sites (LBS).
• Local	• Areas of semi-natural ancient woodland smaller than 0.25 ha.
	• Areas of habitat or species populations considered to appreciably enrich the ecological resource within the local context, e.g., species-rich flushes or hedgerows or evidence of regular otter activity.
• Negligible	• Usually widespread and common habitats and species. Features falling below Local importance are not normally considered in detail in the assessment process.

7.5.24 The Proposed Development is located within NHZ 19 (Western Southern Uplands and Solway Firth). However, the Proposed Development Area is located on the boundary between NHZ 19 and NHZ 17 (West Central Belt), with a small portion to the west of the Proposed Development Area being within NHZ 17. NHZ 19 is characterised by a series of upland massifs of undulating, rounded domed, conical and craggy hills, drumlins, peninsulas and plateaux separated by valleys, dales and glens of varying cross-sections, tending to open to coastal flats at the Solway shore and raised beach at the Clyde shore. The dominant land cover types in NHZ 19 are conifer plantation, rough grazing and improved grazing. The character of NHZ 17 varies widely, with large areas of urban development, but also two major plateaux (the 'Ayrshire Rim' and the Slammanan Plateau). To the west the zone is dominated by extensive Ayrshire lowlands, which are dissected by radiating river valleys of varying character flowing to the lowland coast. The dominant land cover types in NHZ 17 are farmland and urbanised landscapes (SNH, 2001)[32]. It is therefore considered that the Proposed Development Area is most associated with NHZ 19 and this is the zone that the Proposed Development will be assessed against.

7.5.25 Attributing geographical value to a feature is generally straightforward in the case of designated sites, as the designations themselves are normally indicative of level of value. For example, a SAC designated under the Habitats Directive is explicitly of European (International) importance. However occasionally a default level of value may not be appropriate in the specific context of the Proposed Development. Where this is the case professional judgement has been applied and rationale for decreasing or increasing the geographical level of value of a feature is given. An example of this might be bats, all of which are of international importance due to their protection under Annex IV of the Habitats Directive. However, if only very few foraging/commuting records of common and widespread bat species were made at a site, attributing international importance to the population present at the Proposed Development would be disproportionate and the importance would be reduced accordingly (noting that this does not change the protection level from a legislative

[32] SNH (2001) Natural Heritage Zones: A National Assessment of Biodiversity (Habitats). SNH, Edinburgh.

standpoint). For non-designated features, the use of guidelines such as the national guidelines for the selection of SSSIs can be helpful in determining a feature's importance and level of value.

7.5.26 It should be acknowledged that some features, including certain legally protected species such as badger, may be of insufficient ecological and/or nature conservation importance at a given Proposed Development to warrant impact assessment within the EcIA, as there are unlikely to be significant effects to their population arising from the Proposed Development. However, due to the level of legal protection offered to these features, they are considered in the EcIA within the context of legal and policy implications.

7.5.27 Part of the process of attributing importance to a species involves defining the population to be valued and requires professional judgment to identify an ecologically coherent population against which effects on integrity can be assessed. For example, for wide-ranging species such as otter, it may be more appropriate to consider the otter population in a whole catchment, whereas for more localised species, such as water vole, importance may be attributed to groups of related colonies which function as a meta-population.

7.5.28 In line with the principles of proportionate EIA, embedded mitigation is considered at the outset of the assessment. IEF status has only been assigned where there is still considered to be the potential for significant effects to integrity of the feature at the assigned value level arising from the Proposed Development, after the application of embedded measures.

Valuing Bats

7.5.29 For the purposes of this assessment and of assigning value to bats, the NatureScot guidance[11] has also been considered. Table 2 in this guidance identifies the population vulnerability of bat species based on the collision risk posed for individual bat species by wind turbines as determined by behavioural characteristics, and by bat population sensitivity based upon species rarity (adapted from Wray *et al.* (2010)[33]). Table 7.6 summarises the risk of wind turbine impact to bat species and the sensitivity of bat populations.

Table 7.6: Risk of wind turbine impact affecting bat populations in Scotland[11]

Species	Wind Turbine Impact/Collision risk	Sensitivity of Population
• Noctule (Nyctalus noctula)	• High	• High
• Leisler's bat (Nyctalus leisleri)	• High	• High
• Nathusius' pipistrelle (*Pipistrellus nathusii*)	• High	• High
• Common pipistrelle (Pipistrellus pipistrellus)	• High	• Medium
• Soprano pipistrelle (*Pipistrellus pygmaeus*)	• High	• Medium
• *Myotis** species	• Low	• Low/Medium
• Brown long-eared bat (*Plecotus auritus*)	• Low	• Low

• *Myotis is the genus that includes Daubenton's bat (*Myotis daubentonii*), Natterer's bat (*Myotis nattereri*) and whiskered bat (*Myotis mystacinus*).

7.5.30 The guidance provided by Wray *et al.* (2010)[33] includes a framework for identifying the importance of bats in the landscape through the evaluation of bat roosts and habitats. Applying this framework, bat roosts can be valued according to species rarity and roost status.

7.5.31 Following NatureScot guidance[11], data from all seasons were run through Ecobat[34] in order to provide an assessment of relative bat activity within the Proposed Development Area when compared with bat activity at other sites within 100 km.

7.5.32 Using information provided within Tables 3a (initial site risk assessment) and 3b (overall risk assessment) of NatureScot *et al.* (2021)[11], an overall risk assessment was made in relation to the Proposed Development Area and Ecobat relative activity. The initial site risk assessment for the Proposed Development gave a risk level of 2, based on the following assumptions:

- The Proposed Development is considered to be a medium sized project as it:
  - Consists of fewer than 10 wind turbines (small project size);
  - Has one other operational wind development within 5 km (medium size); and
  - Proposed wind turbines have a height greater than 100 m (large project size). However, most wind developments now contain wind turbines above 100 m and other criteria suggest that the Proposed Development is of medium size.
- The Proposed Development Area is defined as a low habitat risk due to the small number of low-quality potential roost features, low quality foraging habitat and limited connection to the wider landscape by linear features.

[33] Wray, S., Wells, D., Long, E. and Mitchell-Jones, T. (2010) Valuing bats in Ecological Impact Assessment. CIEEM InPractice, Number 70.

[34] Ecobat is an online tool run by the Mammal Society that is used to assess the relative activity of bat species recorded at a site compared with other sites in the local area within a set time period. For more information go to http://www.ecobat.org.uk/

Magnitude of Impact

7.5.33 The magnitude of impact is predicted quantitatively where possible e.g., habitat loss. Where this is not possible, a more qualitative approach is taken. The criteria used in this assessment for describing the overall magnitude of a potential impact are summarised in Table 7.7.

7.5.34 The assessment also considers whether the effect is beneficial or adverse, short-term (for example only during construction) or long-term (throughout the lifetime of the Proposed Development), reversible or permanent.

Table 7.7: Description of impact magnitudes relating to the evaluation of an IEF

Impact magnitude	Description
• Very high negative	• Total or almost complete loss of an ecological feature resulting in a permanent adverse effect on the integrity of the feature. The conservation status of the feature would be permanently affected.
• High negative	• Result in large-scale, permanent changes in an ecological feature, likely to change its ecological integrity. These impacts are therefore likely to result in overall changes in the conservation status of an ecological feature.
• Medium negative	• Includes moderate-scale long-term changes in an ecological feature, or larger-scale temporary changes; however, the integrity of the ecological feature is not likely to be affected. This may result in temporary changes in the conservation status of the ecological feature, but these are reversible and unlikely to be permanent.
• Low negative	• Includes long-term impacts that are small in magnitude, or larger-scale temporary changes, and where integrity of the ecological feature is not affected. These effects are unlikely to result in overall changes in the conservation status of an ecological feature.
• Negligible	• No perceptible change in the ecological feature.

7.5.35 When characterising ecological impacts, it is essential to consider the likelihood that a change/activity will occur as predicted, with a degree of confidence in the impact assessment (in relation to the impact on ecological structure and function). Where possible, the degree of confidence should be predicted quantitatively. However, where this is not possible, a more qualitative approach is taken; particularly where the confidence level can only be based on expert judgement.

Significance of Effect

7.5.36 The CIEEM guidelines (CIEEM, 2018)[1] use only two categories to classify effects: "significant" or "not significant". A significant effect is defined in ecological terms as an effect on the integrity or conservation status of a defined site, habitat or species. The significance of an effect is determined by considering the value level of the feature and the magnitude of the impact and applying professional judgement as to whether the integrity/conservation status of the feature will be affected at the given value level. This concept can be applied to both designated and undesignated sites and to defined populations.

7.5.37 In this assessment, an effect that threatens the integrity of a feature is considered to be significant in terms of the EIA Regulations (2017). Effects assessed as not significant should be considered as not significant in terms of the EIA Regulations. It should be noted that, alongside the criteria provided, professional judgement is applied in determining the significance of a potential effect.

7.6 Baseline

Desk Study

7.6.1 There were no records of great crested newt, FWPM, European eel, Atlantic salmon, river lamprey, water vole, badger or pine marten on NBN Gateway[16] within 10 km of the Proposed Development between 2011 and 2021.

7.6.2 Records of the following species were found within 10 km of the Proposed Development between 2011 and 2021 on NBN Gateway:

- Red squirrel (*Sciurus vulgaris*) (85 records, including two records within the Proposed Development Area);
- Otter (4 records); and
- Bats (9 records including common and soprano pipistrelle only).

7.6.3 One Local Wildlife Site, one Scottish Wildlife Trust (SWT) reserve were found within 5 km of the Proposed Development Area additionally, four Provisional Wildlife Sites (PWSs) were found within 1 km of the Proposed Development (see Table 7.8). PWSs are not classed as LNCS but could become Wildlife Sites/LNCS in the future.

Table 7.8: LNCS within 5 km of the Proposed Development Area

Site	Designation	Distance from Proposed Development Area (km)
• Dunaskin Ironworks	• Wildlife Site	• 0.1
• Dalmellington Moss	• SWT Reserve	• 2.6
• Wallace Moor/Keirs Hill	• PWS	• Within Proposed Development Area
• Auchenroy/Glenmount Uplands	• PWS	• 0.1
• Doon Valley Wetlands	• PWS	• 0.7
• Dunaskin Glen/Benquhat Hill	• PWS	• 0.9

7.6.4 The SWT Reserve, Dalmellington Moss is a raised bog on the floodplain of the River Doon. It is also designated as a Site of Special Scientific Interest (SSSI), for further

information about designated sites see the Scoping Report. Dunaskin Ironworks is a post-industrial site in the valley of the River Doon comprising a mosaic of ephemeral habitats, stands of tall herb, wetland, broad-leaved woodland and scrub, with a rich flora, including many local rarities. One PWS (Wallace Moor/Keirs Hill) was located within the Proposed Development Area. Wallace Moor/Keirs Hill is small area of relatively unmodified blanket bog plus wet modified bog and wet heat/acid grassland mosaic, surrounded by Molinia dominated marshy grassland. This area was surveyed as part of 2012/2013 and 2021 Phase 1 and NVC surveys.

7.6.5 Five areas listed on the AWI were found within 1 km of the Proposed Development Area, with one area of ancient woodland located within the Proposed Development Area (see Table 7.9).

Table 7.9: Woodland listed on the AWI within 1 km of the Proposed Development Area

Woodland	Description	Distance from Proposed Development Area (m)
• Keirs Glen	• Ancient Woodland (of semi-natural origin)	• Within Proposed Development Area 60 m from proposed access track
• Carskeoch	• "Roy" Woodland - mapped as woodland in 1750 and had only a short break in continuity, likely to retain features of ancient woodland	• 233
• Lambdoughty Glen	• Long-established (of plantation origin)	• 560
• Sclenteuch Moor Plantation	• Long-established (of plantation origin)	• 725
• Grimmet Glen	• Ancient Woodland (of semi-natural origin)	• 869

Previous Data – Keirs Hill

7.6.6 Extended Phase 1 and NVC surveys were undertaken in the area of the proposed access route as part of the baseline for the Keirs Hill Wind Farm application. These surveys identified the presence the following Annex 1 and potential GWDTE habitats:

- Unimproved acid grassland (SBL/potential GWDTE);
- Marshy grassland (SBL/potential GWDTE);
- Wet heath (Annex 1/SBL/potential GWDTE);
- Acid/neutral flush (SBL/potential GWDTE); and
- Basic flush (SBL/potential GWDTE).

7.6.7 Signs of protected species were recorded during 2012 and 2013 surveys. These included badger setts and otter holts showing signs of recent use, and live sightings of red squirrel within the Keirs Hill Wind Farm site.

7.6.8 Manual transect and static detector sample surveys undertaken during 2012 and 2013 identified the presence of eight bat species:

- Common pipistrelle;
- Soprano pipistrelle;
- Nathusius' pipistrelle;
- Daubenton's bat;
- Natterer's bat
- Noctule;
- Leisler's bat; and
- Brown long-eared bat.

7.6.9 Activity was recorded across the whole Keirs Hill Wind Farm site, though most activity was in the west of the survey area, particularly near Loch Spallander Reservoir. One small pipistrelle bat roost was located in a building in Keirs Glen, over 1 km away from currently proposed wind turbines and over 250 m from the currently proposed access track. Additionally, the area of broadleaved woodland along Keirs Glen (within 200 m of the currently proposed access track) was assessed to have high potential for bat roosts.

7.6.10 Great crested newt (GCN) surveys were undertaken in ten ponds within the Keirs Hill Wind Farm site in 2013. These comprised of Habitat Suitability Index (HSI) assessment and a four-visit presence/absence survey, which found no presence of great crested newts.

Habitats

Overview

7.6.11 The Proposed Development Area is located within an upland landscape context and comprises mostly rotationally felled conifer plantation. The habitat in the area around the proposed access track between the wind farm and the A713 road consists mostly of acid, neutral and marshy grassland with some small collections of broadleaved trees. There is a flat open area at the top of Keirs Hill, where the access track enters the forestry plantation, that holds small areas of wet heath and blanket bog.

7.6.12 There are several small watercourses within the Proposed Development Area: Lochhead Burn and Lamdoughty Burn, which are within the conifer plantation, and Keirs Burn, which is near to the access track. The River Doon runs through the valley below the Proposed Development and the access track crosses this river. The reservoir Loch Spallander borders the Proposed Development Area to the north west and Lochhead Burn flows into this reservoir.

Previous Data – Keirs Hill Wind Farm application

7.6.13 Phase 1 and NVC surveys were updated within 250 m of the 2021 infrastructure layout as part of the baseline surveys for the Proposed Development. As the layout changed between 2021 surveys and the design freeze some areas did not get updated (see Paragraph 7.5.20 for further information). Therefore, information from the 2012 and 2013 Phase 1 and NVC surveys undertaken for Keirs Hill Wind Farm application has been used in these areas. Small sections of the following habitats were surveyed as part of Keirs Hill Wind Farm application baseline surveys (in 2012 or 2013) but not during 2020/2021 baseline surveys for the Proposed Development:

- Coniferous plantation;
- Marshy grassland;
- Wet heath/acid grassland mosaic;
- Blanket bog; and
- Wet modified bog.

7.6.14 It is considered unlikely that these areas have changed significantly since 2012/2013 based on local knowledge from surveyors and recent satellite imagery.

Phase 1 and NVC Survey Results

7.6.15 The Phase 1 Habitat Survey results are provided in Table 7.10 and illustrated in Figure 7.4, showing the area of recorded habitat occurring within the Proposed Development Area. Further details defining each habitat type along with target notes taken during the survey are provided within the Appendix 7.1. The NVC survey characterised the habitats further and results are included in Table 7.10 and illustrated on Figure 7.5. The survey identified a range of typical upland habitat types within the Proposed Development Area to community and sub-community level, where possible.

7.6.16 Ground Water Dependent Terrestrial Ecosystems (GWDTEs) have protection under the Water Environment and Water Services (Scotland) Act 2003, to prevent deterioration, protect and enhance the status of terrestrial ecosystems and wetlands and the aquatic ecosystems they depend on. Therefore, mitigation must be undertaken when carrying out any activities that may impact upon any of these ecosystems. The NVC survey results were used to identify potential GWDTEs. Altogether four NVC communities were present which are classed in SEPA (2017)[35] as indicative of potential GWDTEs, meaning that they have moderate or high dependency on groundwater in certain hydrological settings. Classification as a GWDTE does not necessarily confer any additional conservation importance to habitats present. Further details of the GWDTE assessment can be found in Chapter 9 Geology, Hydrology and Hydrogeological Assessment

7.6.17 Habitats found during Phase 1/NVC surveys within the Proposed Development Area are listed below in Table 7.10 along with the relevant conservation status of the habitat. Habitat locations within the Proposed Development Area are shown in Figures 7.4 and 7.5. The predominant habitat found within the Proposed Development Area was coniferous woodland plantation, with a large proportion of the land outwith forested areas being marshy grassland.

[35] SEPA (2017) Land Use Planning System (LUPS), SEPA Guidance Note 31. Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems. Version 3. LUPS-GU31.

Table 7.10: Summary of habitats identified during the Phase 1 and NVC habitat surveys

Phase 1 Habitat	NVC Community and/or Description	Conservation Designation	GWDTE Potential	Area in Proposed Development Area (ha)	Area Permanently Lost to the Proposed Development (ha)	Area Temporarily Lost to the Proposed Development (ha	% Permanently Lost to the Proposed Development	% Temporarily lost to the Proposed Development
• Semi-natural broadleaved woodland	• Areas of silver birch, aspen, blackthorn and willow	• SBL	• No	• 3.27	• 0	• 0	• 0	• 0
• Coniferous, broadleaved and mixed plantation*	• Areas of Sitka spruce, larch, Scot's pine and beech plantation	• NA	• No	• 600.06	• 4.51	• 7.96	• 0.75	• 1.33
• Scrub	• Small area of willow scrub	• SBL	• Moderate	• 0.05	• 0	• 0	• 0	• 0
• Scattered broadleaved woodland	• Small cluster of ash and rowan trees	• SBL	• No	• 0.15	• 0	• 0	• 0	• 0
• Felled Forestry	• NA	• NA	• No	• 52.83	• 0.27	• 4.65	• 0.50	• 8.80
• Semi-improved acid grassland	• U4 sheep's fescue-creeping bent-heath bedstraw grassland; U5 mattgrass-heath bedstraw grassland	• SBL (watching brief only)	• No	• 4.18	• 0	• 0	• 0	• 0
• Unimproved neutral grassland	• MG5 crested dog's tail-knapweed grassland	• SBL	• No	• 21.51	• 0.03	• 0	• 0.14	• 0
	• MG10 Yorkshire fog-soft rush rush pasture	• No	• Moderate					
• Improved grassland	• MG6 perennial ryegrass-crested dog's-tail grassland	• NA	• No	• 5.23	• 0.18	• 0	• 3.44	• 0
• Marshy grassland*	• M23a and b soft rush/sharp-flowered rush-marsh bestraw rush-pasture, sharp-flowered rush and soft rush sub-communities; M6 star sedge-*Sphagnum recurvum/auriculatum* mire	• SBL	• High	• 127.48	• 0.77	• 0	• 0.52	• 0
	• MG10 Yorkshire fog-soft rush rush pasture	• No	• Moderate					
	• MG6 perennial ryegrass-crested dog's-tail grassland	• No	• No					
• Tall Ruderal	• NA	• No	• No	• 0.19	• 0	• 0	• 0	• 0
• Wet heath	• M15 deergrass-cross-leaved heath wet heath	• Annex 1; SBL	• Moderate	• 4.34	• 0.11	• 0	• 2.43	• 0
• Wet heath/acid grassland mosaic*	• M15 deergrass-cross-leaved heath wet heath; U4 sheep's fescue-creeping bent-heath bedstraw grassland; M6 star sedge-*Sphagnum recurvum/auriculatum* mire	• As in habitat specific sections	• As in habitat specific sections	• 9.12	• 0.07	• 0	• 0.80	• 0
• Blanket bog*	• M2 *Sphagnum cuspidatum/recurvum* bog pool; M3 common cottongrass bog pool; M17b deergrass-	• Annex 1; SBL	• No	• 36.73	• 0.28	• 0	• 0.76	• 0

	hare's-tail cottongrass blanket mire, *Cladonia spp.* sub-community; M19a Ling heather-hare's-tail cotton grass blanket mire, cross-leaved heath sub-community							
• Wet modified bog*	• M25 purple moorgrass-tormentil mire	• Annex 1; SBL	• Moderate	• 19.49	• 0.14	• <0.01	• 0.70	• <0.01
• Acid flush†	• NA	• SBL	• High	• 1.15	• 0	• 0	• 0	• 0
• Standing water	• Small ponds	• SBL	• No	• 0.11	• 0	• 0	• 0	• 0
• Running water	• River Doon	• SBL	• No	• 1.84	• 0	• 0	• 0	• 0
• Quarry	• NA	• NA	• No	• 0.63	• 0	• 0.52	• 0	• 83.33
• Buildings	• NA	• NA	• No	• 0.01	• 0	• 0	• 0	• 0
• Road/Urban	• NA	• NA	• No	• 0.01	• 0	• 0	• 0	• 0

- *Small areas of these habitats within the 250 m buffer of the Proposed Development were last surveyed in 2012 or 2013 due to infrastructure amendments between surveys undertaken in 2021 and the design freeze. † None of this habitat was within 250 m of the Proposed Development and the area was identified during 2012 or 2013 surveys. Therefore, this habitat is not shown on Figure 7.4.

Bats

Bat Roosts

7.6.18 No potential roosting features (PRFs) were found during surveys undertaken within 250 m of proposed wind turbine locations. Habitats within the 250 m buffer of the proposed wind turbines consisted mostly of homogenous coniferous plantation, with no suitable roosting features and no buildings. Bat droppings and PRFs were recorded in a barn over 1.2 km from the Proposed Development during a barn owl survey in 2020.

7.6.19 Two groups of trees with moderate bat roost potential were found during surveys within 250 m of the proposed access track in 2021 (see Figure 7.4). PRFs such as snapped branches, tree holes and lifting bark were identified on trees in these groups. One group of trees was located within 100 m of the proposed access track (but over 250 m from any proposed wind turbine locations).

7.6.20 See Appendix 7.1 for full details of PRFs recorded within the Proposed Development Area.

Bat Activity

7.6.21 A total of 67,448 bat passes were recorded, consisting of the following species/species groups: soprano pipistrelle, common pipistrelle, Nathusius's pipistrelle, pipistrelle sp. (*Pipistrellus sp.*), *Myotis* sp., noctule, *Nyctalus sp.* (either Leisler's or noctule bat) and brown long-eared bat (see Table 7.6). Some *Nyctalus* calls recorded were initially identified as Leisler's bat. However, following further analysis of 10 % of all calls auto-identified as Leisler's, it was observed that 98 % could not be confidently separated from noctule. Noctule and Leisler have a two part call: the lower part of the Leisler's call overlaps considerably with the upper part of the noctule call. In situations where the call can be distorted and only one part is present it is very difficult to separate the two. Therefore, all potential Leisler's bat calls have been recorded and analysed as *Nyctalus* sp. As both species have the same threat of impact with wind turbines and sensitivity of population (see Table xx) this method is considered appropriate in this situation. There were some social calls recorded that were distinctive of Leisler's bat, furthermore both Leisler's and noctule are known to be present in south west Scotland, with Leisler's more prevalent in the west, and noctule in the east[36]. It is therefore assumed that Leisler's bat was present in the Proposed Development Area, but the true number of Leisler's calls recorded is not possible to determine. This assessment of Leisler's calls was undertaken after submission of data to Ecobat, therefore Ecobat relative assessment still includes Leisler's bat.

7.6.22 The highest number of calls was associated with common pipistrelle, with 64% of calls recorded across the Proposed Development Area being made by common pipistrelle. Detector 5 had the highest number of bat passes out of all the detector locations for all bat species (34 % of all bat passes recorded within the Proposed Development Area), followed by detector 6 with 18 % of all bat passes recorded at this detector. Detector 5 was located within the forestry plantation, on a forestry ride. This ride is connected with a watercourse (Lochhead Burn) that runs into Loch Spallander. Detector 6 was located on an existing track at the end of this ride. It is considered likely that bats use the Lochhead Burn and this ride to commute to Loch Spallander. Most calls (55%) were recorded during the autumn deployment.

Ecobat: Relative Abundance

7.6.23 Ecobat has assessed that the relative abundance at median activity levels was low for brown long-eared bat, low/moderate for Nathusius's pipistrelle and Myotis bats, moderate for noctule, moderate/high for Leisler's bat and high for common and soprano pipistrelle (for all seasons and detectors combined). The relative abundance at maximum activity levels was assessed to be moderate/high for BLE and high for all other species (for all seasons and detectors combined). Median values calculated through Ecobat do not take into account nights where no bats were detected. Relevant results are presented within Appendix 7.1.

Bat Risk Assessment

7.6.24 The overall risk assessment for each species or species group as calculated using the Ecobat results and the NatureScot guidance[11] is provided in Table 7.11. Risk assessment scores are based on Table 3b in NatureScot guidance[11] using a site risk level of 2 (as set out in Paragraph 7.5.32). The guidance classifies risk as follows:

- Low (green): scores between 0 and 4;
- Medium (yellow): scores between 5 and 12; and
- High (red): scores between 15 and 25.

Table 7.11: Overall bat risk assessment

Species	Assessment (Median)	Assessment (Maximum)
• Common pipistrelle	• Medium (10/25)	• Medium (10/25)
• Soprano pipistrelle	• Medium (10/25)	• Medium (10/25)

[36] Newson, S.E., Evans, H.E., Gillings, S., Jarrett, D. & Wilson, M.W. (2017) A survey of high risk bat species across southern Scotland. Scottish Natural Heritage Commissioned Report No. 1008.

• Nathusius' pipistrelle	• Low (4/25)	• Medium (10/25)
• *Myotis* species	• Low (4/25)	• Medium (10/25)
• Leisler's bat*	• Medium (8/25)	• Medium (10/25)
• Noctule	• Medium (6/25)	• Medium (10/25)
• Brown long-eared bat	• Low (2/25)	• Medium (8/25)

- * Now considered as *Nyctalus* sp. – this does not include calls identified during original analysis as *Nyctalus* sp.

7.6.25 For species that have a high collision risk (as set out in Wray *et al.* (2010)[33]) (common, soprano and Nathusius' pipistrelle, Leisler's and noctule) a further risk assessment has been carried out at the detector level in order to identify areas of the Proposed Development Area with the highest relative activity levels. This assessment is provided in Table 7.13.

Table 7.12: Summary of bat passes recorded during the static bat detector survey, plus bat passes recorded during each season

Detector	1	2	3	4	5	6	7	8	9	10	Total	Spring	Summer	Autumn
Distance from nearest wind turbine (m)	150	181	228	346	293	118	345	227	100	441	-	-	-	-
Common pipistrelle	913	4312	3498	388	16558	8229	1728	778	2156	4504	43064	738	22085	20241
Soprano pipistrelle	490	1358	2823	341	5151	3457	142	403	840	3284	18289	99	4782	13408
Pipistrelle sp.	76	82	68	9	332	207	46	20	48	234	1122	0	755	367
Nathusius's pipistrelle	0	0	1	2	12	8	4	0	2	12	41	1	31	9
Myotis spp.	25	29	12	125	29	37	7	30	57	46	397	18	133	246
Noctule	61	42	14	16	97	48	9	30	72	16	405	0	117	288
Nyctalus sp.	102	152	90	107	900	272	30	213	1070	1078	4014	0	172	448
Brown long-eared bat	7	11	4	10	11	5	0	8	47	13	116	0	1	115
Total	1674	5986	6510	998	23090	12263	1966	1482	4292	9187	67448	859	29719	36870
Percentage	2	9	10	1	34	18	3	2	6	14	-	1	44	55

Table 7.13: Bat risk assessment by detector for species with a high collision risk (Wray *et al.* (2010)[33])

Detector number	Distance from wind turbine	Common pipistrelle		Soprano pipistrelle		Nathusius's pipistrelle		Leisler's bat*		Noctule	
		Median	Maximum	Median	Maximum	Median	Maximum	Median	Maximum	Median	Maximum
1	150	Medium (10)	Medium (10)	Medium (10)	Medium (10)	Nil	Nil	Medium (6)	Medium (10)	Medium (8)	Medium (8)
2	181	Medium (8)	Medium (10)	Medium (10)	Medium (10)	Nil	Nil	Medium (6)	Medium (10)	Low (4)	Medium (10)
3	228	Medium (10)	Medium (10)	Medium (10)	Medium (10)	Low (2)	Low (2)	Medium (8)	Medium (10)	Medium (6)	Medium (6)
4	346	Medium (8)	Medium (10)	Medium (8)	Medium (10)	Low (2)	Low (2)	Medium (6)	Medium (10)	Low (2)	Medium (6)
5	293	Medium (10)	Medium (10)	Medium (10)	Medium (10)	Medium (8)	Medium (8)	Medium (10)	Medium (10)	Medium (6)	Medium (10)
6	118	Medium (10)	Medium (10)	Medium (10)	Medium (10)	Low (4)	Medium (8)	Medium (8)	Medium (10)	Medium (6)	Medium (10)
7	345	Medium (10)	Medium (10)	Medium (8)	Medium (10)	Medium (8)	Medium (8)	Medium (8)	Medium (8)	Nil	Medium (8)
8	227	Medium (10)	Medium (10)	Medium (8)	Medium (10)	Nil	Nil	Medium (8)	Medium (10)	Medium (6)	Medium (8)
9	100	Medium (10)	Medium (10)	Medium (10)	Medium (10)	Low (2)	Low (2)	Medium (10)	Medium (10)	Medium (8)	Medium (10)

• 10	• 441	• Medium (10)	• Medium (10)	• Medium (10)	• Medium (10)	• Low (4)	• Medium (10)	• Medium (8)	• Medium (10)	• Medium (6)	• Medium (6)

- * Now considered as *Nyctalus* sp. – this does not include calls identified during original analysis as *Nyctalus* sp.

Common pipistrelle

7.6.26 Common pipistrelle was the most frequently recorded bat species in 2021 (total 43,064 passes, representing 64 % of the total bat passes recorded during the survey period). The highest call rate for common pipistrelle was in summer. Common pipistrelle was recorded across the Proposed Development Area. However, detector 5 had a much higher percentage of nights with a high number of calls for this species. The collision risk assessment for common pipistrelle predicted a medium risk at both median and maximum activity levels. This was the same at all detector locations.

7.6.27 In the spring survey period, the earliest recorded common pipistrelle activity (one call) was a few minutes before sunset, but all other activity started after sunset. 21 % of common pipistrelle activity in spring was recorded within 30 minutes of sunset. Early activity was recorded at several detectors, with 45 % of the early calls being at detector 6 and 34 % at detector 8 (which were not close to each other). It is thought that this early activity could be indicative of small transitional roosts in the area. As no PRFs were found within 200 m of Proposed Development it is assumed that any transitional pipistrelle roosts were over 200 m from the Proposed Development. Activity was only recorded on seven nights in spring and the latest that activity was recorded was 1.5 hours before sunrise. The absence of activity around sunrise is also indicative that no significant common pipistrelle roosts were present at the Proposed Development.

7.6.28 In the summer survey period, the earliest common pipistrelle activity was recorded a few minutes after sunset, but most activity started 20 minutes after sunset: only 0.2 % of calls were recorded within 30 minutes of sunset. Activity was then constant through the night until approximately 20 minutes before sunrise. During the autumn survey period activity started a few minutes after sunset and was consistent throughout the night. The latest activity recorded was a few minutes before sunrise, but mostly finished 30 minutes before sunrise: 99 % of the activity in the autumn survey period was between 30 minutes after sunset and 30 minutes before sunrise.

Soprano pipistrelle

7.6.29 Soprano pipistrelle was the second most frequently recorded bat species in 2021 (total 18,289 passes, representing 27 % of the total bat passes recorded during the survey period). Together with soprano pipistrelle and unidentified pipistrelle species they made up 93 % of the total bat calls detected during the survey period. Soprano pipistrelle passes were recorded much more frequently in the autumn deployment compared with spring and summer. Soprano pipistrelle was recorded across the Proposed Development Area. The largest number of soprano pipistrelle passes was recorded at detector 5, but detectors 6 and 10 also had a relatively high number of soprano pipistrelle passes.

7.6.30 The collision risk assessment for soprano pipistrelle predicted a medium risk at both median and maximum activity levels. This was the same at all detector locations. Activity across the night for soprano pipistrelle was similar to that of common pipistrelle, except that 95 % of activity in spring was recorded over 30 minutes after sunset. Additionally, in summer the earliest activity started 30 minutes after sunset and in spring the latest activity was recorded four hours before sunrise, suggesting there are no significant roosts present in the vicinity.

Nathusius's pipistrelle

7.6.31 Nathusius's pipistrelle was recorded infrequently during bat detector surveys, with a total of 41 calls (representing 0.1 % of the total bat calls recorded during the survey). This species was only recorded at detectors 3-7 and 10, with detectors 5 and 10 recording the highest number of Nathusius's pipistrelle calls. The species was recorded most during the summer deployment. The collision risk assessment for Nathusius's pipistrelle predicted a low risk at median activity levels and a medium risk at maximum activity levels. Detectors 5, 6, 7 and 10 had a medium risk at maximum activity levels and detectors 5 and 7 had a medium risk at median activity levels.

7.6.32 The earliest Nathusius's pipistrelle activity was recorded 30 minutes after sunset, which was in spring when only one pass was recorded. The latest Nathusius's pipistrelle activity was recorded 40 minutes before sunrise, which was in summer. However, most activity was recorded between one hour after sunrise and one hour before sunset: 100 % of calls were recorded between 30 minutes after sunset and 30 minutes before sunrise. This suggests that there are no significant roosts present in the vicinity.

***Myotis* species**

7.6.33 Myotis spp. were recorded relatively infrequently in the Proposed Development Area, with 397 calls recorded, which is 0.6 % of the total bat passes recorded during the survey. Myotis spp. were recorded across the Proposed Development Area, but in the highest numbers at detector 4. Detector 4 was located on the edge of a patch of bog surrounded by Scot's pine plantation. The species group was recorded most frequently during autumn. This species group was assessed as having a low risk at median activity levels and a medium risk at maximum activity levels.

7.6.34 The earliest recorded Myotis pass was 30 minutes after sunset, with one pass recorded at that time in spring and summer. Otherwise, activity was between one hour after sunset and one hour before sunrise: 65 % of calls were recorded between

2 hours after sunset and 2 hours before sunrise and 100 % of calls were recorded between 30 minutes after sunset and 30 minutes before sunrise. This suggests that there are no significant roosts present in the vicinity.

Nyctalus species

7.6.35 *Nyctalus* sp. was the third most recorded species/species group in the Proposed Development Area. 4,014 *Nyctalus* sp. calls were recorded during the survey, which is 7 % of the total bat passes recorded during the survey. This represents calls of either Leisler's bat or noctule (see Paragraph 7.6.21 for further details). It is therefore likely that there are both Leisler's and noctule calls included within these values. The highest number of *Nyctalus* sp. calls was at detectors 9 and 10. Detector 9 was on the edge of the conifer plantation, bordering on an open area of wet heath, blanket bog and marshy grassland. Detector 10 was located on a track next to an area of Scot's pine plantation. The species group was also recorded in relatively high numbers at detectors 5, the location of which has been discussed in other species assessments. The species group was recorded most frequently during the summer and autumn deployments. The collision risk assessment for Leisler's bat predicted a medium risk at both median and maximum activity levels. This was the same at all detector locations.

7.6.36 In the spring survey period, only three passes of *Nyctalus* sp. were recorded, which were all 40 minutes after sunset. In the summer survey period, the earliest activity was recorded a few minutes after sunset, but most activity started 20 minutes after sunset: 99 % of passes were more than 30 minutes after sunset. Activity was higher in the first half of the night, dropping off after 3 hours after sunset. The latest activity in summer was recorded one hour before sunrise. During the autumn survey period the earliest activity was recorded at sunset. However, most activity started 10 minutes after sunset: only 5 % of passes recorded in the autumn were within 30 minutes of sunset. Activity in summer and autumn was highest in the two hours around sunset: 56 % in summer and 64 % of passes in autumn were recorded within 2 hours of sunset. The latest activity was recorded 10 minutes before sunrise, but only 0.9 % of passes were recorded within 30 minutes of sunrise. *Nyctalus* sp. emerge from roosts close to sunset and re-enter roosts close to sunrise[37], meaning that some passes being recorded within 30 minutes of sunset or sunrise is not indicative of a Leisler's or noctule roost within the Proposed Development Area.

Noctule

7.6.37 Noctule was recorded relatively infrequently at the Proposed Development Area, with 405 calls recorded, which is 0.6 % of the total bat passes recorded during the survey. Noctule were recorded across the Proposed Development Area, but in the highest numbers at detector 4. Detector 4 was located on the edge of a patch of bog surrounded by Scot's pine plantation. The species group was recorded most frequently during autumn. The collision risk assessment for noctule predicted a medium risk at both median and maximum activity levels. All detectors had a medium risk at maximum activity levels and all detectors except for 2, 4 and 7 had a medium risk at median activity levels.

7.6.38 The earliest recorded noctule pass was a few minutes after sunset in both summer and autumn. Noctule activity was highest in the first two hours after sunset in both seasons: 75 % of passes in summer and 59 % of passes in autumn were recorded within 2 hours of sunset. However, 88 % and 81 % of passes were recorded more than 30 minutes after sunset (and more than 30 minutes before sunrise) in summer and autumn respectively. As noctule bats emerge close to sunset[37] this activity is not considered to be indicative of a noctule roost at the Proposed Development Area. In autumn the latest activity was recorded 10 minutes before sunrise, whereas in summer the latest activity was recorded 40 minutes before sunrise.

Brown long-eared bat

7.6.39 Brown long-eared bat was recorded infrequently at the Proposed Development Area, with 116 calls recorded, which is 0.2 % of the total bat passes recorded during the survey. BLE was recorded across the Proposed Development Area, except for at detector 7. The highest numbers were recorded at detector 9, which was located on the edge of a patch of bog within Scot's pine plantation. The species was almost exclusively recorded during the autumn deployment (only one record was recorded outside of the autumn deployment, which was in the summer deployment). BLE was assessed as having a low risk at median activity levels and a medium risk at maximum activity levels. All BLE activity was between one hour after sunset and one hour before sunrise.

Great Crested Newts

7.6.40 HSI surveys were repeated in 2021 for all ponds except for 7 and 8, which were over 500 m from the Proposed Development (see Table 7.14). No evidence of great crested newt was found within any ponds surveyed for eDNA (see Table 7.14).

[37] Altringham, J. (2014) British Bats (Collins New Naturalist Library, Book 93). HarperCollins, London.

However, the result of eDNA surveys was undetermined for three ponds (2, 3 and 10), all of which were considered to have average or lower habitat suitability for great crested newt. This means that it was not able to be determined whether or not great crested newt eDNA was present in the water sample.

Table 7.14: Great crested newt HSI assessment and eDNA results

Pond Number	HSI Score	Habitat Suitability	eDNA Result	Distance from Proposed Development (m)
1	0.77	Good	Negative	52
2	0.68	Average	Undetermined	38
3	0.56	Below Average	Undetermined	0.1
4a	0.64	Average	NA – dry	227
4b	0.64	Average	NA – dry	244
5	0.73	Good	Negative	37
6	0.51	Below Average	Negative	238
7*		Good*	NA*	>500
8*		Poor*	NA*	>500
9	0.51	Below Average	Negative	272
10	0.46	Poor	Undetermined	258

- *No access was permitted to ponds 7 and 8, therefore HSI data is from the 2013 HSI survey undertaken for the Keirs Hill application and eDNA survey was not possible.

7.6.41 Some ponds were located within 50 m of the Proposed Development; however, these are located within the forestry plantation and the nearby Proposed Development is to be the upgrade of existing forest tracks. See Figure 7.2 for details of pond locations in relation to the Proposed Development.

7.6.42 A four-visit presence/absence survey was undertaken in all ponds within 500 m of the Proposed Development in 2013 (as part of the baseline surveys for Keirs Hill Wind Farm application) and no great crested newts were found.

Freshwater Pearl Mussel

7.6.43 It was found that the River Doon provides potentially optimal habitat for FWPM immediately upstream and downstream of the bridge over the river on the eastern margin of the study area near Waterside. There was also a short stretch of sub-optimal habitat at the most upstream part of the river within the study area.

7.6.44 Short sections of the Lambdoughty Burn were considered to provide limited suitable habitat for FWPM. These were identified as sub-optimal habitat on a precautionary basis.

7.6.45 The remainder of the watercourses within the study area were all found to be unsuitable for FWPM.

7.6.46 For full results of the FWPM habitat survey see Appendix 7.1.

Fish

7.6.47 No watercourses surveyed were found to have a high suitability for salmon, trout or lamprey spawning or nursery areas. However, it is considered likely that the River Doon is used by migratory fish for feeding and migrating during the adult and smolt phases (or young/older eels).

7.6.48 Some watercourses are unlikely to be used by migratory fish (in particular, lamprey and eels) due to significant obstacles downstream (Lambdoughty Burn and Lochhead Burn). See Table 7.15 for the assessment of fish habitat at the Proposed Development. See Appendix 7.1 for the full results of the fish habitat survey.

Table 7.15: Fish habitat suitability assessment

Watercourse	Fish Habitat Suitability Assessment
Keirs Burn	Watercourse very narrow and shallow with mostly sandy substrate and relatively steep gradient in parts. Limited suitability for salmon, trout and lamprey spawning and nursery areas. Low suitability for supporting young eels.
River Doon	Watercourse wide and deep with fast flowing water and sandy substrate. Unlikely to be used for spawning by salmon, trout or lamprey but likely to be used by adult salmon and trout for feeding and migrating. Could be some areas suitable for older eels.
Red Burn	Watercourse slow flowing with shallow gradient. Some areas of mostly larger substrate with shallow depth, but also areas of very sandy substrate. Some limited suitability for spawning and nursery areas for salmon, trout and lamprey. Could be some limited suitability for eels.
Lochhead Burn	Watercourse entirely surrounded by forestry plantation or felled forestry and upstream of Loch Spallander Reservoir. Dam on reservoir likely to be a barrier to migratory fish. Substrate and depth suggests that there could be some limited potential for salmon, trout and lamprey spawning and nursery areas and habitat for older fish, including eels, if fish can pass the dam and the water quality is sufficient (given the surrounding forestry plantation). Lamprey and eels highly unlikely to be present in the watercourse due to the dam on Loch Spallander.
Lambdoughty Burn	Very narrow and shallow watercourse with a relatively sandy substrate bordered on one side by forestry plantation. Waterfalls in Lambdoughty Glen downstream of the Proposed Development are thought likely to pose an obstacle to migration for lamprey and eels and possibly salmon and trout. Watercourse unlikely to have much suitable habitat for salmon or trout spawning or nursery areas due to the size and substrate of the watercourse.

Protected Mammals

7.6.49 The following signs of protected mammal species were found during the protected mammal surveys undertaken for the Proposed Development (badger and pine marten survey and otter and water vole survey):

- Badger (feeding signs, latrines, three active setts);
- Pine marten (probable scat); and
- Otter (spraint, potential couches (overground resting places) with no signs of recent use).

7.6.50 No signs were found of any other protected mammal species (including water vole), and it is therefore assumed that other protected mammal species are absent from the area or only present in such low numbers to make detection difficult. For further information about results of the protected mammal surveys see Appendix 7.1 and Confidential Appendix 7.2. However, based on the presence of red squirrels being recorded during surveys undertaken in 2012/2013 and records of red squirrel being reported as part of the desk study, it is assumed that red squirrel are present within the forested parts of the Proposed Development Area.

Future Baseline

7.6.51 In the absence of the Proposed Development, it is assumed that the habitat use within the Proposed Development Area would remain the same for the foreseeable future. Current habitat use is rotational conifer plantation, pasture and areas of heavily drained wet heath, blanket and modified bog. There is evidence of considerable peat hagging in the small area of blanket bog on Keirs Hill. In the absence of the Proposed Development, drainage and peat hagging is likely to continue, leading to possible further modification impacts of drying and degradation of the bog and wet heath habitats within the Proposed Development Area over the medium to long term.

7.6.52 It is more difficult to predict changes that that may occur in the longer-term (i.e. over 35 years), especially in the wake of climate change, which is predicted to cause range shifts in some species. In addition, climate change may alter habitat types by impacting on the composition and health of the plant communities present, thereby affecting the suitability of the Proposed Development Area for some of the species which currently occupy the Proposed Development Area. Baseline surveys carried out for the Proposed Development represent a snapshot of the ecology community present at the time and cannot be extrapolated to predict future population trends in the event of climate change, or a future change in land use within the Proposed Development Area.

7.7 Embedded Mitigation

7.7.1 Embedded mitigation measures are proposed at the outset of the Proposed Development, to reduce impacts associated with construction and operation.

Mitigation by Design

7.7.2 During the design process, several aspects were taken into consideration in order to minimise the potential risk to species and habitats arising from the Proposed Development. Refer to Chapter 3: Design Evolution and Alternatives for detail on the overall design process.

7.7.3 A minimum distance of 60 m has been maintained between the Proposed Development and watercourses, with the exception of locations where access tracks cross watercourses. See Chapter 9: Geology, Hydrology and Hydrogeological Assessment for further information regarding watercourse crossings.

7.7.4 The layout of the Proposed Development has avoided impacts to sensitive habitats where possible (e.g. modified and blanket bog), and areas of deepest peat and peat slide hazard zones, taking into account other constraints. Where avoidance has not been possible, the Proposed Development will be constructed in such a way as to maintain the integrity and connectivity of the hydrology of hydrologically sensitive habitats. Access tracks will be designed in keeping with good practice guidance (Scottish Renewables *et al.*, 2019)[12]. Further detail is provided in Chapter 9: Geology, Hydrology and Hydrogeological Assessment.

7.7.5 Felling will be undertaken within 96 m of wind turbines with a hub height of 105 m and within 75 m of wind turbines with a hub height of 125 m. This is in order to ensure that there is at least a 50 m buffer between wind turbine blade tip and nearest woodland edge as set out in current NatureScot guidance[11] in relation to bats and wind farms. This calculation is based on assumed candidate wind turbine dimensions set out in Chapter 2: Proposed Development. Buffer distance is estimated by the equation:

- $\sqrt{(50 + bl)^2 - (hh - fh)^2}$
- Where bl = blade length (75 m); hh = hub height; and fh = feature (tree) height, estimated here as 25m.

7.7.6 Where possible forest will be key-holed around wind turbines. However, in some areas larger sections of forest will need to be clear-felled and will then be restocked up to the buffer distance set out above. See Chapter 10: Forestry for further details on felling plans.

7.7.7 A buffer of at least 100 m has been left between the Proposed Development and confirmed badger setts to minimise disturbance to badgers with the Proposed Development Area. A buffer of at least 30 m has been left between Proposed

Development and areas that held potential to be used by otters as a couch (over-grown resting place).

Construction

7.7.8 A Construction Environmental Management Plan (CEMP) will be produced prior to construction works commencing, in consultation with East Ayrshire Council and South Ayrshire Council (see Chapter 2). The document will be a live document and will be updated throughout the pre-construction, construction and post-construction phases and will:

- Include measures to safeguard habitats and species to be implemented prior to construction, during construction and post-construction; and
- Provide details of all pre-construction surveys required including methods and timings.

7.7.9 An Environmental Clerk of Works (ECoW) will be present during enabling works and throughout the construction phase of the Proposed Development. They will be a suitably experienced individual, whose role will be to provide advice so that that works are carried out in accordance with environmental measures detailed in the CEMP, and to monitor compliance with relevant legislation and good practice (see 'Legislation, Policy and Guidance' above). The ECoW will review all relevant CEMP documents. Once work has commenced, their role will be to provide ecological and pollution control advice and monitor compliance of all relevant mitigation measures and legislation (see also Chapter 9). The ECoW will also give regular toolbox talks to make site personnel aware of the ecological sensitivities within the Proposed Development Area. The ECoW will have the authority to stop any construction activity that is having or likely to have a significant environmental impact or be in breach of legislation.

Habitats

7.7.10 Detailed mitigation measures will be provided in the CEMP for the protection of habitats during the pre-construction, construction and post-construction phases and will consist of:

- Toolbox talks to inform contractors of the sensitive habitats within the Proposed Development Area;
- Marking of sensitive areas of habitat close to construction areas, to prevent accidental encroachment;
- No storage of materials or machinery permitted within exclusion zones;
- Supervised vegetation clearance by the ECoW in sensitive areas prior to construction; and
- Construction phase control measures will continue during the operational phase, through an operational management plan, where potential effects exist.

7.7.11 Where possible (and where other constraints allow), micrositing of infrastructure will be undertaken to ensure construction does not impact on the most sensitive habitats and any other identified ecological constraints and will be completed in consultation with the ECoW. This is particularly important when working in close proximity to waterbodies and sensitive habitats. Where micrositing cannot avoid areas of sensitive habitats or features, the ECoW will discuss and agree additional required mitigation to ensure impacts are minimised.

7.7.12 Any land degraded by construction and not required for the operation of the Proposed Development, such as the construction compound and around areas of access tracks and borrow pits, will be restored as soon as possible after construction is completed. Turves will be carefully removed during construction, as far as practicable, and stored for re-use in the restoration of areas not required for the operation of the Proposed Development, following good practice. As such, any vegetation removed for the construction phase will be reinstated within the Proposed Development Area, facilitating natural re-colonisation of vegetation communities. Permanent habitat loss will be limited to that required for the footprint of infrastructure and good site management practices will be implemented to minimise the risk of encroachment of the construction corridor into adjacent habitats. As far as is reasonably practicable, any notable floral species encountered will be marked with an exclusion zone or translocated to other suitable areas of habitat or stored for reuse in reinstatement of temporary infrastructure. The implementation of these measures will reduce the potential for impacts on sensitive habitats.

7.7.13 Site activities have the potential to cause pollution through dust, siltation, leaks and spillages associated with plant and materials during the construction and operational phases. If such incidents were to occur then these pollutants may reach waterbodies and surrounding vegetation. Therefore, these activities may directly or indirectly affect habitats and species, especially where they are hydrologically connected. Pollution incidents may occur during construction as well as within the operational phase during maintenance works.

7.7.14 Pollution prevention measures will be detailed in the CEMP and overseen by the ECoW. Pollution with regards to waterbodies is further discussed in Chapter 9. Measures to control the impact of dust on sensitive habitats will be implemented during the preparation and construction phase. These measures will be adopted when necessary, in dry weather, in areas of active development, and will most likely involve the controlled dampening of tracks utilised by construction vehicles. In

addition, as far as reasonably practicable, materials for construction will be sourced from on-site borrow pits, which will ensure the composition of materials used is as close to the local conditions as possible. Some material will be imported from local quarry sources, which will have similar chemical properties to stone found within the Proposed Development Area to ensure no alteration in soil chemistry. Further detail on the mitigation of potential dust impacts will be detailed within the CEMP.

Watercourses

7.7.15 The pre-construction quality of watercourses and waterbodies will be maintained during construction (see Chapter 9). Watercourse protection measures will be adopted within the CEMP and include protection against siltation, sedimentation and pollution incidents, for instance, by the implementation of a pollution response plan and the safe storage of chemicals in bunded containers. Robust mitigation measures will be installed prior to works commencing to ensure the impacts on watercourses are minimised. Mitigation throughout the Proposed Development will be regularly monitored and maintained/replaced as required. Refuelling of vehicles and machinery will be carried out at a central designated area, on an impermeable surface, located at least 50 m away from any watercourse. Monitoring of water quality will be carried out before and during construction. These measures will be implemented to minimise impacts on protected species.

GWDTE

7.7.16 Details of how impacts upon groundwater flow will be minimised and mitigated are detailed Chapter 9.

Protected Species

7.7.17 A Species Protection Plan (SPP) will be produced as part of the CEMP and agreed by consultees prior to the commencement of construction, detailing measures to be implemented before and during construction to protect species present in the Proposed Development Area. This will include good practice measures to prevent accidental mortality of protected species during construction and felling, such as:

- A suitable vehicle speed limit to be enforced within the Proposed Development;
- Warning signs installed, where appropriate, to reduce risk of collision with protected species;
- Covering of deep excavations, foundations and pipe openings (or a ramp installed) when not active, to prevent entrapment of animals;
- Pre-construction surveys undertaken for protected mammal species (badger, pine marten, red squirrel, otter and water vole) within set buffer areas of the Proposed Development a maximum of 8 months prior to commencement of works, including felling;
- If a potential resting place (e.g. bat roost or otter holt) of a protected species is found within set buffer areas of construction or felling then work will cease within the appropriate buffer area until it can be established whether it is in active use by a protected animal. If presence is confirmed then NatureScot will be consulted to discuss possible mitigation measures and/or seek an appropriate licence. Standard construction buffers will be used as follows:
  - 200 m of a natal otter holt (may be able to be reduced to 100 m if appropriate);
  - 100 m of a badger sett where blasting will be undertaken, or a natal pine marten den;
  - 50 m of a red squirrel drey;
  - 30 m of a badger sett where works do not involve blasting, a non-breeding otter holt or couch or a non-breeding pine marten den; and
  - 10 m of a water vole burrow or bat roost.
- Watercourse crossings will be designed so as to not impede otters, water voles, fish or their food sources;
- Lighting design will ensure watercourses and woodland remain unlit at night when possible. Security lighting and lighting associated with the temporary compound will be low lux and directed away from woodland and watercourses to reduce disturbance; and
- All site personnel will be made aware of the presence of protected species through toolbox talks.

Operation

7.7.18 With the exception of the operation of the wind turbines and general maintenance of the wind turbines, there will be little on-site activity during the operational phase.

7.7.19 Where potential effects exist, control measures will be incorporated into the operation management plan. In particular, the potential for pollution incidents during routine maintenance activities will be minimised by adoption of Scottish Environmental Protection Agency (SEPA) good practice guidance[12].

7.7.20 Any routine maintenance works will take place during the day where practicable to minimise the potential for disturbance to protected species within the Proposed Development Area (since these are mostly nocturnal/crepuscular) and a speed limit

of 15 mph will be enforced for any vehicles going onto the Proposed Development, in order to reduce the risk of collision with protected species.

7.7.21 The Operation Environmental Management Plan (OEMP) will detail mitigation measures required during the operational phase relating to protected species to ensure ongoing compliance with relevant environmental legislation.

Decommissioning

7.7.22 Good practice measures as described in the construction stage will be followed, including specific guidance for the restoration and decommissioning of wind farms (Welstead *et al.*, 2013)[38]. New guidance available at the decommissioning phase will be adopted if appropriate, and a decommissioning plan will be drafted for agreement by consultees prior to commencement of decommissioning.

7.8 Assessment of Potential Effects

7.8.1 Impacts may arise for species and habitats within the Proposed Development Area via a number of mechanisms:

- Direct impacts associated with habitat loss and/or mortality;
- Direct impacts on protected species associated with resting place destruction;
- Indirect impacts on habitats and species associated with dust, siltation, leaks and spillages;
- Indirect impacts on protected species associated with disturbance and displacement; and
- Indirect impacts on species through pollution of habitats/watercourses affecting food sources.

[38] Welstead, J., Hirst, R., Keogh, D., Robb, G. and Bainsfair, R (2013) Research and guidance on restoration and decommissioning of onshore wind farms. Scottish Natural Heritage Commissioned Report No. 591.

Table 7.16: Summary of habitats and species and their conservation importance

Species/Habitat	Covering legislation and guidance/conservation status	Geographical level of value	IEF	Rationale
• Dalmellington Moss	• LNCS; SWT Reserve; SSSI	• Local	• No	• Dalmellington Moss is not hydrologically linked to the Proposed Development and is outwith the Zone of Influence for dust impacts, meaning that there is no route to impact for this site. All designated sites were scoped out of assessment during the scoping process. See the Scoping Report for more information. This site is therefore not considered to be an IEF in the context of the Proposed Development and not discussed further in this chapter.
• Dunaskin Ironworks	• LNCS; Local Wildlife Site	• Local	• No	• Dunaskin Ironworks is on the opposite side (north) of the River Doon to the majority of the Proposed Development and is uphill from the start of the proposed access track that would be on the north side of the River Doon. Therefore, the site is not hydrologically linked to the Proposed Development. There are also buildings and other developed areas in between the Proposed Development and Dunaskin Ironworks and it is therefore considered that the feature is outwith the Zone of Influence for dust impacts. This site is therefore not considered to be an IEF in the context of the Proposed Development and not discussed further in this chapter.
• Wallace Moor/Keirs Hill; Auchenroy/ Glenmount Uplands; Doon Valley Wetlands; Dunaskin Glen/Benquhat Hill	• Provisional Wildlife Sites	• Negligible	• No	• Provisional Wildlife Sites are not classed as Local Nature Conservation Sites but could become Local Wildlife Sites (and therefore LNCS) in the future. As such they are not considered to have any more than negligible value as an IEF. Therefore these features are not considered to be and IEF and are not discussed further in this chapter.
• Ancient or long-established woodland	• SBL; AWI	• Local	• No	• No areas of ancient or long-established woodland will be lost to the Proposed Development. One area of ancient woodland (Keirs Glen) is within the Proposed Development Area and is 60 m from the proposed access track. This is considered to be sufficient distance to avoid impact on tree roots. It is assumed that no trees present within the woodland will have a stem diameter of over 1 m. Standing advice from Natural England and the Forestry Commission states that there should be a buffer zone between ancient woodland and construction of at least 15 times the diameter of the tree (assumed to be less than 15 m). There is therefore potential for an indirect impact from dust created during construction works, or from accidental pollution. A pollution prevention plan and measures to control dust will be included in the CEMP and monitored by the ECoW, and so it is considered that embedded mitigation is sufficient to prevent adverse effects to this habitat. Therefore, this feature is not considered to be an IEF in the context of the Proposed Development and not discussed further in this chapter.
• Semi-natural broadleaved woodland	• SBL	• Local	• No	• None of this habitat will be lost to the Proposed Development. There is potential for an indirect impact from dust created during construction works, or from accidental pollution. A pollution prevention plan and measures to control dust will be included in the CEMP and monitored by the ECoW, and so it is considered that embedded mitigation is sufficient to prevent adverse effects to this habitat. Given that there will be no habitat loss from the Proposed Development and the low conservation value this habitat is not considered to be an IEF in the context of the Proposed Development and not discussed further in this chapter.
• Scattered scrub	• SBL; Moderate GWDTE	• Local	• No	• None of this habitat will be lost to the Proposed Development. There is potential for an indirect impact from dust created during construction works, or from accidental pollution. A pollution prevention plan and measures to control dust will be included in the CEMP and monitored by the ECoW, and so it is considered that embedded mitigation is sufficient to prevent adverse effects to this habitat. Given that there will be no habitat loss from the Proposed Development and the low conservation value this habitat is not considered to be an IEF in the context of the Proposed Development and not discussed further in this chapter.
• Coniferous, broadleaved and mixed plantation and felled forestry	• NA	• Negligible	• No	• The habitat in the Proposed Development Area holds little to no conservation interest and is widespread throughout Scotland. This habitat is therefore not considered to be an IEF and not discussed further in this chapter.
• Unimproved/semi-improved acid grassland	• SBL (watching brief only)	• Negligible	• No	• None of this habitat will be lost to the Proposed Development. All areas of unimproved grassland within the Proposed Development Area correspond with habitats that are included on the SBL as a watching brief only and therefore this area has only low conservation value. • There is potential for an indirect impact from dust created during construction works, or from accidental pollution. A pollution prevention plan and measures to control dust will be included in the CEMP and monitored by the ECoW, and so it is considered that embedded mitigation is sufficient to prevent adverse effects to this habitat. Given that none of the habitat will be lost to the Proposed Development and the low conservation value, this habitat is not considered to be an IEF and is not discussed further in this chapter.

• Unimproved/semi-improved neutral grassland	• NA	• Negligible	• No	• The habitat in the Proposed Development Area holds little to no conservation interest and is widespread throughout Scotland. This habitat is therefore not considered to be an IEF and not discussed further in this chapter.
• Improved grassland	• NA	• Negligible	• No	• The habitat in the Proposed Development Area holds little to no conservation interest and is widespread throughout Scotland. This habitat is therefore not considered to be an IEF and not discussed further in this chapter.
• Marshy grassland	• SBL; Moderate/High GWDTE	• Negligible	• No	• A small area of this habitat will be lost as part of the Proposed Development (0.77 ha / 0.52 % of habitat within Proposed Development Area). A large majority of the marshy grassland habitat that will be lost to the Proposed Development is MG10 and MG6, which have no conservation value (MG10 and MG6 are not included in the purple moorgrass/rush pasture habitat on the SBL), meaning that the value of SBL habitat lost is much less than 0.77 ha and is considered to be negligible in the context of the site and the region. As such, no significant effects of the Proposed Development on the integrity of this feature are likely. Furthermore, the CEMP will include provision for micrositing of infrastructure where possible to ensure construction does not impact on the most sensitive areas of this habitat. • There is also the potential for an indirect impact from dust created during construction works, or from accidental pollution. A pollution prevention plan and measures to control dust will be included in the CEMP and monitored by the ECoW. It is therefore considered that embedded mitigation is sufficient to prevent adverse effects to this habitat and as such no significant effects on the integrity of this feature are likely as a result of the Proposed Development. Therefore, this habitat is not considered to be an IEF and is not discussed further in this chapter. • Some areas of this habitat have a moderate or high potential to be a GWDTE (depending on the NVC classification of the area: MG10 has moderate and M23 has high potential to be a GWDTE). Given that some infrastructure will be located within 250 m of these habitats, the Proposed Development could have an impact on the hydrology of this habitat. Further discussion of GWDTEs is presented in Chapter 9.
• Wet heath	• Annex 1; SBL; Moderate GWDTE	• Local	• No	• A small area of this habitat will be lost as part of the Proposed Development (0.11 ha / 2.43 % of habitat within Proposed Development Area, and 0.07 ha / 0.8 % of wet heath/acid grassland mosaic habitat within the Proposed Development Area). Wet heath is a priority habitat on Annex 1 and the SBL. The wet heath habitat found within the Proposed Development Area is heavily degraded and fragmented, with regular drainage ditches across the area and a grassy sward as a result. It is considered likely that in the absence of the Proposed Development the wet heath within the Proposed Development Area will degrade further and will likely change structure to no longer be classified as wet heath. This habitat therefore does not represent the typical Annex 1/SBL priority habitat. Furthermore, wet heath is widespread within the region, with an estimated 6593 ha of wet heath present within NHZ 19. The wet heath habitat loss at the Proposed Development therefore represents >0.01 % of wet heath within NHZ 19. As such, no significant effects on the integrity of this feature are likely as a result of the Proposed Development. Therefore, this habitat is not considered to be an IEF and is not discussed further in this chapter. • There is also the potential for an indirect impact from dust created during construction works, or from accidental pollution. A pollution prevention plan and measures to control dust will be included in the CEMP and monitored by the ECoW. It is therefore considered that embedded mitigation is sufficient to prevent adverse effects to this habitat and as such no significant effects of the Proposed Development on the integrity of this feature are likely. Therefore, this habitat is not considered to be an IEF and is not discussed further in this chapter. • Given that wet heath has high potential for being GWDTE, the Proposed Development could impact on the hydrology of these habitats. Further discussion of GWDTEs is presented in Chapter 9: Geology, Hydrology and Hydrogeological Assessment.
• Blanket bog	• Annex 1; SBL	• Regional	• No	• A small area of this habitat will be lost as part of the Proposed Development (0.28 ha / 0.76 % of habitat within Proposed Development Area). Blanket bog is a priority habitat on Annex 1 and the SBL. The only blanket bog habitat to be lost to the Proposed Development is M17, which is not widely represented within NHZ 19. Areas of M17 within the Proposed Development Area represent 21.2 % of the NHZ 19 habitat estimate for M17. It is therefore considered that blanket bog within the Proposed Development Area is regionally important. Blanket bog habitat loss due to the Proposed Development represents 0.18 % of the NHZ 19 habitat estimate for M17. As such, no significant effects on the integrity of this feature are likely as a result of the Proposed Development. Therefore, this habitat is not considered to be an IEF and is not discussed further in this chapter. • There is also the potential for an indirect impact from dust created during construction works, or from accidental pollution. A pollution prevention plan and measures to control dust will be included in the CEMP and monitored by the ECoW. It is therefore considered that embedded mitigation is sufficient to prevent adverse effects to this habitat and as such no significant effects of the Proposed Development on the integrity of this feature are likely. Therefore, this habitat is not considered to be an IEF and is not discussed further in this chapter.
• Wet modified bog	• Annex 1; SBL; Moderate GWDTE	• Negligible	• No	• A small area of this habitat will be lost as part of the Proposed Development (0.14 ha / 0.70 % of habitat within Proposed Development Area). Modified bog that is capable of natural regeneration is a priority habitat on Annex 1 and is included on the SBL. The purple moorgrass dominated modified bog habitat that is present in the Proposed Development Area is a habitat that is considered capable of natural regeneration. However, the areas of modified bog that will be lost as part of the Proposed Development are on peat that is less than 1 m deep, which suggests that the area would be unlikely to readily revert to blanket bog.

				Therefore, this habitat is not considered to represent an Annex 1 or SBL priority habitat. Therefore, this habitat holds little to no conservation interest. This habitat is therefore not considered to be an IEF and not discussed further in this chapter.
• Running/standing water	• SBL	• Local	• No	• A number of small burns and ponds and a small section of the River Doon are located within the Proposed Development Area. Rivers, burns and ponds are listed on the SBL. These habitats are widespread across Scotland. Protection for watercourses is embedded in the project design through good practice. Protection measures will be outlined in the CEMP. Further information on watercourses can be found in **Chapter 9:** Geology, Hydrology and Hydrogeological Assessment. This habitat is not considered to be an IEF and is therefore not discussed further in this chapter.
• Bats (all species)	• Conservation Regulations; Wildlife and Countryside Act; SBL	• Local	• Yes	• The site offers some limited foraging and commuting corridors along the Lochhead Burn, which connects the Proposed Development Area to Loch Spallander. However, no PRFs were found within 200 m of proposed wind turbine locations and the coniferous plantation habitat in the wind turbine area is low quality for foraging bats. The overall collision risk for bats at the Proposed Development is considered to be medium. Two species recorded during surveys (Nathusius's pipistrelle and Leisler's bat) are considered to be rare in Scotland and are only found in the south west of the country (in the area of the Proposed Development). A medium collision risk was predicted for Leisler's bat and a low-medium collision risk was predicted for Nathusius's pipistrelle. All other species recorded were common and widespread and known to occur throughout Scotland. Common and soprano pipistrelles had the highest activity levels at the Proposed Development and a medium collision risk was predicted for both species. Additionally, noctule and Leisler's bat (high risk species for wind turbine collision) were highlighted as having a medium risk at the Proposed Development. The Proposed Development is therefore considered of local conservation importance for all occurring species of bats. • Due to the high levels of activity of some bat species within the Proposed Development Area and the rarity of some bat species recorded, the Proposed Development has potential to cause a significant effect on bats. Therefore, they are considered to be an IEF.
• Great crested newt	• Conservation Regulations; Wildlife and Countryside Act; SBL	• Absent	• No	• There was no evidence of great crested newt found at in the Proposed Development Area during 2021 eDNA surveys, 2013 presence/absence surveys or as part of the desk study. Furthermore, no great crested newts were recorded within 20 km of the Proposed Development as part of the 2014 SNH commissioned report looking at the distribution of great crested newt within Scotland (Wilkinson *et al.*, 2014[39]). Ponds 1-3 were located within commercial conifer plantation, which is considered to be poor habitat for great crested newts[40]. Ponds 4-10 were located on the north side of the River Doon and the Proposed Development is on the south side of the river. The River Doon is therefore considered to be a barrier to movement of great crested newts in the unlikely event that there was an undetected population or if newts move into the area before/during construction. It is therefore considered that great crested newts are absent from the Proposed Development Area and are unlikely to move into the area before construction. Great crested newts are therefore not considered to be an IEF and are not discussed further in this chapter.
• Freshwater pearl mussel	• Conservation Regulations; Wildlife and Countryside Act; SBL	• Local	• No	• Suitable freshwater pearl mussel habitat was found within the River Doon in the area of the proposed new watercrossing. The watercrossing will span the watercourse and no construction work will take place within the river. An area of sub-optimal FWPM habitat was also found within the Lambdoughty Burn. No construction will be undertaken within 50 m of this watercourse. As no proposed watercrossings will directly impact suitable FWPM habitat there is no potential for direct impacts to FWPM. • There is, however, potential for indirect impacts to FWPM through pollution or sedimentation caused by construction works. A pollution prevention plan and measures to control sedimentation will be included in the CEMP and monitored by the ECoW. It is therefore considered that embedded mitigation is sufficient to prevent adverse effects to FWPM and as such no significant effects of the Proposed Development on the integrity of this feature are likely. Additionally, it is proposed that a Water Quality and Fish Monitoring Plan (WQFMP) is implemented as part of the planning conditions. This will include pre-construction, construction and post-construction water quality and FWPM surveys. Further information on watercourses can be found in **Chapter 9:** Geology, Hydrology and Hydrogeological Assessment. FWPM is not considered to be an IEF and is therefore not discussed further in this chapter.
• Fish	• SBL	• Local	• No	• Suitable fish feeding and migrating habitat was found within the River Doon in the area of the proposed new watercrossing. The watercrossing will span the watercourse and no construction work will take place within the river. Additionally, some areas of sub-optimal habitat for fish spawning, nursery and feeding areas were found within Lochhead Burn and Keirs Burn. Watercrossings are proposed on both watercourses. All watercrossings will be designed so as to not impede fish or their food sources. As no proposed watercrossings will directly impact suitable fish habitat there is no potential for direct impacts to fish. • There is, however, potential for indirect impacts to fish through pollution or sedimentation caused by construction works. A pollution prevention plan and measures to control sedimentation will be included in the CEMP and monitored by the ECoW. It is therefore considered that embedded mitigation is sufficient to prevent adverse effects to fish and as such no significant effects of the Proposed Development on the integrity of this feature are likely. Additionally, it is proposed that a Water Quality and Fish Monitoring Plan (WQFMP) is implemented as part of the planning conditions. This will include pre-construction, construction and post-

[39] Wilkinson, J. W., Arnell, A., Driver, D. & Driver, B. (2014) Elaborating the distribution of the great crested newt in Scotland (2010-2011). Scottish Natural Heritage Commissioned Report No. 793.
[40] Langton, T. E. S., Becket, C. L. & Foster, J. P. (2001) Great crested newt conservation handbook, Froglife, Halesworth.

				construction water quality and fish surveys. Further information on watercourses can be found in **Chapter 9:** Geology, Hydrology and Hydrogeological Assessment. Fish are not considered to be an IEF and are therefore not discussed further in this chapter.
• Protected mammals (excluding bats)	• Conservation Regulations; Wildlife and Countryside Act; SBL	• Local	• No	• Signs of badger, pine marten and otter were found within the Proposed Development Area. No signs of other protected mammal species were found during baseline surveys. Two records of red squirrel were reported within the Proposed Development Area as part of the desk study and it is therefore considered likely that a small population of red squirrel is present at the Proposed Development. It is assumed that other protected mammal species (e.g., water vole) are absent from the Proposed Development Area or are only present in very low numbers. All species recorded are widespread across Scotland and in the local area of the Proposed Development. The levels of activity recorded indicate that while all species are present at the Proposed Development, this is unlikely to be in sufficient numbers to consider the population of greater than Local value. • Three active badger setts and three features with potential for use by otter as a couch were found within the Proposed Development Area. All badger setts were over 100 m from proposed infrastructure and all potential otter couches were over 30 m from proposed infrastructure. Pre-construction mammal surveys included in the embedded mitigation will confirm the status of badger setts and otter couches and identify those that need to be protected during the construction phase. Signs and resting places of other protected mammals (such as pine marten and water vole) will also be recorded during pre-construction protected mammal surveys. Works will not be carried out within specific buffers of protected mammal resting places unless done so under licence from NatureScot (see Paragraph 7.7.17 for further information). Water crossings will also be built to ensure safe access for otters and water voles up and down stream of the track. Furthermore, no felling will be undertaken in the vicinity of the badger sett and it is considered that there will be sufficient forest habitat maintained to support badgers and other protected mammals identified in the Proposed Development Area. • All potential impacts to protected mammals will be mitigated under embedded mitigation, including embedded mitigation to avoid indirect impacts such as pollution of watercourses. Therefore, a significant effect on the integrity of the local population is considered unlikely and none of these protected mammals are considered to be an IEF.

7.8.2 One feature has been identified as an IEF, requiring EcIA following the application of embedded mitigation (see Section 7.7). This is:

- Bats (direct impacts associated with collision during the operational phase).

7.8.3 Assessment of impacts of the Proposed Development on this IEF is provided below.

Construction Effects

7.8.4 No significant construction effects are predicted.

Operational Effects

Bats

7.8.5 During the operational phase, rotating wind turbines present a risk to flying bats as a result of potential collision when flying in close proximity to wind turbines. Research work by Exeter University (Mathews *et al.*, 2016[41]) found that most bat fatalities at UK wind farms were common pipistrelle, soprano pipistrelle and noctule bats. In this study the percentage casualty rates for soprano pipistrelle, common pipistrelle and noctule bats were higher than the relative proportions of their calls recorded from ground level acoustic surveys.

7.8.6 Bat activity levels are classified according to NatureScot [11]. Relative activity levels based on the output provided by Ecobat can be found in Appendix 7.1. Areas of conifer plantation within 96 m or 75 m of wind turbines (dependent on hub height) will be felled to maintain a 50 m buffer between woodland edge and wind turbine blade tip, as set out in the guidance[11]. Therefore, detectors located in an open environment away from mature woodland edges are considered to resemble the likely operational conditions the most. Detectors 1, 2 and 7 are the most representative locations regarding habitat for much of the Proposed Development Area as they were located within areas of felled or juvenile conifer plantation. Additionally, detectors 4 and 9 were located on the edge of conifer plantation and marshy grassland/blanket bog, which are the habitats most likely to regenerate in areas of felling. Detectors 1, 2, 4, 7 and 9 all showed relatively low bat activity compared with other detectors deployed within the Proposed Development Area and each detector recorded less than 10 % of the total recorded bat activity. The five detectors combined (50 % of the bat detectors deployed) recorded 21 % of the total recorded bat activity.

7.8.7 Detectors 5 and 6 recorded the most bat passes, with 38 % and 18 % of bat passes being recorded at these detectors respectively. This is thought to be due to bats foraging and commuting along the Lochhead Burn and the tree line connecting the burn to the wider landscape. The nearest wind turbine to the watercourse is 195 m (Turbine 6) to the top of the watercourse. This distance is close to the conservative Eurobats guidance of a gap of 200 m between wind turbines and habitats that are specifically important to bats (Rodrigues *et al.*, 2015[42]). The area of forest around this wind turbine will be felled and will therefore remove the woodland edge that is likely to have been used by commuting pipistrelles. This will reduce the suitability of the habitat for commuting bats and should therefore reduce the collision risk to bats in the area around Turbine 6. No other foraging/commuting corridors were identified from the bat activity survey results. It is considered that there are sufficient woodland edges and other linear features for commuting bats in the wider area. This means that the displacement impact of felling trees will be negligible.

Common and Soprano Pipistrelle

7.8.8 Common and soprano pipistrelle bats were both recorded at the Proposed Development and were assessed as being at a medium collision risk at both the site level and detector level (all detectors). However, both species showed a high relative activity at maximum activity levels. Both pipistrelle species are assessed in NatureScot guidance[11] as having an overall high collision risk with wind turbines, but due to both species being common and widespread across Scotland, they have only a medium population vulnerability to wind turbines.

7.8.9 The majority of common and soprano pipistrelle passes recorded during the bat activity survey were at detector 5 and 6: 58 % of all common pipistrelle passes and 47 % of all soprano pipistrelle passes were recorded at these detectors, respectively. As previously discussed, it is assumed that detectors 5 and 6 were located along a route used regularly by commuting pipistrelles as they were located on the Lochhead Burn and a connecting woodland edge. The woodland edge on which detector 6 was located will not be present during wind farm operation due to felling operations. Therefore, the area (which is within 200 m of Turbine 6) will have a reduced suitability and collision risk to bats after felling. The number of common and soprano pipistrelle passes recorded at detectors 1, 2, 4, 7 and 9 was lower, with 22 % of common pipistrelle calls and 17 % of soprano pipistrelle calls being recorded at these five detectors. These detectors are considered to have been located in

[41] Matthews, F., Richardson, S., Lintott, P. and Hosken, D. (2016) Understanding the Risk of European Protected Species (Bats) at Onshore Wind Turbine Sites to Inform Risk Management. Report by University of Exeter for RenewableUK and UK Department of Energy and Climate Change (DECC).

[42] Rodrigues, L., Bach, L., Dubourg-Savage, M. J., Karapandža, B., Kovač, D., Kervyn, T., Dekker, J., Keppel, A., Bach, P., Collins, J., Harbusch, C., Park, K., Micevski, B. and Minderman, J. (2015) Guidelines for consideration of bats in wind farm projects – Revision 2014. EUROBATS Publication Series No. 6 (English version). UNEP/EUROBATS Secretariat, Bonn, Germany, 133pp.

habitats that are most representative of proposed wind turbine locations during the operational phase.

7.8.10 Common and soprano pipistrelle activity has been shown as medium risk for wind turbine collision across the Proposed Development Area and the recommended buffer distance will be left between wind turbines and woodland edges, with felling planned around wind turbine locations (see Paragraph 7.7.5 for further information). However, given the limited understanding of bat interaction with wind turbines and the high relative activity of common and soprano pipistrelles within the Proposed Development Area, there is still a risk that common and soprano pipistrelle species will be impacted by the Proposed Development. As the overall population vulnerability of these two species to wind turbines is medium, it is considered that operational effects of the Proposed Development on common and soprano pipistrelle due to collisions would not affect the integrity of the local populations of these species, and so would not be significant.

7.8.11 Therefore, the impact of the Proposed Development on common and soprano pipistrelles during operation is predicted to be medium negative resulting in an effect which is not significant at the Local level.

Nathusius's pipistrelle

7.8.12 Nathusius's pipistrelle was recorded within the Proposed Development Area with moderate relative activity levels. The species was assessed as being at a low or medium collision risk at both the site level and detector level (depending on the activity level and detector location). The species is assessed in NatureScot guidance[11] as having an overall high collision risk with wind turbines and is considered to be one of the rarest species in Scotland. The species therefore has an overall high population vulnerability to wind turbines.

7.8.13 Nathusius's pipistrelle was recorded at all detectors except for 1, 2 and 8. It was recorded in low numbers and 76 % of calls were recorded at detectors 5, 6 and 10, which are not considered to be representative of the habitat that will be present around wind turbines during the operational phase. As previously discussed, it is assumed that detectors 5 and 6 were located along a route used regularly by commuting pipistrelles as they were located on the Lochhead Burn and a connecting woodland edge. The woodland edge on which detector 6 was located will not be present during wind farm operation due to felling operations. Therefore, the area (which is within 200 m of Turbine 6) will have a reduced suitability and collision risk to bats after felling. The number of Nathusius' pipistrelle passes recorded at detectors 1, 2, 4, 7 and 9 was low, with 20 % of calls being recorded at these five detectors (none recorded at detectors 1 and 2). These detectors are considered to have been located in habitats that are most representative of proposed wind turbine locations during the operational phase.

7.8.14 All trees within 75 m or 96 m of wind turbines (depending on the wind turbine hub height) will be felled prior to wind farm operation, which will reduce the collision risk of all bat species around wind turbines. However, given the moderate relative activity levels and the limited understanding of bat interaction with wind turbines there is still a risk that Nathusius's pipistrelle species will be impacted by the Proposed Development. As the relative activity levels and the collision risk assessment was low-moderate/low-medium it is considered that operational effects of the Proposed Development on Nathusius's pipistrelle due to collisions would not affect the integrity of the local population of this species, and so would not be significant.

7.8.15 Therefore, the impact of the Proposed Development on Nathusius's pipistrelle during operation is predicted to be medium negative resulting in an effect which is not significant at the Local level.

Myotis species

7.8.16 Myotis sp. are assessed by NatureScot guidance[11] to be of low risk in terms of collision and threat to national populations. This species group was assessed as having a low to medium risk at the Proposed Development (dependent on activity levels and location). The highest activity levels for Myotis sp. were at detector 4, where high relative activity levels were recorded for the species group. This detector was located on the edge of Scot's pine plantation and blanket bog. The detector was located more than 250 m from proposed wind turbine locations. Relative activity levels of Myotis sp. at all other detectors were low to moderate.

7.8.17 The impact during the operational phase on Myotis bat species is therefore considered to be low negative resulting in an effect which is not significant at the Local level.

Nyctalus sp.

7.8.18 Although all potential Leisler's bat calls have been classed as *Nyctalus* sp. the reclassification was undertaken after submission to Ecobat. Therefore, the Ecobat assessment for Leisler's is discussed here for completeness. It is considered likely that some of the *Nyctalus* sp. calls recorded were Leisler's bat, but due to the difficulties in separating calls from noctule the number cannot be determined. Both Leisler's and noctule are assessed in NatureScot guidance[11] as having an overall high collision risk with wind turbines and are both considered to be rare in Scotland. These species therefore have an overall high population vulnerability to wind turbines.

7.8.19 Leisler's bat and noctule were recorded at the Proposed Development with moderate to high relative activity levels at all detectors and Nyctalus sp. was the third most recorded species group within the Proposed Development Area. Both Leisler's and noctule were assessed as being at a medium collision risk at both the site level and detector level.

7.8.20 *Nyctalus* sp. were recorded in the highest numbers at detector 9 and 10, which both recorded 27 % of all *Nyctalus* sp. calls. Together, these two detectors recorded 54 % of all *Nyctalus* sp. calls. A high relative activity level was also recorded for noctule at detector 9. Detector 9 was located on the edge of the conifer plantation and was 100 m from the proposed location of Turbine 9. This detector was highlighted as being located in a habitat similar to that which is likely to be present around wind turbines during operation (blanket bog). It is, however, considered that the high number of *Nyctalus* sp. passes at this detector was due to the woodland edge rather than the blanket bog habitat. Detector 10 was in an area of Scot's pine plantation near to a small patch of blanket bog. The detector location is not considered to be representative of the habitat that will be present around wind turbines during the operational phase. The area of Scot's pine plantation is also over 200 m from the nearest wind turbine location, giving a larger buffer than set out in Eurobats guidance (Rodrigues *et al.*, 2015**Error! Bookmark not defined.**) as the distance to leave between wind turbines and habitats that are specifically important to bats. Detector 5 also showed high numbers of *Nyctalus* sp. and noctule calls: 22 % of *Nyctalus* sp. calls and 24 % of noctule calls were recorded here. As previously discussed, it is assumed that detector 5 was located along a route used regularly by commuting bats as it was located on the Lochhead Burn. This watercourse is 195 m from the closest wind turbine (Turbine 6). A suitable buffer will be left between the woodland edge and the wind turbine through felling around wind turbine locations. Therefore, the area around the wind turbine will have a reduced suitability and collision risk to bats after felling.

7.8.21 The number of *Nyctalus* sp. passes recorded at detectors 1, 2 and 7 was low, with 7 % of calls being recorded at these three detectors. The locations of these detectors are considered to have been the most representative of proposed wind turbine locations during the operational phase as they were in areas of felled or juvenile forestry. The number of noctule passes recorded at detectors 2 and 7 was low, with 12 % of calls being recorded at these three detectors. However, the number of noctule passes at detector 1 were slightly higher than average, with 15 % of noctule passes recorded here. It is likely that the higher than average number of noctule calls at detector 1 is due to it being located on the edge of conifer plantation. Detectors 2 and 7 were located further from a woodland edge than detector 1.

7.8.22 All trees within 75 m or 96 m of all wind turbines (depending on the wind turbine hub height) will be felled prior to wind farm operation. This will reduce the collision risk of all bat species around wind turbines. However, given the moderate to high relative activity levels and the limited understanding of bat interaction with wind turbines there is still a risk that *Nyctalus* sp. (including noctule) will be impacted by the Proposed Development. As the collision risk assessment was medium it is considered that operational effects of the Proposed Development on *Nyctalus* sp. due to collisions would not affect the integrity of the local population of this species, and so would not be significant.

7.8.23 Therefore, the impact of the Proposed Development on *Nyctalus* sp. during operation is predicted to be medium negative resulting in an effect which is not significant at the Local level.

Brown Long-eared Bat

7.8.24 The overall activity rates of brown long-eared bat were low and the species is assessed by NatureScot guidance[11] and Mathews *et al.*, 2016[41] to be at low risk in terms of collision with wind turbines). This species was assessed as having a low to medium collision risk (during periods of activity) at the Proposed Development. Brown long-eared bats were almost exclusively recorded in autumn and were recorded at all detectors except for 7. They were recorded most frequently at detector 9, which recorded 41 % of brown long-eared bat passes and had a moderate relative activity level. Detector 9 was highlighted as being located in a habitat similar to that which is likely to be present around wind turbines during operation (blanket bog). It is, however, considered that the higher number of passes at this detector was due to the woodland edge rather than the blanket bog habitat. A suitable buffer will be left between the woodland edge and the wind turbines through felling around all wind turbine locations, therefore these areas will have a reduced suitability and collision risk to bats after felling. Relative activity levels of brown long-eared bat at all other detectors were low or low-moderate.

7.8.25 Due to the low collision risk, low activity and the widespread nature of for this species the operational impact on brown long-eared bats is considered to be negligible resulting in an effect which is not significant at the Local level.

Decommissioning Effects

7.8.26 No significant decommissioning effects are predicted.

7.9 Mitigation

Habitats

7.9.1 A Habitat Management Plan (HMP) for the Proposed Development will be provided, subject to consultation with the landowner, NatureScot, East Ayrshire Council and South Ayrshire Council. The main aim of this HMP will be to improve and restore areas of bog within the Proposed Development Area. Two areas have been identified in which blanket bog restoration could be undertaken:

- Areas of deep peat (>1 m) currently within conifer plantation that will be felled as part of the construction of the Proposed Development, for instance around Turbine 4. Possible management to restore blanket bog in these areas post-felling would be ditch blocking and control of conifer sapling regeneration; and
- The area of M17 blanket bog between the proposed access track and the conifer plantation. This area of bog has considerable peat hagging present. Possible management in this area would be ditch blocking, peat hag reprofiling and reseeding of bare peat.

7.9.2 The HMP will include a monitoring programme to assess the success of management implemented. This will likely include water table monitoring and vegetation monitoring.

7.9.3 A monitoring regime will be included as part of this plan in order to assess the effectiveness of management measures implemented as part of the HMP.

Fish and freshwater pearl mussel

7.9.4 A comprehensive Water Quality and Fish Monitoring Plan (WQFMP) will be produced in consultation with NatureScot and local fishery boards to monitor the watercourses and the species that depend on them. The monitoring will commence during the pre-construction phase and continue during the period of construction of the Proposed Development. The requirement for operational monitoring will be determined following completion of the pre-construction and construction monitoring.

7.9.5 The following pre-construction surveys will be undertaken in order to obtain up-to-date baseline and pre-construction information:

- Electrofishing surveys will be carried out along watercourses draining the Proposed Development;
- FWPM surveys will be carried out within the River Doon and Lambdoughty Burn, where potential habitat was recorded during baseline surveys; and
- Macro-invertebrate monitoring will be carried out along watercourses draining the Proposed Development to establish water quality information (using biological indicator species) to assess the health of the watercourse ecosystems.

7.9.6 This monitoring programme will run alongside the pre-construction and construction water quality monitoring detailed in Chapter 9: Geology, Hydrology and Hydrogeological Assessment which includes assessments of turbidity levels and chemical indicators of pollution as well as biological indicators.

7.10 Assessment of Residual Effects

7.10.1 The mitigation and compensation measures are expected to reduce the level of residual effects for all IEFs to which they apply, in the short and long term, and as such no significant residual effects are predicted as a result of the construction and operation of Proposed Development.

7.11 Assessment of Cumulative Effects

7.11.1 NatureScot guidance[10] states that assessments should focus on the most significant cumulative effects and conclude with a clear assessment of those which are likely to influence decision making. As per the guidance, any wind farm developments of fewer than three wind turbines were excluded from the cumulative impact assessment (CIA). This is due both to the lack of quantitative environmental information which usually exists in the public domain for such small-scale developments, and also due to the low likelihood that significant adverse effects would be predicted for them. Only IEFs for which a greater than negligible residual effect is predicted are considered in the CIA, as negligible effects will not result in a detectable increase in cumulative effects.

7.11.2 The context in which cumulative effects are considered depends upon the ecology of the species or habitat in question. Of all protected mammal species observed, bats are most likely to be affected by additional wind farm development because of the distances travelled by some species of foraging bat and the cumulative risks to bat populations as a result of collision with wind turbines during operation. The implementation of good practice measures regarding buffer distances of wind turbines from forestry edges to minimise impacts on commuting and foraging bats minimises likelihood of cumulative impact. With moderate adverse residual effects predicted for common and soprano pipistrelles, these have been scoped into the CIA, along with bog habitats which also have minor beneficial residual effects predicted.

7.11.3 All existing, consented and submitted developments (of three or more wind turbines) within 10 km of the Proposed Development were considered as part of the assessment of cumulative impacts.

7.11.4 It should be noted that CIAs may be complicated by availability of EIAR/ES chapters and Appraisals for consented developments and, where this information is available, survey periods and methods may differ between sites. Furthermore, some wind farms may have been in existence for many years, and thus contemporary data may not be available.

7.11.5 Within this search area, eight development sites were identified:

- Dersalloch Wind Farm (operational) – 23 wind turbines, immediately adjacent to the south of the Proposed Development
- South Kyle Wind Farm (construction) – 50 wind turbines, 9 km west of the Proposed Development
- Polquhairn Wind Farm (consented) – 9 wind turbines, 6 km north of the Proposed Development
- Carrick Wind Farm (application) – 13 wind turbines, 9 km south of the Proposed Development
- Craiginmoddie Wind Farm (application) – 14 wind turbines, 9 km south west of the Proposed Development
- North Kyle Wind Farm (application) – 54 wind turbines, 6 km east of the Proposed Development
- Knockcronal Wind Farm (application) – 12 wind turbines, 4 km south of the Proposed Development
- Knockkippen Wind Farm (scoping) – 12 wind turbines, 3 km north west of the Proposed Development

7.11.6 Therefore, information for informing the CIA was available from three wind farm projects with submitted applications, one consented wind farm, one wind farm under construction and one operational wind farm (see Table 7.17). The two developments at the scoping stage have not been included as impacts have not yet been assessed and the projects have yet to go through planning.

7.11.7 A combination of Minor and Moderate adverse residual effects have been predicted within 10 km of the Proposed Development for pipistrelle, Nyctalus and Myotis bats. Bat mitigation plans (including curtailment) were included for Carrick and North Kyle Wind Farms, both of which had a Moderate to Major adverse effect predicted for some bat species. Bat mitigation plans were predicted to reduce the impact of both developments on bats to a non-significant effect. It is therefore considered that the cumulative impact for all bat species will be Moderate adverse.

7.11.8 With the application of good practice mitigation in relation to bats, the cumulative impact is predicted to be moderate adverse resulting in an effect which is not significant.

Table 7.17: Cumulative impact assessment

Site	No. Wind turbines	Site status	Baseline surveys	Pipistrelle species	*Myotis* species	*Nyctalus* species
• Sclenteuch (Proposed Development)	• 9	• EIA	• 2021	• Moderate adverse •	• Minor adverse	• Moderate adverse
• Dersalloch	• 23	• Operational	• 2010-2011	• Soprano pipistrelle – Minor adverse	• -	• Noctule – Minor adverse
• South Kyle	• 50	• Construction	• 2012	• All bat species – Minor adverse	• All bat species – Minor adverse	• All bat species – Minor adverse
• Polquhairn	• 9	• Construction	• 2014	• All bat species – negligible adverse	• All bat species – negligible adverse	• All bat species – negligible adverse
• Carrick	• 13	• Application	• 2019	• High adverse pre-mitigation. With mitigation no significant effect	• -	• High adverse pre-mitigation. With mitigation no significant effect
• Craiginmoddie	• 14	• Application	• 2020	• All bat species – Moderate adverse	• All bat species – Moderate adverse	• All bat species – Moderate adverse
• North Kyle	• 54	• Application	• 2017-2018	• Common and soprano pipistrelle – Moderate adverse (significant) pre-mitigation • Nathusius's pipistrelle – Minor adverse pre-mitigation • With mitigation no significant effect for any bat species	• -	• Moderate to Major adverse (significant) pre-mitigation • With mitigation no significant effect for any bat species
• Knockcronal	• 12	• Application	• 2019-2020	• All bat species – Minor adverse	• All bat species – Minor adverse	• All bat species – Minor adverse
• Cumulative Impact	• 172	• -	• -	• 2x Moderate adverse • 3x Minor adverse • 1x Negligible adverse • 2x High/Major adverse pre-mitigation, non-significant with mitigation • A combination of Minor and Moderate adverse residual effects have been predicted within 10 km of the Proposed Development. Bat mitigation plans (including curtailment) were included for Carrick and North Kyle Wind Farms, both of which had a Moderate to Major adverse effect predicted for pipistrelles. Bat mitigation plans were predicted to reduce the impact of both developments on bats to a non-significant effect. It is therefore considered that the cumulative impact for pipistrelles will be Moderate adverse.	• 1x Moderate adverse • 3x Minor adverse • 4x Negligible adverse • A combination of Minor and Moderate adverse residual effects have been predicted for *Myotis* sp. within 10 km of the Proposed Development. As *Myotis* sp. are at a low risk to wind turbine collisions it is not considered likely that the cumulative impact of the developments will have a significant impact on the local population. It is therefore considered that the cumulative impact for *Myotis* sp. will be Moderate adverse.	• 2x Moderate adverse • 3x Minor adverse • 1x Negligible adverse • 2x High/Major adverse pre-mitigation, non-significant with mitigation • A combination of Minor and Moderate adverse residual effects have been predicted within 10 km of the Proposed Development. Bat mitigation plans (including curtailment) were included for Carrick and North Kyle Wind Farms, both of which had a Moderate to Major adverse effect predicted for *Nyctalus sp.* Bat mitigation plans were predicted to reduce the impact of both developments on bats to a non-significant effect. It is therefore considered that the cumulative impact for *Nyctalus sp.* will be Moderate adverse.

7.12 Summary

7.12.1 In order to inform the EcIA, baseline ecology surveys were undertaken in 2020 and 2021. These included Phase 1 and NVC habitat surveys, protected mammal surveys, bat surveys (roost assessment and activity surveys), fish and FWPM habitat surveys, following standard NatureScot guidance.

7.12.2 An assessment has been made of the predicted significance of effects of the Proposed Development on ecological interests. This assessment predicted no significant effects on all of the IEFs recorded and no significant cumulative effects on any IEFs.

7.12.3 Habitat enhancement measures targeted at blanket bog are proposed. Embedded mitigation measures to minimise impacts of the construction and operation of the Proposed Development on IEFs, and to prevent a breach of legislation under the Wildlife and Countryside Act (1981) as amended by the Nature Conservation (Scotland) Act (2004) are outlined. A SPP is proposed and good practice guidance regarding protected species and pollution prevention will be followed, with an ECoW employed during construction. Further mitigation in the form of a HMP to restore blanket bog habitats and a WQFMP to monitor fish and FWPM are proposed. It is considered that implementation of these mitigation and habitat enhancement measures will reduce the likelihood of impacts on IEFs at the appropriate biogeographical scale. A summary of effects is found in Table 7.18.

Table 7.18: Summary of residual effects

Likely Significant Effect	Mitigation	Means of Implementation	Residual Effect
• Common, soprano and Nathusius's pipistrelle and *Nyctalus sp.* bats	• No mitigation	• NA	• Moderate adverse
• Myotis bats	• No mitigation	• NA	• Minor adverse
• Brown long-eared bats	• No mitigation	• NA	• Negligible

8 Ornithology Assessment

8.1 Statement of Competence

8.1.1 This Environmental Impact Assessment Report (EIAR) chapter has been prepared by suitably qualified and experienced ecologists and all data were collected by suitably qualified and experienced surveyors.

8.1.2 The author of this chapter has 16 years of experience in environmental consultancy and has been working as an Ecological Consultant for the last six years. During this time, he has been involved with the design, implementation and management of ecological assessments, production and review of EIAR chapters, scoping reports, technical baseline reports and operational monitoring reports as well as client and consultee liaison. The author was assisted by a Senior Environmental Consultant with 10 years of experience working in the environmental/conservation sector prior to moving into renewable energy consultancy 12 years ago. Also assisting was a Technical Director with 12 years of experience in Ecological Impact Assessment (EcIA) and EIAR compilation.

8.2 Introduction

8.2.1 This ornithological chapter of the EIAR has been prepared by Natural Power Consultants (Natural Power) on behalf of RES (the "Applicant") in respect of the proposed Sclenteuch Wind Farm (hereafter referred to as 'the Proposed Development'). This chapter describes the ornithological interests at the Proposed Development and assesses the predicted effects of the Proposed Development on these interests. It details the methods used to identify the baseline bird community within the Proposed Development Area and the surrounding locale, and the process used to determine the nature conservation value of the bird populations present. The chapter then sets out the potential effects of the Proposed Development on birds during construction, operation and decommissioning, and assesses the significance of potential impacts on bird populations, including cumulative effects, at appropriate bio-geographic scales. An assessment of residual impacts, taking into consideration proposed mitigation measures, is provided. Non-avian ecology is assessed in Chapter 7: Ecology, of the EIAR and complements this chapter.

8.2.2 This EIAR chapter has been prepared following a scoping process which led to a Scoping Report issued to consultees in August 2021. In line with the principles of proportionate Environmental Impact Assessment (EIA), embedded mitigation is considered at the outset of the assessment (see Section 8.7: Assessment of Potential Effects). Furthermore, to ensure proportionality based on the likelihood of potential effects, only ornithological features for which it is considered there may be significant effects in the absence of mitigation, are identified as Important Ornithological Features (IOFs) and taken forward for a full EcIA.

8.2.3 Ornithological baseline conditions have been assessed through a combination of desk study and the results of baseline ornithological surveys. Species are described and evaluated in terms of the recognised criteria outlined in Section 8.5: Methodology.

8.2.4 The baseline surveys for the Proposed Development were carried out over two periods, totalling 23 months: between September 2018 and February 2019 (inclusive), and between February 2020 and July 2021 (inclusive) (see Section 8.5: Methodology, and Technical Appendix 8.1 for further details).

8.2.5 Summaries of survey times and dates are given in the Technical Appendix 8.1. Full survey data, including details of survey dates, times and weather conditions, plus full results data, can be provided on request, but only data considered necessary to the EcIA are presented here and in the Technical Appendix 8.1.

8.2.6 The following Figures accompany this EIAR:

- Figure 8.1: Ornithology Survey Areas
- Figure 8.2: Vantage Point Locations and Viewsheds
- Figure 8.3: Statutory Sites Designated for Ornithological Features within 25 km of Sclenteuch Wind Farm
- Figure 8.4a: Vantage Point Surveys: Non-breeding Season Sep 2018–Feb 2019 (Gulls)
- Figure 8.4b: Vantage Point Surveys: Non-breeding Season Sep 2018–Feb 2019 (Other species)
- Figure 8.4c: Vantage Point Surveys: Breeding Season Feb-Aug 2020 (Gulls)
- Figure 8.4d: Vantage Point Surveys: Breeding Season Feb-Aug 2020 (Other species)
- Figure 8.4e: Vantage Point Surveys: Non-breeding Season Sep 2020 – Feb 2021 (All species)
- Figure 8.5: Breeding Bird Survey Results 2020, 2021
- Figure 8.6: Raptor Surveys Results 2020, 2021 (Confidential Figure)

Terminology

8.2.7 The following areas are defined within this chapter:

- The 'Proposed Development': the proposed Sclenteuch Wind Farm development;

- The 'Proposed Development Area': all ground within the site boundary (see Figure 8.1);
- 'Study Area': the ornithological assessment focuses on the Proposed Development Area and appropriate buffer areas (collectively the 'study areas') which have been applied as recommended by NatureScot guidance[1]. Within the Proposed Development Area surveys concentrated on the wind turbine envelope area ('Main Study Area') and the access track to the east of it ('Access Track Study Area'). The specific study areas are as follows (Figure 8.1):
  - breeding bird surveys: open habitat within 500 m of the proposed wind turbines (current at the time of the surveys);
  - breeding raptor surveys: all suitable breeding habitat within 2 km of the proposed wind turbines (current at the time of the surveys);
  - black grouse surveys: all suitable lekking habitat within 1.5 km of the proposed wind turbines (current at the time of the surveys); and
  - Vantage Point (VP) surveys: viewsheds extended to 2-3 km from two VP locations;
- 'Collision Risk Zone' (CRZ): this is the area derived by applying a buffer around each wind turbine with a radius equal to the length of the wind turbine blades, plus an additional precautionary 200 m;
- 'Zone of Influence' (ZoI): this is "the area over which ecological features may be subject to significant effects as a result of the proposed project or associated activities" (Chartered Institute of Ecology and Environmental Management (CIEEM)).

8.3 Legislation, Policy and Guidance

8.3.1 The ornithological baseline surveys and subsequent assessment have been carried out with reference to a number of national policy documents, as addressed in Chapter 4: Approach to EIA/Climate Change, Legislative and Policy Context and Chapter 7: Ecology, of the EIAR. Legislative and guidance documents with specific relevance to ornithology are listed below.

Legislation

- The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (the Habitats Regulations), which transposed the Habitats Directive (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora) and elements of the Birds Directive (Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds) into UK law;
- The Conservation of Habitats and Species Regulations 2017 (as amended), relating to reserved matters in Scotland including the granting of consent under section 36 of the Electricity Act (together, "the Habitats Regulations");
- Wildlife and Countryside Act 1981 (as amended) which transposed elements of the Birds Directive into UK law;
- The Nature Conservation (Scotland) Act 2004;
- The Wildlife and Natural Environment (Scotland) Act 2011;and
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, which transposed the EIA Directive into the Scottish system for considering applications for consent under Sections 36 and 37 of the Electricity Act 1989.

Policy

- Planning Advice Note (PAN) 60: Planning for Natural Heritage (Scottish Government 2000);
- PAN 1/2013 – Environmental Impact Assessment (Scottish Government, 2013);
- Nature Conservation: Implementation in Scotland of the Habitats and Birds Directives: Scottish Executive Circular 6/1995 as amended (June 2000); and
- EU Exit: The Habitats Regulations in Scotland (Scottish Government, December 2020).

Guidance

8.3.2 Note that some documents published by NatureScot still refer to their former name of Scottish Natural Heritage (SNH).

- CIEEM (2018) Guidelines for EcIA in the United Kingdom and Ireland[2];
- SNH (2017) Recommended bird survey methods to inform impact assessment of onshore wind farms[1];
- Birds and Wind Farms: Risk Assessment and Mitigation[3];
- Developing field and analytical methods to assess avian collision risk at wind farms[4];
- SNH (2000) Windfarms and birds: calculating a theoretical collision risk assuming no avoidance action[5];

1 SNH (2017) Recommended bird survey methods to inform impact assessment of onshore wind farms. Scottish Natural Heritage, Battleby.

2 CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, Winchester. Version 1.1 – Updated September 2019.

3 de Lucas, M., Janss, G. & Ferrer, M. (eds.) (2007) Birds and Wind Farms: risk assessment and mitigation. Quercus, Madrid.

4 Band, W., Madders, M. & Whitfield, D.P. (2007) Developing field and analytical methods to assess avian collision risk at wind farms. In de Lucas, M., Janss, G. & Ferrer, M. (eds.) Birds and Wind Farms: risk assessment and mitigation. Quercus, Madrid.

5 SNH (2000) Windfarms and birds: calculating a theoretical collision risk assuming no avoidance action. Scottish Natural Heritage, Edinburgh.

- SNH (2018) Assessing significance of impacts from onshore windfarms on birds outwith designated areas[6];
- SNH (2009) Monitoring the impacts of onshore wind farms on birds[7];
- SNH (2009) Guidance on methods for monitoring bird populations at onshore wind farms[8];
- SNH (2018) Avoidance rates for the onshore NatureScot wind farm collision risk model[9];
- SNH (2018) Assessing the cumulative impact of onshore wind energy developments[10];
- SNH (2016) Assessing connectivity with Special Protection Areas (SPAs)[11];
- Natural Research (2017) A Review of Disturbance Distances in Selected Bird Species[12];
- British Standard 42020:2013 Biodiversity – code of practice for planning and development;
- Natural Heritage Zone (NHZ) bird population estimates. Scottish Windfarm Bird Steering Group (SWBSG). Commissioned report number 150413;
- Bird Monitoring Methods[14];
- A method for censusing upland breeding waders[15];
- Raptors: A Field Guide to Survey and Monitoring[16];
- Scottish Renewables; SNH; Scottish Environment Protection Agency (2010) Good Practice during Wind Farm Construction[17];
- Birds of Conservation Concern (BoCC) 5: the population status of birds in the United Kingdom, Channel Islands and the Isle of Man[18];
- Map of bird sensitivities to wind farms in Scotland (2008)[19]; and
- Scottish Biodiversity List (SBL).

8.4 Consultation

8.4.1 Throughout the baseline survey period, ongoing consultations between Natural Power and NatureScot on the progress of the baseline surveying programme were taking place and these are summarised in Table 8.1.

Table 8.1. Summary of consultation between Natural Power and NatureScot during baseline survey period

Date	NatureScot advice/response	Comment/action taken by Natural Power
17/12/2018	NatureScot agreed that if there have been no significant changes in flight activity levels since 2011/2012, then one year of survey work will be sufficient to inform EIA.	The flight activity surveys commenced in September 2018, but they stopped after six months due to project being put on hold. The surveys recommenced in February 2020 and covered another 13 months; therefore the total period of flight activity surveys was 19 months. The level of recorded flight activity was low (similar to that recorded during the 2011/12 surveys).
06/03/2020	NatureScot agreed that that for this site, species of interest are generally detectable at longer distances and the proposed 3 km VP viewshed is therefore acceptable. However, it was recommended that Natural Power undertake distance detection analysis by looking at flights recorded plotted against distance at which they were first recorded.	Natural Power established that flight activity at the Proposed Development was too low in order to fit a detection curve to the data and thereby estimate a correction factor. Consequently, Distance Sampling was regarded unsuitable in this case. NatureScot agreed with this conclusion (in a letter dated 1 July 2020).
11/05/2021	NatureScot confirmed that only one year of (flight activity) survey was required and that the scope of work outlined during previous consultations was appropriate, and the relevant survey guidance met. NatureScot noted that Natural Power proposed to repeat other bird surveys in 2021.	The baseline surveys, including breeding birds, raptors, and black grouse surveys, were undertaken in 2020, but they also continued in the breeding season 2021. However, as the 2021 surveys covered the previously unsurveyed area (Access Track Study Area), they still constitute one year of baseline surveys.

8.4.2 The ‘Sclenteuch Wind Farm Scoping Report’ was submitted to the Scottish Government’s Energy Consents Unit (ECU) in August 2021. The formal scoping

[6] SNH (2018) Assessing significance of impacts from onshore windfarms on birds outside designated areas. Scottish Natural Heritage, Inverness.
[7] SNH (2009) Monitoring the impact of onshore wind farms on birds (Guidance note). Scottish Natural Heritage, Edinburgh.
[8] SNH (2009) Guidance on methods for monitoring bird populations at onshore wind farms. Scottish Natural Heritage, Edinburgh.
[9] SNH (2018) Avoidance rates for the onshore SNH wind farm collision risk model. Scottish Natural Heritage, Battleby.
[10] SNH (2018) Assessing the cumulative impacts of onshore wind farms on birds: guidance. Scottish Natural Heritage, Inverness.
[11] SNH (2016) Assessing connectivity with Special Protection Areas (SPAs) (Guidance note: Version 3). Scottish Natural Heritage, Edinburgh.
[12] Ruddock, M. & Whitfield, D.P., (2007) A Review of Disturbance Distances in Selected Bird Species. A report from Natural Research (Projects) Ltd to Scottish Natural Heritage.
[13] Wilson, M.W., Austin, G.E., Gillings, S. & Wernham, C.V. (2015) Natural Heritage Zone bird population estimates. SWBSG commissioned report number 1504. Pp72. Available from www.swbsg.org
[14] Gilbert, G., Gibbons, D.W. & Evans, J. (1998) Bird Monitoring Methods. RSPB, Sandy.
[15] Brown, A. F. & Shepherd, K. B. (1993) A method for censusing upland breeding waders. Bird Study, 40: 189-195.
[16] Hardey, J., Crick, H., Wernham, C., Riley, H., Etheridge, B. & Thompson, D. (2013) Raptors: a field guide to survey and monitoring. 3rd Edition. The Stationery Office, Edinburgh.
[17] Scottish Renewables, Scottish Natural Heritage, Scottish Environment Protection Agency, Forestry Commission Scotland (2010) Good practice during windfarm construction.
[18] Stanbury, A., Eaton, M., Aebischer, N., Balmer, D., Brown, A., Douse, A., Lindley, P., McCulloch, N., Noble, D., and Win I. (2021) The status of our bird populations: the fifth Birds of Conservation Concern in the United Kingdom, Channel Islands and Isle of Man and second IUCN Red List assessment of extinction risk for Great Britain. British Birds 114: 723-747.
[19] Bright, J. A., Langston, R., Bullman, R., Evans, R., Gardner, S. and Pearce-Higgins, J. (2008) Map of bird sensitivities to wind farms in Scotland: a tool to aid planning and conservation. Biological Conservation 141: 2342-2356.

response issued from the ECU was received in November 2021. Those responses considered relevant to this chapter are summarised in Table 8.2.

Table 8.2. Consultee scoping responses relating to ornithology

Consultee	Issues raised and recommendations	Scoping response addressed
East Ayrshire Council	No comments	-
South Ayrshire Council	No comments	-
NatureScot	NatureScot agrees with the list of features and impacts proposed for the EIAR and with those that have been scoped out (subject to consideration of the detailed information provided in the EIAR).	Acknowledged.
	Bogton Loch SSSI (Site of Special Scientific Interest) lies within 5 km of the Proposed Development Area and is designated for its breeding bird assemblage. As passerine birds form the primary component of the objectives of designation, we are satisfied that the Proposed Development will not have any significant effect on the qualifying interest of the SSSI.	Acknowledged. Bogton Loch SSSI was scoped out of the EIAR.
RSPB	No comments	-
Crosshill, Straiton and Kirkmichael Community Council	Not in agreement that kestrel and buzzard be scoped out. In common with other windfarm applicants the risk to birds and especially raptors is underplayed.	The EIA focuses on target species as defined by NatureScot (see Section 8.5: Method of Assessment). Buzzard (no conservation designations) and kestrel (Amber listed in BoCC but no other conservation designations) were recorded during the baseline surveys as secondary species (Table A8.11 in Technical Appendix 8.1), hence, they were included in the EIA. Recording buzzard and kestrel as secondary species follows NatureScot guidance. This method of recording does not allow collision risk modelling to be undertaken. However, although potential collision risk for these species exists, given their abundance and wide distribution in Scotland, the effect of the Proposed Development on these species will be non-significant.

8.5 Methodology

Scope of Assessment

8.5.1 It is widely accepted that wind turbines present three main areas of potential risk to birds[3, 20].

1. Direct habitat loss resulting from the construction of a wind farm and associated infrastructure;
2. Displacement of birds from wind farms due to disturbance during the construction and operational phases; this may be temporary or permanent. Displacement can include barrier effects in which birds alter their migration flyways or local flight paths to avoid a wind farm; and
3. Death due to collision or interaction with rotating wind turbine blades, towers, overhead wires, guy lines and fencing. Collision risk depends on a range of factors related to bird species, numbers and behaviour, weather conditions, and topography, and the nature of the wind farm itself, but is generally considered to be of particular relevance for sites located in areas known to support raptors or large concentrations of wildfowl.

8.5.2 These issues are considered in this assessment (Section 8.7: Assessment of Potential Effects).

8.5.3 The potential key avian ecology issues relating to the Proposed Development were identified during scoping stage, and are as follows:

- The potential to adversely affect defined populations of bird species afforded the highest level of statutory protection via inclusion in Annex I of Directive 2009/147/EC on the Conservation of Wild Birds and/or Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). Such an effect may arise through habitat loss, disturbance or displacement, more directly through collisions with the wind turbines, or indirectly through cumulative impacts;
- The potential to adversely affect defined populations of breeding and/or non-breeding raptor species through wind turbine collision risk, habitat loss and/or displacement; and
- The potential to adversely affect defined populations of gull species through collisions with the wind turbines.

Target Species

8.5.4 NatureScot guidance**Error! Bookmark not defined.** is that assessment of the effects of wind farms on birds should, in most circumstances, be limited to those protected

[20] Drewitt, A.L. & Langston, R.H.W. (2006) Assessing the impacts of wind farms on birds. Ibis, 148: 29-42 (and references therein).

species and other species of conservation concern that, as a result of their flight patterns or response behaviour, are likely to be affected by or subject to significant and adverse impacts from wind farms. The guidance states that there are three overarching lists describing protected species and species of conservation concern:

1. Species listed in Annex I of the Council Directive 2009/147/EC on the Conservation of Wild Birds (Annex I species);
2. Species protected under Schedule 1 of the Wildlife & Countryside Act 1981 (as amended) (Schedule 1 species); and
3. Red-listed Birds of Conservation Concern as identified in BoCC (Red listed species).

8.5.5 In addition, consideration should be given to local biodiversity action plan species[21], SBL species and any other species for which a proposed development site hosts a particular concentration.

8.5.6 Within these lists, NatureScot recommends that the greatest attention should be paid to those species which as a result of their flight patterns or response behaviour, may be subject to impacts from wind farms (such as raptors) and any species that are not particularly manoeuvrable in flight (e.g. geese and swans). Such species are termed 'target species'.

8.5.7 In accordance with NatureScot guidance**Error! Bookmark not defined.** and site-specific requirements, surveys focused on the following target species:

- All raptors and owls listed in Annex I of the EC Birds Directive and/or Schedule 1 and 1A of the WCA 1981 (as amended);
- All species of wildfowl (with the exception of Canada goose and mallard);
- Black grouse;
- All gull species; and
- All wader species.

8.5.8 Secondary species are species which may also be sensitive to wind farm development, but which are of lesser conservation concern or lower sensitivity than target species. Some species may be classed as secondary at one site and target at another e.g. gulls at the Proposed Development were precautionarily classed as target species due to proximity of the Proposed Development to Loch Spallander Reservoir (which can attract large numbers of gulls in winter). At the Proposed Development the following species were classed as secondary:

- Mallard, Canada goose and grey heron;
- All other raptor species not classed as targets;
- Raven;
- Crossbill; and
- Any large aggregations of red-listed passerines.

Desk Study

8.5.9 A desk study was undertaken to collate public domain survey data, data not in the public domain from third-party bodies, and the outcome of consultations. The purpose of the desk study was to collate information on bird populations in and around the Proposed Development. This information, combined with baseline survey results, was utilised to put each target bird species into context in terms of its importance at the Proposed Development.

8.5.10 The ornithological baseline conditions of the Proposed Development were already described as part of the previous Keirs Hill Wind Farm application (refused consent in 2016). The baseline surveys for Keirs Hill Wind Farm (which covered a larger area than the Proposed Development) were conducted in 2010-12 and were summarised in the 2013 Keirs Hill Environmental Statement (ES). The ES concluded no significant effects on any IOFs. The main findings from the ES, although now outdated, were used to inform the survey programme for the Proposed Development.

8.5.11 Records of relevant ornithological data from within a 10 km radius of the Proposed Development were requested in January 2022 from the following organisations:

- South Strathclyde Raptor Study Group (SSRSG);
- Royal Society for Protection of Birds (RSPB); and
- South-West Scotland Environmental Information Centre (SWSEIC).

8.5.12 Searches for species data were limited to data from within the past 10 years (2011-2021).

8.5.13 A search was made for all sites with an international and national authority designation for ornithological interests. This included SPAs, Ramsar sites and Sites of Special Scientific Interest (SSSIs) within a 10 km radius of the Proposed Development. In addition, for all SPAs, Ramsar sites and SSSIs that have geese or gulls listed as a qualifying feature, the search area was extended to 25 km due to

[21] Ayrshire BAP is outdated (2007-2010). A new local BAP is for North Ayrshire (2019-2031) and it does not cover the Proposed Development (there is no BAP for South Ayrshire where the Proposed Development lies). Priority species listed in both BAPs include five passerine species and grey partridge, i.e. species not considered as target species in context of this EcIA.

larger foraging distances for these species. The following sources were accessed to obtain information on designated sites:

- Joint Nature Conservation Committee (JNCC)[22]; and
- NatureScot Sitelink website[23].

Ornithological Survey Programme

8.5.14 Ornithological fieldwork commenced in September 2019 and was completed in July 2021. All surveys followed good practice methods and NatureScot guidance available at the time (see paragraph 8.3.2).

8.5.15 A summary of each of the baseline ornithology survey methods is given below. Further survey method details, along with dates of survey visits and analysis methods are given in Technical Appendix 8.1. Full survey details including survey timings and weather conditions can be provided on request.

Flight activity Vantage Point (VP) Surveys

8.5.16 The flight activity survey focuses on identifying flight lines and flight heights of target species, such as wildfowl and raptors, and allows any regular patterns of flight lines to be identified, allowing wind turbine locations to be designed to minimise collision risk to birds. The data generated can also be used to estimate the theoretical collision risk of a particular species.

8.5.17 VP surveys were undertaken during:

- Non-breeding season 2018/19 (September 2018 – February 2019);
- Breeding season 2020 (February – August 2020); and
- Non-breeding season 2020/21 (September 2020 – February 2021).

8.5.18 This accounted for 19 months of baseline monitoring.

8.5.19 The VP locations were carefully selected to obtain maximum visibility based on viewshed analysis and a ground-truthing visit prior to surveys commencing. In the non-breeding season 2018/19 two VP locations were used to carry out the VP surveys covering the Proposed Development from the south (VP1) and from the north-east (VP2) (Figure 8.2). The viewshed for both VPs was extended to 3 km following consultation with NatureScot.

8.5.20 In 2020 and 2021 the VP surveys covered the Proposed Development and were conducted from a single location (VP1) with a 3 km viewshed (this was agreed with NatureScot).

8.5.21 Following NatureScot guidance**Error! Bookmark not defined.** a minimum of 36 hours of survey effort was undertaken at each VP during the breeding season and two non-breeding seasons. During goose migration periods and the core raptor breeding season, additional survey effort was undertaken (see Technical Appendix 8.1).

8.5.22 For every flight, the time and duration were recorded, and the altitude of the target bird(s) was recorded at the start of the observation and at 15 second intervals thereafter into one of four height bands: (1) <25 m, (2) 25-150 m, (3) 150-220 m, (4) >220 m. These height bands are further referred to as height band 1, 2, 3, and 4.

Breeding Bird Surveys

8.5.23 Breeding bird surveys were undertaken in 2020 and 2021, following standard NatureScot guidance**Error! Bookmark not defined.**. These surveys covered areas of open moorland ground: in 2020 within the Main Study Area, and in 2021 within the Access Track Study Area. Forested habitats were not covered (in line with NatureScot guidance**Error! Bookmark not defined.**).

8.5.24 Surveys were based upon the standard methodology for assessing upland wader populations, as described by Brown and Shepherd (1993)[15]. This methodology was used to map the distribution and estimate the abundance of breeding birds within the study areas. The latest NatureScot recommendation**Error! Bookmark not defined.** is that only waders, skuas, gulls, red grouse and some wildfowl species are targeted during upland breeding bird surveys and the recording of moorland passerine species is generally not required. This approach was followed, however for completeness passerine species were also recorded, but were only tallied within each km^2 on the Ordnance Survey (OS) map grid (or part thereof) and were not mapped.

8.5.25 Four survey visits were carried out between April and July, as recommended by Calladine *et al*. (2009)[24]. After the last survey visit, wader species and red grouse records from all visits were combined and analysed to estimate the location of breeding territories. Territories were identified using a cluster analysis method, as outlined in Bibby *et al*. (2000)[25].

Breeding Raptor Surveys

8.5.26 Breeding raptor surveys were undertaken in 2020 (within the Main Study Area) and in 2021 (within the Access Track Study Area). A combination of VP surveys and walkover surveys over suitable breeding habitat were undertaken. VP surveys were carried out with the aim of identifying courtship displays and territorial behaviour

[22] http://www.jncc.gov.uk (Accessed: 26 January 2022)
[23] https://sitelink.nature.scot/home (Accessed: 26 January 2022)
[24] Calladine, J., Garner, G., Wernham, C. & Thiel, A. (2009) The influence of survey frequency on population estimates of moorland breeding birds. Bird Study, 56, 381-388.
[25] Bibby, C. J., Burgess, N. D., Hill, D. A. & Mustoe, S. (2000) Bird Census Techniques. Second Edition. Academic Press, London.

and walkover surveys were to check for signs of breeding raptors and, where relevant, to locate nest sites. All surveys followed the methods described in Hardey *et al.* (2013)[16] and were carried out under a Schedule 1 Licence by suitably experienced surveyors.

Black Grouse Surveys

8.5.27 Surveys for lekking black grouse were carried out covering suitable habitats within the Main Study Area (2020) and Access Track Study Area (2021), following the 'National Black Grouse Survey Instructions'[26] summarised in Gilbert *et al.* (1998)[14]. Areas of suitable lekking habitat were identified during the first visit in March. Once identified, these areas were visited on two further occasions (in April and May), around the hours of dawn, to identify whether lekking males were present.

Survey limitations

Changes to the Proposed Development

8.5.28 A portion of the Proposed Development Area was subject to a previous application by the Applicant in 2013. It was for 17 wind turbines each up to 149 m to blade tip. Following the scoping responses and further assessments, the 9-wind turbine layout with a tip height of approximately 200 m was submitted for scoping in August 2021.

8.5.29 During the subsequent refinement stage (January 2022) some wind turbines were micro-sited, which resulted in study areas not covering a full buffer around wind turbines 5-9. This could have potentially affected the breeding bird survey results owing to small survey buffer required for this type of survey (500 m). However, the area around wind turbines 5-9 that was not surveyed falls mostly within the forested habitat where breeding bird surveys are not required (in line with NatureScot guidance**Error! Bookmark not defined.**).

Access restrictions

8.5.30 Due to land ownership restrictions, it was not possible for surveyors to access survey buffers out with the Proposed Development Area. As such, not all parts of the recommended buffers of infrastructure for raptors and black grouse were accessed by surveyors. However, in order to provide as much survey coverage as possible to these areas, surveyors used public roads where available, and scanned the buffer from the edge of the Proposed Development Area, or from suitable vantage points within in, using binoculars. In this way data could be collected on the presence of, for example, displaying raptors and lekking black grouse, in areas beyond those that were physically accessible to surveyors. This survey limitation is not regarded to significantly affect the level of baseline information collected (due to scarcity of target species present during the surveys), however it is acknowledged that some forested areas to the west of the Proposed Development that may suitable for breeding goshawk were not checked for nests.

Collision Risk Modelling

8.5.31 Collision risk modelling (CRM) is used at proposed wind farm developments to predict the number of individuals of target bird species that might collide with the wind turbine rotors. A recognised method for doing this is the Band *et al.* (2007)[4] collision risk model, recommended by NatureScot[5], and this approach was followed in this assessment.

8.5.32 Where there was sufficient flight activity within the Collision Risk Zone (CRZ) at Potential Collision Height (PCH), CRM was used to predict the number of individuals per target species that might collide with the wind turbine rotors. The CRZ is defined as a 275 m buffer of the proposed wind turbine locations, representing half the rotor diameter of the wind turbines to be used at the Proposed Development plus a 200 m precautionary buffer zone.

8.5.33 It is proposed that two different heights of wind turbines be used at the Proposed Development, which shall result in rotor swept heights of 30 m (for the 180 m tip height wind turbines) and 50 m (for the 200 m tip height wind turbines). Since the height within which the proposed wind turbine blades will rotate, falls within height bands 2 and 3 (covering 25 m – 220 m above ground level (AGL)), only flights within these height bands were considered a potential collision risk. A precautionary approach was taken in which it was assumed that all bird activity recorded within the 25 m – 220 m height range covered by the height bands, shall be at rotor-swept height, although in reality some flights may have been below or above this range.

8.5.34 In the interests of proportionality, species rarely present, for which significant collision impacts due to the Proposed Development are highly unlikely, were excluded. Sufficient flight activity to qualify for CRM was defined as ≥ 3 flights or ≥ 10 individuals at PCH in the CRZ over either the breeding or non-breeding seasons. At the Proposed Development, two target species fulfilled this criterion: goshawk and great black-backed gull.

[26] Etheridge, B. & Baines, D. (1995) Instructions for the Black Grouse Survey 1995/6. Unpublished document, RSPB/GCT/JNCC/SNH, Edinburgh.

8.5.35 Goshawk is expected to spend time utilising the airspace at the Proposed Development Area ('non-directional flight'), whereas great black-backed gull is typically considered a commuting species which will likely pass directly through a site ('directional flight').

8.5.36 For species exhibiting 'non-directional flight' behaviour, the observed time spent flying within the CRZ at PCH is calculated and extrapolated up to predict the number of transits through the rotor-swept volume per season.

8.5.37 For species exhibiting 'directional flight' behaviour, the number of observed passages through a site are extrapolated up to predict the total number of expected passages within a season. A species-specific two-dimensional risk window is constructed based on the mean direction of passage through a site and used to predict the number of passages through the rotor-swept area in each season.

8.5.38 These methodologies were used to predict collisions during the breeding season based on one year of breeding season data (March to August 2020 inclusive, plus an additional survey on 27 February 2020) and two years of non-breeding season data (September 2018 to February 2019, and September 2020 to February 2021 inclusive). Only data from VP1 were used for CRM, as VP2 was used only during one season (non-breeding 2018/19) and it didn't provide any flight information within the CRZ.

8.5.39 The CRM runs as a two-stage process. Firstly, the risk is calculated based on assumption that flight patterns are unaffected by the presence of the wind turbines, i.e. that no avoidance action is taken. This probability is then multiplied by the estimated numbers of bird movements through the wind farm rotors at risk height in order to estimate the theoretical numbers at risk of collision if they take no avoiding action. The second stage incorporates the probability that the birds, rather than flying heedlessly into the wind turbines, will actually take a degree of avoiding action. NatureScot has recommended using species-specific avoidance rates[9], where available; or using a precautionary value of 98 %, as a general default avoidance rate, where species-specific values are not available. Therefore, a parameter representing avoidance behaviour is applied to the estimated collision mortality.

8.5.40 For each species, the risk of collision for an individual is calculated by estimating the likelihood of collision based on the characteristics of the birds and of the wind turbines. Wind farm specifications and bird characteristics used in the model are provided in Technical Appendix 8.1.

Approach to Impact Assessment

8.5.41 This section presents the approach taken to the EcIA within this chapter and provides an overview of how the potential for impact has been determined and the method by which the identified impact is considered to have a likely significant effect on the identified IOFs. The approach to the EcIA adopted within this assessment follows the CIEEM guidelines[2]. In line with these guidelines professional judgement has been applied where appropriate. The criteria used and the underlying rationale are described further within the following sections.

Sensitivity of Features

8.5.42 The assessment process involves identifying IOFs, in accordance with CIEEM guidelines[2]. Assigning a value level to ornithological features is undertaken with reference to the criteria defined in Table 8.3. It should be noted that these criteria are intended as a guide and are not definitive; professional judgement has also been applied in determining value level for ornithological features.

Table Error! No text of specified style in document**..3: Approach used to evaluate ornithological features by defined geographical context**

Level of value	Example of IOF
International	A regularly occurring species listed as a qualifying feature of an internationally designated site (e.g. SPA or Ramsar wetland site) within the ZoI of the development; and found in numbers that are crucial to the integrity of the designated site.
	Species populations present with sufficient conservation importance to meet criteria for SPA selection[27].
National	A regularly occurring species listed as a qualifying feature of a nationally designated site (e.g. SSSI) within the ZoI of the development.
	Species populations present with sufficient conservation importance to meet criteria for SSSI selection[28, 29, 30].
Regional	A species occurring within SPAs, Ramsar sites and SSSIs, but not crucial to the integrity of the site.
	Species populations present falling short of SSSI selection criteria but with sufficient conservation importance to likely meet criteria for selection as a local site e.g. important in the context of NatureScot Natural Heritage Zone populations.
Local	Species described above but which are present very infrequently or in very low numbers.
	Other species of conservation concern, including species included on the UK BoCC Red and Amber Lists[18].

[27] An area is used regularly by 1% or more of the Great Britain (or in Northern Ireland, the all-Ireland) population of a species listed in Annex I of the Birds Directive (79/409/EEC as amended) in any season; an area is used regularly by 1% or more of the biogeographical population of a regularly occurring migratory species (other than those listed in Annex I) in any season; an area is used regularly by over 20,000 waterfowl (waterfowl as defined by the Ramsar Convention) or 20,000 seabirds in any season.

[28] Drewitt, A.L., Whitehead, S. and Cohen, S. (2020) Guidelines for the Selection of Biological SSSIs. Part 2: Detailed Guidelines for Habitats and Species Groups. Chapter 17 Birds (version 1.1). Joint Nature Conservation Committee, Peterborough.

[29] Woodward, I., Aebischer, N., Burnell, D., Eaton, M., Frost, T., Hall, C., Stroud, D.A. & Noble, D. (2020) Population estimates of birds in Great Britain and the United Kingdom. British Birds 113: 69–104.

[30] Areas which regularly support 1% or more of the total British breeding population of any native species (as per Woodward *et al.*, 2020), including lekking and feeding areas and seabird colonies of over 10,000 breeding pairs; Areas which regularly support 1% or more of the total British non-breeding population of any native species in any season and non-breeding waterbird assemblages of over 20,000 individuals (as per Woodward *et al.*, 2020).

Negligible	All other species that are widespread and common and which are not present in locally important (or greater) numbers and which are considered to be of low conservation concern (e.g. UK BoCC Green List species[18]).

8.5.43 The assessment of ornithological features recorded during the baseline surveys also considers the importance of the Proposed Development Area for the species under consideration, rather than only considering the nature conservation importance of the species itself. As such, a species of international conservation importance may only have local or negligible importance in the context of the Proposed Development if very rarely recorded at the site.

8.5.44 Therefore, while the importance of the species is taken into account, in order to assess the nature conservation importance of the site, the number of individuals of that species using it and the nature and level of this use is also taken into account. An assessment is then made of the importance of the Proposed Development Area to the species in question, in order to determine whether they are an IOF.

8.5.45 In line with the principles of proportionate EIA, embedded mitigation is considered at the outset of the assessment. IOF status has only been assigned where there is still considered to be the potential for significant effects to the feature at the assigned value level arising from the Proposed Development, after the application of embedded measures.

Magnitude of Impact

8.5.46 Impacts on IOFs are judged in terms of magnitude and duration.

8.5.47 Magnitude refers to the size of an impact and is determined on a quantitative basis where possible, for example the predicted loss of individuals in the case of a population of a particular species of bird.

8.5.48 Impacts can be positive, negative or neutral.

8.5.49 In determining the magnitude of impact, the resilience of a population to recover from temporary adverse conditions is considered in respect of each potentially affected population.

8.5.50 The sensitivity of individual IOFs to disturbance during relevant behaviours is considered when determining spatial and temporal magnitude of change and is assessed using guidance described by Bright *et al*. (2008)[19], Hill *et al*. (1997)[31] and Whitfield (2007)[12]. Within this EcIA, magnitude is assessed within five levels, as detailed in Table 8.4 below.

Table 8.4: Spatial magnitude of negative impacts

Magnitude	Description
Very high	Total or near total loss of a bird population due to mortality or displacement. Total or near total loss of productivity on a bird population due to disturbance. Guide: >80 % of population lost or increase in additive mortality.
High	Major reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: 21-80 % of population lost or increase in additive mortality.
Medium	Partial reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: 1-5 % of population lost or increase in additive mortality.
Low	Small but discernible reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: 6-20 % of population lost or increase in additive mortality.
Negligible	Very slight reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Reduction barely discernible, approximating to the “no change” situation. Guide: <1 % of population lost or increase in additive mortality.

8.5.51 In the case of designated sites, spatial magnitude is assessed in respect of the area within the designated site boundary. For non-designated sites, spatial magnitude is assessed at an appropriate scale depending on the feature’s importance e.g. impacts on breeding bird populations are assessed in a regional context.

8.5.52 Effects and spatial magnitude are assessed within the appropriate bio-geographic regions as recommended in NatureScot guidance[6]. These are detailed below:

- The appropriate regional bio-geographic unit has been identified by NatureScot as Natural Heritage Zones (NHZ). NHZ classifications represent areas with a high level of bio-geographic coherence and are unrelated to administrative boundaries;
- The Proposed Development straddles the West Central Belt NHZ (NHZ 17) and Western Southern Uplands & Inner Solway NHZ (NHZ 19) and regional impacts are assessed within these areas as far as is practicable; and
- Effects on non-breeding bird populations are assessed in a national context.

8.5.53 Duration is defined as the time for which the impact is expected to last before recovery, i.e. return to pre-construction baseline conditions. The criteria used for describing duration in this EcIA is summarised in Table 8.5 below.

[31] Hill, David & Hockin, David & Price, David & Tucker, Graham & Morris, Rob & Treweek, Jo. (1997) Bird Disturbance: Improving the quality and utility of disturbance research. The Journal of Applied Ecology. 34. 275.

Table 8.5: Temporal magnitude of impact

Magnitude	Description
Permanent	Effects continuing indefinitely beyond the span of one human generation (taken as approximately 30+ years), except where there is likely to be substantial improvement after this period (e.g. the replacement of mature trees by young trees which need > 30 years to reach maturity, or restoration of ground after removal of a development. Such exceptions are termed "very long-term effects").
Temporary	Long-term (15 - 30 years or longer; see above)
	Medium term (5 – 15 years)
	Short-term (up to 5 years)
	Negligible <12 months

8.5.54 Knowledge of how rapidly the population or performance of a species is likely to recover following loss or disturbance (e.g. by individuals being recruited from other populations elsewhere) is used to assess duration, where such information is available.

8.5.55 In addition, birds are assessed with consideration for their behavioural sensitivity and ability to recover from temporary negative conditions. Behavioural sensitivity is determined subjectively based on the species' ecology and behaviour, using the broad criteria set out in Table 8.6 below. The judgement takes account of information available on the responses of birds to various stimuli (e.g. predators, noise and disturbance by humans).

Table 8.6: Behavioural sensitivity of birds

Sensitivity	Definition
High	Species or populations occupying habitats remote from human activities, or that exhibit strong and long-lasting (guide: > 20 minutes) reactions to disturbance events.
Medium	Species or populations that appear to be warily tolerant of human activities, or that exhibit short-term reactions (guide: 5-20 minutes) to disturbance events.
Low	Species or populations occupying areas subject to frequent human activity and exhibiting mild and brief reaction (including flushing behaviour) to disturbance events.

8.5.56 It should be noted that behavioural sensitivity can differ between similar species and between different populations of the same species. Thus, the behavioural responses of birds are likely to vary with both the nature and context of the stimulus and the experience of the individual bird. Sensitivity also depends on the activity of the bird, for example, a species is likely to be less adaptable to disturbance whilst breeding than at other times. However, tolerance is likely to increase as breeding progresses. In addition, individual birds of the same species will differ in their tolerance depending on the level of human disturbance that they regularly experience in a particular area, and have become habituated to (e.g. individuals that live in an area with high levels of recreational activity and associated disturbance are likely to have a greater tolerance than those that occupy remote locations with little or no human disturbance).

Significance of Effect

8.5.57 Having followed the process of identifying an IOF, determining its sensitivity, and characterising potential impacts, as set out above, the significance of the effect is then determined. The CIEEM guidelines[2] use only two categories to classify effects: "significant" or "not significant". In this EIAR chapter, significance of effects is assessed following an assumption of the application of embedded mitigation measures (see Section 8.7: Assessment of Potential Effects).

8.5.58 The significance of an effect is determined by considering the importance of the feature, the magnitude of the impact and applying professional judgement as to whether the integrity of the feature will be affected. The assessment includes potential impacts on each IOF from all phases of the development, e.g. construction, operation and decommissioning, and considers direct, indirect, secondary and cumulative impacts and whether the impacts are short, medium, long-term, permanent, temporary, reversible, irreversible, positive and/or adverse. A finding of significance or non-significance is then made using this assessment.

8.5.59 Effects are more likely to be considered significant where the feature affected is of higher conservation importance or where the magnitude of the effect is high. Effects not considered to be significant would be those where the integrity of the feature is not threatened, effects on features of lower conservation importance, or where the magnitude of the effect is low.

8.5.60 With reference to CIEEM[2], paragraph 5.25 provides "A significant effect is simply an effect that is sufficiently important to require assessment and reporting so that the decision maker is adequately informed of the environmental consequences of permitting a project. A significant effect is a positive or negative ecological effect that should be given weight in judging whether to authorise a project".

8.5.61 Where likely effects on an IOF of the Proposed Development are assessed as significant, specific mitigation measures are identified following the recognised hierarchy of 'avoid, minimise, off-set' in order to 'avoid, reduce and/or compensate' for potentially significant effects.

8.5.62 The significance of residual effects on features after the effects of implementation of mitigation measures have been considered can then be determined, along with any monitoring requirements (in line with the recommendations outlined in NatureScot guidance[8]).

8.6 Baseline

Desk Study

Existing Records

8.6.1 Records of relevant ornithological data from within a 10 km radius of the Proposed Development were sought from SSRSG, RSPB and SWSEIC, however at the time of writing this Chapter, no response had been received from SSRSG and SWSEIC, and only RSPB returned any information. This data is summarised in Technical Appendix 8.1.

8.6.2 Baseline information collected for the Keirs Hill Wind Farm application was also used for context in this assessment. During VP surveys undertaken in 2011 and 2012 a total of 13 target species were recorded from locations covering the Keirs Hill Wind Farm site (Keirs Hill Wind Farm ES Table 8.6). Gulls were not recorded as targets during these surveys.

Table 8.7: Summary of target species flights recorded during all VPs at the previously proposed Keirs Hill Wind Farm during 2011 and 2012

Species	No. of flights	No. of individuals
Whooper swan	5	30
Pink-footed goose	2	152
Greylag goose	9	156
Teal	1	1
Goldeneye	1	1
Goosander	46	139
Hen harrier	4	4
Merlin	3	3
Peregrine	4	4
Oystercatcher	1	2
Golden plover	2	139
Curlew	45	61
Woodcock	1	1

8.6.3 During breeding bird surveys undertaken in 2011 and 2012 four species of waders were recorded: oystercatcher, snipe, curlew and common sandpiper – all in single numbers apart from curlew (up to six territories).

8.6.4 No evidence was recorded of any Annex I or Schedule 1 raptors breeding within the survey area in 2011, nor black grouse or black grouse leks were recorded in 2011 as part of the Keirs Hill Wind Farm baseline.

Designated Sites

8.6.5 One site of national importance designated for ornithological interests was identified within 3.2 km of the Proposed Development – Bogton Loch SSSI (Figure 8.3). It is designated for its breeding bird assemblage which includes song thrush, grasshopper warbler, spotted flycatcher, willow tit, reed bunting and, sporadically, a small colony of black-headed gulls. Passerine birds form the primary component of the objectives of designation and there will be no direct or indirect route for the Proposed Development to impact on these features. As no black-headed gulls were recorded during baseline surveys there is also considered to be no route to impact on the non-passerine species of the breeding assemblage. As such, Bogton Loch SSSI is not considered further in this assessment.

8.6.6 No SPAs which list geese and/or gulls as a qualifying interest were identified within 25 km.

Baseline Surveys

VP Surveys

8.6.7 The breeding season surveys during 2020 recorded flight lines from a total of seven target species. Table 8.8 summarises levels of flight activity for each species and the amount of that flight activity which was in the CRZ at PCH (i.e. potential for collisions). Great black-backed gull and goshawk were the most frequently recorded species at all heights (including risk height), with the former being recorded in the greatest numbers overall. The associated flight lines are shown in Figures 8.4a and 8.4b. In bold are species for which flight activity meets the required criteria for conducting CRM.

Table 8.8: Results of the breeding season flight activity surveys in 2020, including flights and individuals recorded in the CRZ at PCH.

Species	No. of flights (individuals)	No. of flights (individuals) at risk
Goshawk	12(13)	4(4)
Red kite	3(3)	-
Curlew	8(9)	1(2)
Great black-backed gull	14(17)	7(8)
Common gull	1(1)	-
Herring gull	2(3)	-

Lesser black-backed gull	1(1)	1(1)

8.6.8 A total of 13 target species were recorded during non-breeding season VP surveys between September 2018 to February 2019 (inclusive) and September 2020 to February 2021 (inclusive). Six of those species were also recorded during the breeding season. Table 8.9 summarises levels of flight activity for each species and the level of flight activity which was in the CRZ at PCH. In terms of total number of flights and flights/individuals at risk height, herring gull and goshawk were the most frequently recorded species, the former being recorded in greater numbers. The flight lines for the non-breeding season target species are shown in Figures 8.4a, b and e. In bold are species for which flight activity meets the required criteria for conducting CRM.

Table 8.9: Results of the non-breeding season flight activity surveys in 2018/19 and 2020/21, including flights and individuals recorded in the CRZ at PCH.

Species	No. Flights (individuals) 2018/19	No. Flights (individuals) at risk 2018/19	No. Flights (individuals) 2020/21	No. Flights (individuals) at risk 2020/21
Greylag goose	3(10)	-	-	-
Goosander	1(2)	-	-	-
Goshawk	6(6)	2(2)	1(1)	1(1)
Hen Harrier	4(4)	-	1(1)	-
Red kite	3(3)	-	1(1)	-
Golden plover	3(18)	-	-	-
Snipe	4(6)	-	1(1)	-
Common gull	2(9)	-	-	-
Great black-backed gull	3(5)	2(3)	4(7)	-
Herring gull	6(24)	-	-	-
Lesser black-backed gull	5(5)	-	-	-
Unidentified gull	7(28)	-	-	-
Unidentified large gull	2(2)	-	-	-
Barn owl	-	-	1(1)	-
Peregrine	2(2)	-	-	-

8.6.9 Incidental records of target species and records of secondary species recorded during VP surveys in 2018–2021 are summarised in Technical Appendix 8.1.

Breeding Bird Surveys

8.6.10 A total of 25 bird species were recorded during the breeding bird surveys 2020-2021 within the study areas, of which 18 were passerine species and five were species of no conservation concern and/or species of which no breeding was suspected. Detailed survey results are presented in Technical Appendix 8.1

8.6.11 Territory mapping analyses were conducted only for two target species (waders), and the results are shown in Table 8.10 and on Figure 8.5.

Table 8.10: Abundance estimates for species breeding at the Proposed Development recorded during breeding bird survey 2020 and 2021

Species	Estimated no. territories in the Main Study Area (2020)	Estimated no. territories within Access Track Study Area (2021)
Snipe	2	1
Oystercatcher	-	1

Breeding Raptor Surveys

8.6.12 Although target raptor species were recorded within the study areas in 2020 and 2021 there was no evidence of breeding having taken place. The results of these surveys are shown in Confidential Figure 8.6.

8.6.13 In 2020 the surveys covered the Main Study Area:

- a female hen harrier was observed hunting in March; with no further records of this species made later in the season;
- two flights of red kite were recorded in March, with no further records of this species made later in the season; and
- two pairs of goshawk were seen displaying in April, suggesting the possibility of two separate territories. A single unoccupied nest was located (however it was not confirmed whether it was used by goshawk), but there was no evidence of breeding recorded, and no further flight records of goshawk were made beyond April.

8.6.14 In 2021 the surveys covered the Access Track Study Area:

- a female goshawk was recorded in June.

Black Grouse Surveys

8.6.15 There were no black grouse recorded within the study areas during dedicated surveys in 2020 and 2021.

Collision Risk Modelling

8.6.16 Two target species fulfilled criterion for CRM: goshawk and great black-backed gull. The risk of collision for each species, calculated with avoidance factors of 95 %, 98 %, 99 %, 99.5 % and 99.8 %, are presented in Table 8.11. Shaded cells represent

avoidance rate recommended by NatureScot[9] for goshawk and by Furness, 2019[32] for great black-backed gull. Annual estimates are sums of breeding and non-breeding estimates.

Table 8.11: Estimated number of collisions during the breeding season (March to August) and the non-breeding seasons (September to February).

Species	Model type	Season	Estimated mortality assuming avoidance of:				
			95 %	98 %	99 %	99.5 %	99.8 %
Goshawk	Non-directional	Breeding	0.40	0.16	0.08	0.04	0.02
		Non-breeding	0.06	0.02	0.01	0.01	0.00
		Annual	0.46	0.18	0.09	0.05	0.02
Great black-backed gull	Commuting	Breeding	0.59	0.23	0.12	0.06	0.02
		Non-breeding	0.09	0.04	0.02	0.01	0.00
		Annual	0.68	0.27	0.14	0.07	0.02

Trends and Predicted Future Baseline

8.6.17 In the absence of the Proposed Development, it is assumed that the land use within the Proposed Development Area and the surrounding locale would remain the same for the foreseeable future. Current habitat use is rotational conifer plantation, pasture and areas of heavily drained wet heath, blanket bog and modified bog. There is evidence of considerable peat hagging in the small area of blanket bog on Keirs Hill. In the absence of the Proposed Development, drainage and peat hagging is likely to continue, leading to possible further modification impacts of drying and degradation of the bog habitat within the Proposed Development Area over the medium to long term.

8.6.18 The plantation forestry located to the west of the Proposed Development Area is also anticipated to remain unchanged in the short and medium term, at least; but in accordance with the rotational felling and replanting that is a part of this land management and which shall result in small-scale changes to the distribution of forest and forest-edge dwelling species.

8.6.19 It is more difficult to predict changes that may occur in the long-term, especially in the wake of climate change, which is thought to cause range shifts in some bird species[33]. Climate change may alter habitat types by impacting the composition and health of the plant communities present, thereby affecting the suitability of the Proposed Development Area for some of the bird species which currently occupy the site. Baseline surveys carried out for the Proposed Development represent a snapshot of the bird community at the time and cannot be extrapolated to predict future population trends in the event of climate change.

8.7 Assessment of Potential Effects

8.7.1 This section assesses the potential impacts and the significance of effect during construction, operation and decommissioning of the Proposed Development on IOFs. The Proposed Development has undergone several design iterations to minimise potential environmental impacts (see Chapter 3: Design Evolution and Alternatives, for further details). Consequently, ornithological constraints have been considered during the scheme evolution. Likely significant effects are assessed against the final design.

8.7.2 The main ways in which a wind farm may affect ornithological receptors are via:

- Habitat loss due to land-take;
- Disturbance and/or displacement; and
- Collision with wind turbines.

8.7.3 In addition to effects which are directly related to the development, there may be other effects which arise as a result of the combined impacts of multiple wind farms (or other developments) within the local or regional area. These cumulative impacts may also result in effects, which individually would not be significant, but may be more important and significant in the cumulative context.

8.7.4 Each of these potential effects is discussed in turn below for each stage of the development (construction, operation, and decommissioning).

Construction Effects

Habitat loss

8.7.5 Felling of trees and construction of wind turbine foundations, access tracks and other structures will lead to direct habitat loss and without adequate mitigation could also result in destruction or damage to nests, eggs and/or chicks. The effects of habitat loss will depend upon the extent of land-take and the type of habitat affected. Under the WCA 1981 (as amended) it is an offence to kill or injure any wild bird, or to damage or destroy nests and eggs; embedded mitigation measures will be

[32] Furness, R.W. (2019) Avoidance rates of herring gull, great black-backed gull and common gull for use in the assessment of terrestrial wind farms in Scotland. Scottish Natural Heritage Research Report No. 1019.

[33] Huntley, B., Green, R.E., Collingham, Y.C. and Willis, S.G. (2007) A Climatic Atlas of European Breeding Birds. Durham University, The RSPB and Lynx Editions, Barcelona.

put in place to prevent damage to or destruction of nests, as discussed below in this section.

Disturbance and displacement

8.7.6 The construction stage of wind farm developments can have potential impacts caused by associated noise and visual disturbance and if unmitigated could lead to the temporary displacement or disruption of breeding and foraging birds. The level of impact depends on the timing of potentially disturbing activities, the extent of displacement (both spatially and temporally), and the availability of suitable habitats in the surrounding area for displaced birds to occupy.

8.7.7 Potential impacts are likely to be greatest during the breeding season (predominantly between March and August, depending on the species under consideration); behavioural sensitivity to the impacts will vary between species.

8.7.8 Disturbance of birds due to construction activities of this type have not been sufficiently quantified and the available information is often contradictory. However, it is likely that construction impacts will be greater on species that are intolerant of noise and other sources of disturbance. Larger bird species, those higher up the food chain or those that feed in flocks in the open tend to be more vulnerable to disturbance than small birds living in structurally complex or closed habitats such as woodland[34].

8.7.9 The potential impacts associated with construction activities are only likely to occur for as long as the construction phase continues. They are thus short-term and can be readily mitigated by avoiding sensitive areas (through the implementation of appropriately defined buffer zones), and by timing construction activities to avoid periods where sensitive species are present (if and where possible) such as the breeding season. The exception to this would be if an adverse effect on the breeding success of an ornithological feature were such that the local population became threatened with extinction and replacement through recruitment or re-colonisation does not occur.

Operational Effects

Disturbance and displacement

8.7.10 The operation of wind turbines and associated human activities for maintenance purposes also has the potential to cause disturbance and displace birds from the Proposed Development Area. Disturbance impacts during the operational phase may be less than during the construction phase, as species may become habituated to wind turbines and disturbance due to human activities will be considerably reduced. The Proposed Development is planned to have a lifespan of 50 years.

8.7.11 Studies have shown that, in general, species are not disturbed beyond 500 m to 800 m from wind turbines[35, 36] and in some cases, birds do not appear to have been disturbed at all[37, 38, 39, 40]. However, this may depend on the sensitivity of the species in question. Specific disturbance impacts are discussed in the feature assessment below.

8.7.12 There is less consensus of opinion about disturbance impacts closer to wind farm infrastructure. Several studies have examined this in detail, and these are summarised below.

8.7.13 Pearce-Higgins *et al.* (2009)[36] found evidence of lower frequencies of occurrence of some species within the vicinity of wind turbines during the breeding season, with a significant reduction in frequency of occurrence, compared to control sites, in seven of the 12 species studied. The authors extrapolated these findings to predict a percentage reduction in breeding densities within 500 m of wind turbines and found that seven of the 12 species showed a significantly lower frequency of occurrence: buzzard, hen harrier, golden plover, snipe, curlew, meadow pipit and wheatear, while there was no significant effect of wind farm proximity on kestrel, red grouse, lapwing and stonechat distribution. A more recent study of displacement impacts of wind farms on 10 species of upland breeding birds, by the same lead author[41] found evidence for population declines in three of the studies species (red grouse, snipe and curlew) associated with wind farm construction, but little evidence for consistent post-construction population declines in any of the 10 species studied.

[34] Hill, D.A. Hockin, D. Price, D. Tucker, G. Morris, R. and Treweek, J. (1997) Bird Disturbance: Improving the Quality of Disturbance research. Journal of Applied Ecology 34, 275-288.

[35] Hötker, H., Thomsen, K.M. and Koster, H. (2006) The Impact of Renewable Energy Generation on Biodiversity with Reference to Birds and Bats – Facts, Gaps in our Knowledge, Areas for Further Research and Ornithological Criteria for the Expansion of Renewables. NABU Report, Germany.

[36] Pearce-Higgins, J.W., Stephen, L., Langston, R.H.W., Bainbridge, I.P. and Bullman, R. (2009) The Distribution of Breeding Birds Around Upland Wind Farms. Journal of Applied Ecology 46, 1323-1331.

[37] Devereux, C.L., Denny, M.J.H. and Whittingham, M.J. (2008) Minimal Effects of Wind Turbines on the Distribution of Wintering Farmland Birds. Journal of Applied Ecology 45, 1689–1694.

[38] Whitfield, D.P., Green, M. and Fielding, A.H. (2010) Are Breeding Eurasian Curlew Numenius Arquata Displaced by Wind Energy Developments? Natural Research Projects Ltd, Banchory, Scotland.

[39] Douglas, D.J.T., Bellamy, P.E. and Pearce-Higgins, J.W. (2011) Changes in the Abundance and Distribution of Upland Breeding Birds at an Operational Wind Farm. Bird Study 58, 37-43.

[40] Fielding, A.H. and Haworth, P.F. (2013) Farr Wind Farm: A Review of Displacement Disturbance on Golden Plover Arising from Operational Turbines 2005-2013. Haworth Conservation, Isle of Mull, Scotland.

[41] Pearce-Higgins, J.W., Stephen, L., Douse, A. and Langston, R. H. W. (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, 386–394.

8.7.14 In terms of non-breeding population densities, Hötker *et al*. (2006)[35] found a significant adverse displacement effect on geese (several species combined), golden plover and lapwing and a significantly positive effect on starling, although the distances involved were relatively small. In their study of the effects of wind turbines on the distribution of wintering farmland birds, Devereux *et al*. (2008)[37] found no effect on four species groups (seed-eaters, corvids, gamebirds and skylarks); with the only exception of pheasant.

8.7.15 Disturbance and displacement impacts associated with wind farm construction and operation appear to vary between species and sites and should be considered on a case-by-case basis.

8.7.16 Individual wind turbines, or a wind farm as a whole, may present a barrier to the movement of birds, restricting or displacing birds from much larger areas. The effect this would have on a population is subtle and difficult to predict with any degree of certainty. If birds regularly have to fly over or around obstacles or are forced into suboptimal habitats, this may result in reduced feeding efficiency and greater energy expenditure. By implication, this will reduce the efficiency with which they accumulate reserves, potentially affecting breeding success or survival.

Collision with wind turbines

8.7.17 Collision of a bird with wind turbine rotors or towers is almost certain to result in the death of the bird. In low density populations (e.g. raptors) this could have a more adverse effect on the local population than in higher density populations (e.g. skylark) because a higher proportion of the local population would be affected in a low-density population. The frequency and likelihood of a collision occurring depends on a number of factors. These include aspects of the size and behaviour of the bird (including their use of a development site), the nature of the surrounding environment, and the structure and layout of the wind turbines.

8.7.18 Collision risk is perceived to be higher for birds that spend much of the time in the air, such as foraging raptors and those that have regular flight paths between feeding and breeding/roosting grounds (e.g. geese). The risk of bird collisions at wind farms is greatest in areas where large concentrations of birds are present (such as on major migration routes), and in poor flying conditions, such as rain, fog, strong winds that affect birds' ability to control flight manoeuvres, or on dark nights when visibility is reduced[42, 20]. Birds may also be more susceptible if the wind farm is located in an area of high prey density.

8.7.19 It should be noted that operational disturbance and collision risk impacts are mutually exclusive in a spatial sense; i.e. a bird that avoids the wind farm area due to disturbance cannot be at risk of collision with the wind turbine rotors at the same time. However, they are not mutually exclusive in a temporal sense; e.g. a bird may initially avoid the wind farm but then habituate to it and therefore become at risk of collision.

Decommissioning Effects

8.7.20 The removal of wind turbines or other infrastructure may cause disturbance to birds breeding, foraging or roosting within the Proposed Development. The level of impact will depend on the bird species present at the time of decommissioning and cannot be reliably predicted at this stage. However, as decommissioning activities are of a similar type and intensity as construction activities, the assessment considers that the potential effects of decommissioning will be similar in nature to the potential effects of construction, with the exception that habitat is likely to be restored and displaced birds will be able to return to abandoned territories.

Embedded Mitigation

8.7.21 Embedded mitigation is built into the Proposed Development to minimise the potential for any negative effects associated with the Proposed Development, and to ensure compliance with the WCA (1981) as amended, as well as potentially providing positive effects in the longer term. Various measures are proposed for implementation to provide compliance with legislation, and to follow good practice guidance and consultation recommendations, with regard to breeding birds. Where experience of developing projects of this nature has shown that embedded mitigation is sufficient to prevent significant adverse impacts on IOFs, this has been built into the assessment in order to produce an EcIA which is proportionate to the risks posed by the Proposed Development. These embedded mitigation measures are outlined below.

Construction Phase

8.7.22 All relevant construction phase embedded mitigation measures, such as appointment of an Environmental Clerk of Works (ECoW), would be implemented through a Construction Environmental Management Plan (CEMP), which will be agreed with the local planning authorities in consultation with NatureScot and the Scottish Environmental Protection Agency (SEPA).

[42] Gove, B., Langston, R.H.W, McCluskie, A., Pullan, J.D. and Scrase, I. (2013) Windfarms and Birds: an Updated Analysis of the Effects of Wind Farms on Birds, and Best Practice Guidance on Integrated Planning and Impact Assessment. Report T-PVS/Inf. (2013) 15, by RSPB/BirdLife International to the Convention on the Conservation of European Wildlife and Natural Habitats. Bern Convention Bureau Meeting (and references therein)

Environmental Clerk of Works

8.7.23 In line with good practice, an independent ECoW will be appointed prior to the commencement of construction and will be present on-site during enabling works and throughout the construction period. They will be a suitably experienced individual, whose role will be to oversee that all works are carried out in accordance with environmental legislation and good practice, and with agreed construction phase management plans such as the CEMP.

8.7.24 Prior to the start of construction/the bird breeding season, contractors will be made aware of the ornithological sensitivities within the Proposed Development Area (particularly with regard to the potential presence of Schedule 1 breeding species). The ECoW will give regular Toolbox Talks to contractors regarding the status and locations of protected and sensitive species and habitats within the Proposed Development Area.

8.7.25 The ECoW will carry out pre-construction survey checks during the bird breeding season (March to August, inclusive), in advance of vegetation stripping, felling or excavation works, to check for the presence of any breeding birds. Any active nests found will be cordoned off to a suitable distance for the species concerned (in line with appropriate guidance) and construction operations delayed within the cordon until the young have fledged and/or the nest becomes vacant naturally. There will be a clear line of responsibility for establishing that these measures are adhered to. This will minimise the possibility of illegal damage, destruction or disturbance to occupied bird nests during the construction phase. Full details of the ECoW's role and responsibilities will be provided in the CEMP and secured through appropriate planning condition.

Legal Compliance Regarding Breeding Birds

8.7.26 Under the WCA (1981) as amended it is an offence, with only limited exceptions, to:

- Intentionally or recklessly take, interfere with, damage or destroy the nest of any wild bird whilst it is in use or being built (applies year-round for nests of birds included in Schedule 1A);
- Obstruct or prevent any wild bird from using its nest;
- Intentionally or recklessly take, interfere with or destroy the egg of any wild bird;
- Intentionally or recklessly disturb any wild bird listed on Schedule 1 while it is nest building, or at (or near) a nest containing eggs or young, or disturb the dependent young of such a bird;
- Intentionally or recklessly harass any wild bird included in Schedule 1A; or
- Knowingly cause or permit any of the above acts.

8.7.27 Good practice via timing of works and pre-construction surveys will be necessary to reduce the possibility of illegal damage, destruction or disturbance to occupied bird nests during the construction phase. Adherence to this will be overseen by the ECoW.

Operational phase

8.7.28 With the exception of the operation of the wind turbines and general maintenance of the wind turbines, there will be little on-site activity during the operational phase and therefore levels of disturbance will be considerably reduced relative to the construction period.

Decommissioning

8.7.29 Embedded mitigation of decommissioning activities will follow that proposed for the embedded mitigation of construction activities, including pre-decommissioning surveys and ecological supervision of activities.

Feature Assessment

8.7.30 In line with what was agreed with consultees through the scoping process, the following features and impacts were identified and selected for the EcIA (Table 8.12). Goshawk was one of the most frequently recorded species during VP surveys, and along with red kite, was the only target raptor species recorded at the Proposed Development Area in both the breeding and non-breeding season. Both of these species were included in the EcIA based on potential collision risk and disturbance. Gull species were precautionarily treated as target species owing to proximity of the Proposed Development to Loch Spallander Reservoir which can attract large numbers of gulls in winter. The risk of collision was the reason for including these species in the EcIA.

Table 8.12: Features and impacts to be assessed within the EcIA

Features	Impacts
Goshawk	Disturbance/displacement Collision
Red kite	Disturbance/displacement Collision
Great black-backed gull*	Collision
Herring gull*	Collision
Lesser black-backed gull*	Collision

*This feature was qualified for inclusion in the EIA Report on the proviso that sufficient flight information was recorded in the CRZ to conduct CRM

8.7.31 On the basis of the baseline survey results outlined in Section 8.6: Baseline, the ornithological features of relevance to the Proposed Development have been

assigned assessment values in Table 8.13 below. Based on this, they have been assessed as an IOF, or not, in the context of the Proposed Development. Regional population and Scottish context estimates are given in the context of NHZ 17 (West Central Belt) and NHZ 19 (Western Southern Uplands & Inner Solway).

Table 8.13: Determination of important ornithological features occurring within the Proposed Development

Features	Conservation designation	Geographical level of value	Population estimate[29, 13]	Scottish context[43] (unless referenced within)	Baseline	IOF	Rational
Goshawk	Sch 1.1	Regional	GB/UK: 620 pairs in the breeding season (minimum; underreporting considered likely). NHZ 17: <5 breeding pairs. NHZ 19: 31 breeding pairs.	Goshawk is a scarce breeding bird, mostly found in large coniferous forests where birds are least vulnerable to disturbance. Following historical population demise as a result of habitat loss and persecution, goshawk numbers and range are slowly expanding. The Scottish goshawk population was estimated at 130 pairs between 2000 and 2004; the most recent estimations (2019) are for 165 pairs, of which five occupied home ranges were found in Ayrshire[44].	Goshawk was recorded both in the breeding and non-breeding seasons (12 and seven records respectively). Predicted collision mortality for goshawk is 0.16 birds per breeding season and 0.02 birds per non-breeding season, which gives an annual estimate of 0.18 birds. There was no evidence of breeding within the study areas, although nesting was possible in the wider area.	Yes	This species is of regional value as a target species that is afforded special protection (Schedule 1), that is present in regionally important numbers but is not a qualifying feature of any statutory sites within 10 km of the Proposed Development. Although it was recorded infrequently during baseline surveys, it can be considered to be of importance in a regional context. Given its conservation status, small size of the regional population, predicted collision mortality at the Proposed Development and potential for disturbance goshawk is considered to be an IOF and is taken forward for a full EcIA.
Red kite	Sch 1.1, Ann I, SBL	Local	UK: 4,400 pairs in the breeding season. NHZ 17: 0 breeding pairs. NHZ 19: 83 breeding pairs.	Red kite is an uncommon resident breeding bird in Scotland, following successful reintroduction programmes. The populations remain small but are increasing, with most birds remaining close to their natal areas throughout the year. The sedentary Scottish population forms communal winter roosts at a variety of traditional sites from September to March. In 2019, the Scottish population was estimated at 273 pairs, however no breeding was reported from Ayrshire (or wider South Strathclyde).	Red kite was recorded both in the breeding and non-breeding seasons (three and four records respectively), however the low level of activity was insufficient to carry out CRM. There was no evidence of red kite breeding within the study areas.	No	This species is of local value as a target species that is afforded special protection (Schedule 1, Annex I, SBL species) and which is present in locally important numbers but is not a qualifying feature of any statutory sites within 10 km of the Proposed Development. Red kite was recorded infrequently and in low numbers during baseline surveys. Flight activity was low, with no flights recorded within the CRZ at PCH (hence CRM could not be undertaken). As such, collision risk for red kite is considered negligible. Furthermore, there was no evidence of red kite breeding within the study areas or wider environs. Therefore, displacement due to disturbance is not likely to occur during construction or operation of the Proposed Development. As such red kite is not considered to be an IOF.
Great black-backed gull	Amber	Local	UK breeding population: 15,000 breeding pairs. UK wintering population: 77,000 individuals NHZ 17: 243 breeding pairs. NHZ 19: 17 breeding pairs.	Great black-backed gull is a regular but scarce breeding species, which breeds mainly in the Outer and Inner Hebrides and the Northern Isles of Scotland. Smaller numbers breed along the east coast and inland both on rooftops in urban areas, and on islands in freshwater lochs. The breeding population in Scotland is estimated at 14,800 pairs. In	Great black-backed gull records only involved birds passing over in flight. Flights were recorded during the breeding season and non-breeding seasons (14 and seven records respectively, of which seven and two were recorded in the CRZ at PCH). CRM was conducted for this species	No	This species is of local value as a species of moderate conservation concern (Amber listed species) but is not a qualifying feature of any statutory sites within 25 km of the Proposed Development, and was recorded infrequently and in low numbers during baseline surveys. CRM predicted a low collision rate (0.07 birds annually, equating to 1 bird per 14.3 years) that is

[43] Forrester, R.W., Andrews, I.J., McInerny, C.J., Murray, R.D., McGowan, R.Y., Zonfrillo, B., Betts, M.W., Jardine, D.C. & Grundy D.S. (eds). (2007) The Birds of Scotland. The Scottish Ornithologists' Club, Aberlady.

[44] Challis, A., Eaton, M., Wilson, M.W., Holling, M., Stevenson, A. & Stirling-Aird, P. (2019) Scottish Raptor Monitoring Scheme Report 2018. BTO Scotland, Stirling.

				Ayrshire, inland breeding records are scarce and winter counts are of single individuals[45].	and is estimated to result in an annual collision risk estimate of 0.07 birds.		unlikely to be detectable against the background rate of adult mortality (7 % annually)[46]. Therefore, the impact of collision as a result of operation of the Proposed Development is going to be negligible. Great black-backed gulls were not observed feeding or roosting on or adjacent to the Proposed Development Area. Therefore, displacement of great black-backed gulls due to disturbance is not likely to occur during construction or operation of the Proposed Development, and there is no predicted effect on this species. As such this species is not considered to be an IOF.
Herring gull	Red	Local	UK breeding population: 130,000 breeding pairs. UK wintering population: 740,000 individuals NHZ 17: 2,928 breeding pairs. NHZ 19: 1,130 breeding pairs.	Herring gull is a common, but declining, resident breeding bird in Scotland. It is a colonial coastal breeder, in winter dispersing southwards. The availability of feeding opportunities on agricultural land and at landfill sites brings increasing numbers inland. The breeding population in Scotland is estimated at 72,130 pairs[47]. In Ayrshire, the local population is supported by birds breeding at Ailsa Craig SPA, situated in the outer part of the Firth of Clyde (131 pairs)[48].	Herring gull was recorded sporadically during baseline surveys, with two records in the breeding season 2020 (to the south of the Proposed Development) and six records (24 individuals) in the non-breeding season 2018/19 (to the east of the Proposed Development). The flight activity in the non-breeding season was concentrated along the River Doon Valley (outwith the wind turbine envelope). As no flights were recorded in the CRZ at PCH no CRM was carried out.	No	This species is of local value as a species of high conservation concern (Red listed species) but is not a qualifying feature of any statutory sites within 25 km of the Proposed Development, and was recorded infrequently and in low numbers during baseline surveys. Given negligible collision risk and no route to impact as a result of disturbance/displacement, herring gull is not considered to be an IOF.
Lesser black-backed gull	Amber	Local	UK breeding population: 110,000 breeding pairs. UK wintering population: 130,000 individuals NHZ 17: 7,681 breeding pairs. NHZ 19: 1,048 breeding pairs.	Lesser black-backed gull is a common and widespread summer visitor and breeding bird in Scotland. Most Scottish populations leave Scotland for their wintering grounds further south, in late summer and autumn significant flocks congregate at regular roost sites in Clyde and Ayrshire (some at Doonfoot and Spallander). The breeding population in Scotland is estimated at 25,057 pairs[47]. There are no recent inland breeding records from Ayrshire, with maximum counts (c. 400) at Doonfoot (coast) in August, and single counts of wintering adults[45].	Lesser black-backed gull was recorded sporadically during baseline surveys, with only one record in the breeding season 2020 (in the CRZ at PCH) and five individuals recorded in the non-breeding season 2018/19 (to the east and south of the Proposed Development, with no flights in the CRZ). No congregations of lesser black-backed gull or flight activity were observed in connection to Loch Spallander Reservoir which borders the Proposed Development Area to the north-west. Flight activity was too low to carry out CRM.	No	This species is of local value as a species of moderate conservation concern (Amber listed species) but is not a qualifying feature of any statutory sites within 25 km of the Proposed Development, and was recorded infrequently and in low numbers during baseline surveys. Given negligible collision risk and no route to impact as a result of disturbance/displacement, lesser black-backed gull is not considered to be an IOF.

* Key: Sch1.1 = Schedule 1 part 1 of the Wildlife & Countryside Act 1981 (as amended); Ann I = Annex I of the EC Birds Directive; SBL = Scottish Biodiversity List; Red = UK Birds of Conservation Concern (BoCC) Red-listed species; Amber = UK BoCC Amber-listed species

8.7.32 The only species considered to be an IOF in the context of the Proposed Development, and therefore considered further in this EcIA is goshawk. Impact assessment for goshawk is provided below.

[45] Dick, A., M. (ed.) (2015-2016) Ayrshire Bird Report. Scottish Ornithologist's Club Ayrshire Branch.

[46] Horswill, C. & Robinson R. A. (2015) Review of seabird demographic rates and density dependence. JNCC Report No. 552. Joint Nature Conservation Committee, Peterborough.

[47] JNCC. 2021. Seabird Population Trends and Causes of Change: 1986–2019 Report (https://jncc.gov.uk/our-work/smp-report-1986-2019). Joint Nature Conservation Committee, Peterborough. Updated 20 May 2021.

[48] Stroud, D.A., Bainbridge, I.P., Maddock, A., Anthony, S., Baker, H., Buxton, N., Chambers, D., Enlander, I., Hearn, R.D., Jennings, K.R, Mavor, R., Whitehead, S. & Wilson, J.D. - on behalf of the UK SPA & Ramsar Scientific Working Group (eds.) (2016) The status of UK SPAs in the 2000s: the Third Network Review. [c.1,108] pp. JNCC, Peterborough.

Goshawk

Introduction

8.7.33 Goshawk is a scarce breeding bird, mostly found in large coniferous forests where birds are least vulnerable to disturbance. Following historical population demise as a result of habitat loss and persecution, goshawk numbers and range are slowly expanding, although the species remains a scarce breeding bird in Scotland. Being a secretive species and remaining inconspicuous for much of the year, goshawk is notoriously difficult to monitor and likely under reported, thus any population estimates are probably highly conservative. The most recent RSG report states that in 2019 Scottish raptor workers located 165 occupied goshawk territories, of which five occupied home ranges were found in Ayrshire[44].

Baseline summary

8.7.34 During flight activity surveys there were six records in the non-breeding seasons 2018/19, 12 records in the breeding season 2020 and a single record in the non-breeding season 2020/21. In the non-breeding seasons the flight activity was evenly distributed across the study areas, with no dominant direction of travel; in the breeding season all flights were concentrated in the south-west part of the Proposed Development Area. Both sexes were recorded, with some display behaviour observed in March. During raptor surveys, a large stick nest was found within the Proposed Development Area in a conifer block on the edge of windblow. The nest was considered to be suitable for goshawk, however there was no evidence of its current use, and it could not be confirmed that this was a goshawk nest and not that of another large raptor, such as buzzard. A plucking post was found south of the Proposed Development Area, suggesting that this area is used for hunting by goshawk. Overall, no evidence of breeding within the study areas was found during baseline surveys, suggesting it is likely that goshawk breeds in the forestry to the west, outside of the Proposed Development Area.

Potential collision risk impacts

8.7.35 Four flights from the breeding season and three flights from the non-breeding seasons were used to calculate the collision risk for goshawk, producing seasonal estimates of 0.16 birds per breeding season and 0.02 birds per non-breeding season. The predicted collision mortality for goshawk is therefore 0.18 bird per year (or one bird every 5.55 years), representing 1.8 % of the total NHZ 17 population estimate (and also Ayrshire population), and 0.29 % of the total NHZ 19 population estimate.

8.7.36 Raptors are considered susceptible to collision with wind turbines due to their morphology (i.e. heavy wing loading) and foraging behaviour (i.e. focussing on distant prey)[49]. However, goshawk is a species which is generally at lower risk of collision than other raptors, due to their foraging behaviour being at low level and their tendency to stay mostly within woodland cover. In general, goshawks are likely to fly below rotor height when hunting within and adjacent to forestry. Goshawks are more likely to fly at PCH during their display period rather than when foraging for food. Soaring flights are more likely to take a bird into the CRZ, but such flights are likely to be most frequent in the vicinity of the nest. With no nesting confirmed within proximity to proposed wind turbine locations, collision risk is likely to be low.

8.7.37 It is expected that goshawks will show some avoidance of the wind turbine envelope once the Proposed Development has been constructed. Studies suggest that raptors are likely to decline in general abundance in a given area due to avoidance of the wind farm[50]. Such avoidance means that flight activity within the Proposed Development is likely to be lower after construction than during baseline conditions, and it follows that the likelihood of collision will also be lower than estimated by CRM.

8.7.38 The Proposed Development straddles two NHZs: 17 and 19, therefore when making assessment it is important to compare the population estimates from both areas. The breeding goshawk population in NHZ 17 (West Central Belt), which covers a lot of coastal and lowland areas, is low (five pairs) due to lack of suitable breeding habitat. The neighbouring NHZ 19 (Western Southern Uplands & Inner Solway) covers more forested areas (for example, Dumfries and Galloway), and therefore holds more breeding goshawk (31 pairs). Based on an adult survival rate of 0.83[51] and collision estimates calculated for the Proposed Development (0.18 birds per year), additional mortality associated with collisions would increase the annual mortality rate from 17 % to 18.8 % where the NHZ 17 population estimate is concerned, or from 17 % to 17.29 % where the NHZ 19 population estimate is concerned. In both cases the additional mortality due to collisions will be undetectable over the background mortality rates. The goshawk population appears to be expanding in range in Scotland[43], and as this species is BoCC Green-listed, the national and

[49] Kikuchi, R. (2008) Adverse impacts of wind power generation on collision behaviour of birds and anti-predator behaviour of squirrels. Journal for Nature Conservation 16: 44-55.

[50] Garvin, J. C., Jennelle, C. S., Drake, D. and Grodsky, S. M. (2011) Response of raptors to a windfarm. Journal of Applied Ecology, 48: 199-209.

[51] Robinson, R.A. (2005) BirdFacts: profiles of birds occurring in Britain & Ireland. BTO, Thetford (http://www.bto.org/birdfacts, accessed on 03 March 2022)

regional (NHZ 17 and NHZ 19) populations are likely to be in favourable conservation status. As such, the potential effect as a result of collision risk is considered to be of low negative magnitude and not significant for goshawk.

Potential disturbance/displacement impacts

8.7.39 Goshawks are particularly vulnerable to disturbance in the early part of the breeding season during the nest building and early incubation stages (mid-March to mid-May). Some pairs are prone to desert, particularly if they are first-time breeders or in years when prey availability is low[52, 12]. The type of disturbance most likely to affect goshawks is when a sudden change occurs in the nesting environment, such as commencement of harvesting operations or a sudden increase in traffic volume[52]. Thus, there is potential for breeding birds to be disturbed, particularly during construction activities. However, goshawks can become conditioned to some types of regular disturbance, such as road traffic, if the disturbance is present from the start of nesting[52]. Evidence suggests that goshawks can be disturbed up to a distance of 500 m[53], and should breeding goshawk be found within these disturbance distances during the construction phase, embedded mitigation measures will be implemented to prevent or minimise any disturbance to breeding goshawks. This will include pre-construction nest monitoring for breeding activity, implementing and maintaining an appropriate exclusion zone around any active nests, as well as monitoring for disturbance and controlling construction traffic. It is considered unlikely that goshawks will be disturbed by wind turbine operation, although some operational wind farm activities (e.g. track maintenance, cable repairs, etc.) have the potential to disturb breeding goshawks.

8.7.40 No nesting was confirmed within the Proposed Development Area, however given large forestry stands are present within the wider environs to the west and south-east, goshawk is likely to be breeding in some proximity to the Proposed Development Area. The home range of goshawk is variable depending on prey and woodland habitat availability, in areas of coniferous woodland in Scotland nests are found in stands of trees between 2.4–3.8 km apart[54]. The occasional goshawk records within the Main Study Area may suggest that goshawk breeds within such a distance from the Proposed Development. With extensive alternative breeding habitat present in the immediate area of the Proposed Development, any potential effects on goshawk as a result of the Proposed Development are considered negligible (habitat suitability for goshawk within commercial conifer plantations is subject to constant change due to the nature of rotational harvesting). Therefore, construction phase disturbance/displacement effect on this species is predicted to be of no more than short-term, negligible and not significant.

8.7.41 No disturbance or displacement impacts are predicted for goshawk during the operation phase of the Proposed Development.

8.8 Mitigation and Residual Effects

8.8.1 The Proposed Development is predicted to have low or negligible, and therefore not significant effect, on the IOF recorded. Although no species-specific mitigation is required, various embedded measures (described in Section 8.7) will be implemented to ensure compliance with legislation, and to follow good practice guidance with regard to breeding birds. No requirements for further mitigation were identified.

8.8.2 No significant effects on any ornithological features during any phase of the Proposed Development life cycle are predicted.

8.9 Assessment of Cumulative Effects

8.9.1 Following NatureScot guidance[10], the predicted cumulative effects on IOFs from the Proposed Development along with all other plans or projects should be assessed within an appropriate ZoI and against the relevant NHZ population estimates.

8.9.2 In line with this guidance, any wind farm developments of fewer than three wind turbines (small scale wind energy proposals[55]) were excluded from the cumulative impact assessment (CIA), due to the problems associated with finding appropriate data for developments of this size. Only IOFs for which a greater than negligible residual impact is predicted are considered in the CIA, as negligible impacts will not result in a detectable increase in cumulative impacts. All existing, consented and submitted developments (including wind farm developments of three or more wind turbines) within 10 km of the Proposed Development, were considered as part of the assessment of cumulative impacts.

8.9.3 Within this search area, the following wind farm development sites were identified:

- Dersalloch Wind Farm (operational) – 23 wind turbines, immediately adjacent to the south of the Proposed Development;

[52] Petty, S.J. (1996) Reducing disturbance to goshawks during the breeding season. Forestry Commission Research Information Note 267.

[53] Whitfield, D.P., Ruddock, M. & Bullman, R. (2008) Expert opinion as a tool for quantifying bird tolerance to human disturbance. Biological Conservation 141, 2708-2717.

[54] Rutz, C.; Bijlsma, R. G.; Marquiss, M.; Kenward, R. E.. 2006 Population limitation in the Northern Goshawk in Europe: A review with case studies. In: Morrison, M. L., (ed.) The Northern Goshawk: a technical assessment of its status, ecology and management. Cooper Ornithological Society, 158-197. (Studies in Avian Biology, 31).

[55] SNH (2016) Assessing the impact of small-scale wind energy proposals on the natural heritage (Guidance note). Scottish Natural Heritage.

- South Kyle Wind Farm (construction) – 50 wind turbines, 9 km west of the Proposed Development;
- Polquhairn Wind Farm (consented) – 9 wind turbines, 6 km north of the Proposed Development;
- Carrick Wind Farm (application) – 13 wind turbines, 9 km south of the Proposed Development;
- Craiginmoddie Wind Farm (application) – 14 wind turbines, 9 km south west of the Proposed Development;
- North Kyle Wind Farm (application) – 54 wind turbines, 6 km east of the Proposed Development;
- Knockcronal Wind Farm (application) – 12 wind turbines, 4 km south of the Proposed Development.
- Knockkippen Wind Farm (scoping) – 12 wind turbines, 3 km north west of the Proposed Development; and

8.9.4 It should be noted that cumulative assessments may be complicated by availability of EIAR/ES chapters and Appraisals for consented developments and, where this information is available, survey periods and methods may differ between sites. Furthermore, some wind farms may have been in existence for many years, and thus contemporary data may not be available.

8.9.5 Therefore, information for informing the CIA was available from four wind farm developments with submitted applications (Carrick, Craiginmoddie, Knockcronal and North Kyle), one consented wind farm (Polquhairn), one wind farm under construction (South Kyle) and one operational wind farm (Dersalloch). One development at the scoping stage (Knockkippen) has not been included as impacts have not yet been assessed and the project have yet to go through planning.

8.9.6 The cumulative effects resulting from collision impacts were assessed for goshawk (Table 8.14). As no breeding goshawk were recorded at the Proposed Development during baseline surveys, no disturbance/displacement impacts could be predicted, hence these impacts were not included in the CIA.

8.9.7 No significant cumulative collision effects were concluded.

Table 8.14: Summary of the potential cumulative impacts of wind energy developments within 10 km of the Proposed Development on goshawk

Site	No. Wind turbines	Baseline surveys	Impact assessment on goshawk (collision)
Sclenteuch (Proposed Development)	9	2018-2020	CRM predicted an annual collision rate of 0.18 birds and concluded low, and non-significant effect
Dersalloch	23	2003-2006	Goshawk was not recorded during baseline surveys, therefore was not considered an IOF
South Kyle	50	2009-2012	CRM predicted an annual collision rate of 0.01 birds and concluded low, and non-significant effect
Polquhairn	9	2012-2013	Goshawk was not recorded during baseline surveys, therefore was not considered an IOF
Carrick	13	2018-2020	CRM predicted an annual collision rate of 0.004 birds and concluded negligible, and non-significant effect
Craiginmoddie	14	2018-2019	Goshawk was not recorded during baseline surveys, therefore was not considered an IOF
North Kyle	54	2016-2018	CRM predicted an annual collision rate of 0.1055 birds and concluded minor, and non-significant effect
Knockcronal	12	2019-2020	Goshawk flight activity was too low (two flights at risk height) to undertake CRM
mulative Impact	184	-	CRM was undertaken for three sites in addition to the Proposed Development; giving an estimate of 0.2995 collisions per year across all sites (which would represent, 2.99% of the NHZ 17 total of breeding birds and 0.48% of the NHZ 19 total of breeding birds). This would increase the estimated annual mortality rate from 17% to 19.99% where the NHZ 17 population estimate is concerned, and from 17% to 17.48% where the NHZ 19 population estimate is concerned. However, the NHZ population estimates are likely to be an underestimation of current goshawk breeding populations (especially for NHZ 19), as the 2019 Scottish Raptor Monitoring Scheme annual reports[44] indicate that the Scottish breeding goshawk population is increasing with 165 estimated breeding pairs in 2017[56], which is an increase on the 136 breeding pairs estimated by Wilson *et al.* (2015[13]) for the NHZ Bird Population Estimates Report. Based on these estimations, it is predicted that cumulative collision impacts will be low at the regional population level, therefore not significant cumulative effect is concluded.

8.10 Summary

8.10.1 As there is no mitigation required, the level of significance and therefore residual effects are unchanged for the IOF recorded.

8.10.2 The magnitude of pre-mitigation effects and the magnitude and significance of residual effects on the IOF during the construction and operation phases is detailed

[56] Year the estimate relates to.

in Table 8.15 below. As the Proposed Development is not predicted to have a significant effect on the IOF recorded, embedded mitigation will ensure compliance with legislation and good practice guidance.

Table 8.15: Summary of potential effects and residual effects on the IOF recorded, and significance of effects

Description of effect	Potential effect		Mitigation measure	Residual effect	
	Magnitude	Significance		Magnitude	Significance
During construction: Displacement/disturbance					
Goshawk	Negligible (negative)	Not significant	None required	Negligible (negative)	Not significant
During operation: Collision risk					
Goshawk	Low (negative)	Not significant	None required	Low (negative)	Not significant
During operation: Displacement/disturbance					
Goshawk	No impact	-	-	-	-
Cumulative Effects					
Goshawk	No significant cumulative effect is predicted				

9 Geology, Hydrology and Hydrogeology

9.1 Statement of Competence

9.1.1 The geology, hydrology and hydrogeology assessment was undertaken by SLR Consulting Limited under the supervision and direction of Technical Directors, Gordon Robb and Colin Duncan.

9.1.2 Gordon Robb (BSc, MSc, MBA, C.WEM, FCIWEM) has over thirty years' experience assessing renewable energy and electrical infrastructure projects and specifically their potential effects on soils, geology and the water environment.

9.1.3 He is based in Scotland and has worked throughout Scotland, including sites in similar settings to the Proposed Development. He has also prepared and given expert witness evidence relating to wind and electrical infrastructure projects. Prior to completing this assessment he has visited the Proposed Development Area and the surrounding area.

9.1.4 Colin Duncan (BSc, MSc) has over thirty years' experience in environmental consulting and geology. He too is based in Scotland and specialises in engineering geological assessments in the renewables and electrical transmission sector. He has much experience, in infrastructure design, geological assessment, borrow pit assessments, mining related studies, peat slide risk assessments, and the preparation of peat management plans. He also has planning hearing experience on matters relating to peat, geology and coal mining.

9.2 Introduction

9.2.1 This chapter assesses the impacts of the Proposed Development on geology (including peat and soils) and the water environment (hydrology and hydrogeology). The assessment of impacts has been made on the basis of the proposed turbine and infrastructure layout as fully described in Chapter 2 (Proposed Development/Project Description).

9.2.2 It considers the construction, operation, and decommissioning phases of the Proposed Development. The specific objectives of the chapter are to:

- describe the consultation undertaken;
- describe the assessment methodology and significance criteria used in completing the impact assessment;
- characterise the current baseline conditions and how these may change in the future;
- describe the potential effects, including direct, indirect, and cumulative effects;
- describe the mitigation measures proposed to address the likely significant effects; and
- assess the residual effects remaining following the implementation of mitigation measures.

9.2.3 In addition, the assessment uses information and findings presented in Chapter 7 (Ecology Assessment) to inform the assessment of likely effects on possible areas of Groundwater Dependent Terrestrial Ecosystems (GWDTE) which are presented in this chapter.

9.2.4 The chapter is supported by:

- Technical Appendix 9.1: Peat Landslide Hazard and Risk Assessment (PLHRA);
- Technical Appendix 9.2: Peat Management Plan (PMP);
- Technical Appendix 9.3: Coal Mining Risk Assessment (CMRA); and
- Technical Appendix 9.4: Schedule of Watercourse Crossings.

9.3 Legislation, Policy and Guidance

9.3.1 Relevant legislation and guidance documents have been reviewed and considered as part of this assessment.

Legislation

9.3.2 Of particular relevance are:

- The Water Environment (Controlled Activities) (Scotland) Amendment Regulations, 2013 (CAR);
- EU Water Framework Directive (2000/60/EC);
- EU Drinking Water Directive (98/83/EC);
- The Environment Act 1995;
- Environmental Protection Act 1990;
- The Water Supply (Water Quality) (Scotland) Regulations, 2001;
- The Flood Risk Management (Scotland) Act 2009;

- Water Environment and Water Services (Scotland) Act 2003 (WEWS Act);
- Private Water Supplies (Scotland) Regulations 2006; and
- The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017.

Planning Policy

9.3.3 In addition to Scottish Planning Policy (SPP) published by The Scottish Government (June 2020), East Ayrshire Council (EAC) (Local Development Plan, 2017) and South Ayrshire Council (SAC) (Local Development Plan, 2014) provides planning guidance on the type and location of development that can take place in the region. See Chapter 4 (Approach to EIA/Climate Change, Legislative and Policy Context) for details.

Guidance

9.3.4 Planning Advice Notes (PANs), published by the Scottish Government, including:

- PAN 50 Controlling the Environmental Effects of Surface Mineral Workings;
- PAN 61 Planning and Sustainable Urban Drainage Systems; and
- Online Planning Advice on Flood Risk (which supersedes PAN 69).

9.3.5 Scottish Environment Protection Agency (SEPA) Pollution Prevention Guidance Notes (PPG) and Guidance of Pollution Prevention (GPP):

- GPP01 Understanding your environmental responsibilities – good environmental practices;
- GPP02 Above Ground Oil Storage;
- PPG03 Use and Design of Oil Separators in Surface Water Drainage Systems;
- GPP05 Works and Maintenance in or near Water;
- PPG06 Working at Construction and Demolition Sites;
- PPG07 Safe Storage - The Safe Operation of Refuelling Facilities;
- GPP08 Safe Storage and Disposal of Used Oils;
- GPP13 Vehicle Washing and Cleaning;
- GPP21 Pollution Incident Response Planning; and
- GPP22 Dealing with Spills.

9.3.6 CIRIA publications:

- C532 Control of Water Pollution from Construction Sites (2001);
- C648 Control of Water Pollution from Linear Construction Projects – Technical Guidance (2006);
- C741 Environmental Good Practice on Site (2015); and
- C753 The SUDS Manual (2015).

9.3.7 SEPA publications:

- Engineering in the Water Environment: Good Practice Guide – River Crossings (2010);
- Engineering in the Water Environment: Good Practice Guide – Sediment Management (2010);
- Groundwater Protection Policy for Scotland, Version 3 (2009);
- Land Use Planning System SEPA Guidance Note 4, Version 9 (May 2017);
- Land Use Planning System SEPA Guidance Note 2, Version 8 (October 2010);
- Land Use Planning System SEPA Guidance Note 31, Version 3 (September 2014);
- Position Statement – Culverting of Watercourses, Version 2.0 (June 2015); and
- Regulatory Position Statement – Developments on Peat (9th February 2010).

9.3.8 Other guidance:

- DEFRA Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (2011);
- DEFRA Good Practice Guide for Handling Soils (MAFF 2000);
- Scottish Natural Heritage Constructed Tracks in Scottish Uplands, 2nd Edition (June 2013);
- Good Practice during Windfarm Construction, Version 4, a joint publication by Scottish Renewables, Scottish Natural Heritage, Scottish Environment Protection Agency, Forestry Commission Scotland, and Historic Environment Scotland (2019); and
- Scottish Renewables and SEPA - Developments on Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat, and the Minimisation of Waste (2012).

9.4 Consultation

9.4.1 The scope of the assessment has been determined through a combination of professional judgement, reference to the relevant guidance documents and consultation with stakeholders.

9.4.2 Consultation regarding the Proposed Development was undertaken with statutory and non-statutory bodies during 2021 and 2022 as set out in Chapter 4 (Approach to EIA/Climate Change, Legislative and Policy Context). The outcome of the relevant consultations with regards to the water environment and geology (including peat and soils) is summarised in Table 9.1.

9.4.3 In addition to the consultation undertaken in 2021 cognisance has been made of the consultation and determination responses made by consultees for the previous Keirs Hill Wind Farm application.

Table 9.1 – Consultation overview

Consultee	Summary of Key Issues	Where Addressed in Chapter
East Ayrshire Council	Scoping Opinion dated 30 September 2021 requested that the following is assessed: • Nature of the hydrology and hydrogeology of the Proposed Development and potential impacts on watercourses and water supplies including water quality, water quantity and aquatic flora and fauna. • Identify any private water supplies and consider the source, catchment, and receptor as well as the pathway and provide details of mitigation and/or contingency measures required. • Location, size, and nature of borrow pits to include depth of borrow pit floor and final reinstated profile. An appraisal as part of the overall impact should be included. • Potential for the release of water from peat excavation should be considered as a potential cause of flooding.	See Section 9.6 (Baseline Conditions) and Section 9.8 (Potential Effects). See Section 9.6 (Baseline Conditions) and Section 9.9 (Mitigation) See Schedule of Environmental Mitigation (Chapter 17). See Technical Appendices 9.1 (PLHRA) and 9.2 (PMP).
	Further Consultation dated 22 March 2022 regrading private water supplies which confirmed no records of private water supply sources within the Study Area in their Council boundary.	Noted.
	Further Consultation dated 7 April 2022 which confirmed no records of flooding with the Site Boundary. There are records of isolated flooding events downstream of the Site, notably within the Dryoch Burn and Lambdoughty Burn catchments.	Noted.
South Ayrshire Council	Scoping Opinion dated 8 October 2021 requested that the following is assessed: • Ensure there is a section dealing with private water supplies to include those outside the marked boundary but which take their supply from the catchment areas.	See Section 9.6 (Baseline Conditions).
	Further Consultation dated 28 March 2022 regrading private water supplies which confirmed that the elements of the Proposed Development are unlikely to be in hydraulic continuity with registered private water supply sources in their Council boundary.	Noted.
Ayrshire Rivers Trust	Scoping Opinion dated 8 October 2021 requested that the following is assessed: • Potential effects from site preparation, construction, and operational activities should be considered when looking at watercourse crossing installation/upgrading, obstruction to fish migration, road construction/upgrading, acidification of watercourses, rates of surface drainage run-off, hydrocarbon inputs, excess silt loading, dewatering and abstraction, and hydrological regime changes. • A full electrofishing survey to determine the impact of the Proposed Development on the ecology of the receptor watercourses.	See Section 9.8 (Potential Effects), Section 9.9 (Mitigation), Section 9.10 (Assessment of Residual Effects). See Chapter 7 (Ecology Assessment).
NatureScot	Scoping Opinion dated 30 September 2021, requested the following: • Potential impacts to carbon rich soils, deep peat, and priority peatland habitats. Appropriate surveys and mitigation to be demonstrated.	See Section 9.6 (Baseline Conditions) and Technical Appendix 9.2 (PMP).
SEPA	Scoping Opinion dated 29 September 2021, requested the following: • Map of all engineering activities in or impacting the water environment including proposed buffers, flood risk assessment, and related CAR applications. • Map and assessment of impacts upon GWDTE and buffers. • Map and assessment of impacts upon groundwater abstraction and buffers. • Peat depth survey and table detailing re-use proposals.	Figure 9.1 (Local Hydrology) and Section 9.6 (Baseline Conditions). Section 9.6 (Baseline Conditions) and Figure 9.5 (GWDTE). See Section 9.6 (Baseline Conditions) and Figure 9.1 – Local Hydrology). Technical Appendix 9.1 (PLHRA) and 9.2 (PMP). See Figure 9.1 (Local Hydrology). See Section 9.9 (Mitigation).

	• Map and site layout of borrow pits. • Schedule of mitigation including pollution prevention measures. • Borrow Pit Site Management Plan of pollution prevention measures. • Map of proposed surface water drainage layout. • Decommissioning plan	Section 9.9 (Mitigation). Section 9.9 (Mitigation). Technical Appendix 2.1: Outline Construction and Environmental Management Plan (CEMP)
Scottish Water	Their Scoping Opinion dated September 2021 confirmed no objection. A review of their records indicates that there are no drinking water catchments or water abstractions sources, which are designated as Drinking Water Protected Areas under the Water Framework Directive, in the area that may be affected by the proposed activity.	Noted.
Marine Scotland	General internal advice on onshore wind farms was provided from July 2020 in relation to freshwater and diadromous fish and fisheries. The following information is advised to be presented in the EIA report: • Site characteristics surveys of the watercourses for water quality and fish populations; • Site specific mitigation plans including a robust integrated water quality and fish population monitoring programme to be carried out before, during and after construction; and • Considers the potential cumulative impact on water quality and fish populations.	See Section 9.6 (Baseline Conditions) and Chapter 7 (Ecology Assessment). Section 9.9 (Mitigation) and Chapter 7 (Ecology Assessment). See Section 9.6 (Baseline Conditions) and Section 9.11 (Cumulative Assessment).

9.5 Methodology

Scope of Assessment

9.5.1 Scoping was undertaken in August 2021 with statutory and non-statutory bodies including SEPA, NatureScot, EAC and SAC. Further consultation has been undertaken in 2022. The outcome of the relevant consultations with regards to geology and the water environment is summarised in Table 9.1.

9.5.2 This assessment considers the effects of construction, operation, and decommissioning of the Proposed Development upon those receptors identified during the review of desk-based information and field surveys (the extents of the study areas are set out in Section 9.6.

Effects Scoped Into the Assessment

9.5.3 The following potential impacts are considered in full in this assessment:

- pollution risk, including potential impact on surface water and groundwater quality and public and private water supplies during construction, operation and decommissioning;
- erosion and sedimentation which could give rise to potential impact on surface water and groundwater quality, and private water supplies during construction, operation and decommissioning;
- fluvial flood risk resulting from changes to runoff volumes and rates and modifications to natural and man-made drainage patterns during operation;
- potential impact upon the linkage between groundwater and surface water during construction and operation;
- potential impact on areas of peat during construction and operation;
- potential impact on areas of GWDTE during construction and operation; and
- potential cumulative impact during construction and operation.

Effects Scoped out of the Assessment

9.5.4 Based on the desk based and survey work undertaken, policy, guidance and standards, the professional judgement of the EIA team, feedback from consultees and experience from other relevant projects, the following topic areas have been 'scoped out':

- potential effects on geology during both construction and operation as there are no protected geological features within the Proposed Development Area. Furthermore, the nature of the activities during construction, operation and decommissioning of the Proposed Development would be unlikely to alter the geology of the Proposed Development Area. Potential cumulative effects on geology have also been scoped out on this basis. For context, information on the geology of the Proposed Development Area is presented in Section 9.6, Technical Appendix: 9.1 Peat Landslide Hazard and Risk Assessment (PLHRA), Technical Appendix: 9.2 Peat Management Plan (PMP), and Technical Appendix: 9.3 Coal Mining Risk Assessment (CMRA).
- increased flood risk caused by blockages to flow in watercourses during operation and maintenance of the Proposed Development. Watercourse crossings would be subject to maintenance requirements under the Controlled Activities Regulations (CAR), flood risk on-site is negligible, and the development design ensures no critical infrastructure is located near watercourses;

- changes to public/private water supply yield because of changes to runoff rates and volumes during operation and maintenance of the Proposed Development as no significant alterations to runoff rates/infiltration or drawdown of the water table are anticipated during or as a consequence of construction;
- potential effects associated with forest felling on surface water quality and runoff as forest felling is limited to 'key holing' the Proposed Development into the existing forest and any forest felling would be undertaken in accordance with good practice guidelines published by Forest Land Scotland; and
- potential cumulative effects in relation to public/private water supply yields during the operational phase as water requirements are low during operation and any change would not be discernible at the catchment level.

Baseline Characterisation

Study Area

9.5.5 The Study Area includes all the Proposed Development Area. In addition, details of local water use and quality within a buffer of up to 500 m from the Proposed Development Area has been considered.

9.5.6 The assessment of potential cumulative effects uses the catchments within the Study Area, with a maximum distance of 5 km from the Proposed Development Area. Beyond this 5 km distance, any effect is considered to be so diminished as to be undetectable and therefore not significant.

Desk Study

9.5.7 An initial desk study has been undertaken to determine and confirm the baseline characteristics by reviewing available information on soils, geology, hydrology, and hydrogeology such as: the depth and distribution of peat, the nature of the underlying geology, groundwater resources, licensed and unlicensed groundwater and surface water abstractions, public and private water supplies, surface water flows, flood extents, rainfall data, water quality, and soil data.

9.5.8 In addition, information gathered, presented and interpreted in the previous Keirs Hill Environmental Statement (2013) has been reviewed as part of the desk based assessment.

9.5.9 The baseline assessment has also included a review of published geological maps, Ordnance Survey (OS) maps, aerial photographs, digital terrain models (slope plans), and geological literature.

9.5.10 The following sources of information, including good practice guidance and legislation have been consulted in order to characterise and assess the soils, geology, hydrogeology, and hydrology of the area within and surrounding the Proposed Development Area:

- Keirs Hill Wind Farm Environmental Statement – Main Report, 2013.
- OS 1:50,000 and 1:10,000 scale mapping data;
- Flood Estimation Handbook (FEH) web service;
- British Geological Survey (BGS) 1:50,000 scale data - superficial deposits, bedrock, linear features, mass movement, and artificial ground;
- BGS Hydrogeological Map of UK, 2022;
- James Hutton Institute, The National Soil Map of Scotland (1:250,000);
- BGS Hydrogeological Maps of Scotland (groundwater vulnerability and aquifer productivity) 1:100,000 scale;
- SEPA flood maps;
- SEPA Water Environment Hub for water body classifications;
- NatureScot Sitelink Online Information Service;
- Natural England Magic Map;
- Data requests to SEPA regarding details of registered/licensed abstractions and discharges (March 2022); and
- Data requests to South and East Ayrshire Councils regarding details of historic flooding records and private water abstractions (March 2022).

Field Survey

9.5.11 The project hydrologists, geologists, and ecologists have worked closely on this assessment to ensure that appropriate information is gathered to allow potentially sensitive features or receptors to be adequately assessed and a comprehensive impact assessment to be completed.

9.5.12 Site visits and walkover surveys have been undertaken by SLR Consulting Limited on the following dates:

- September 2021 to conduct additional Phase I peat depth probing and peat characterisation exercise, borrow pit assessment and track layout planning; and

- December 2021 and April 2022 to conduct further peat probing around finalised infrastructure locations, GWDTE assessment, and watercourse crossing survey.

9.5.13 The field work has been undertaken in order to:

- verify the information collected during the desk study;
- undertake a visual assessment of the main surface waters and verify private water supplies (PWS);
- identify drainage patterns, areas vulnerable to erosion or sediment deposition, and any pollution risks;
- visit identified potential GWDTEs (in consultation with the project ecologists);
- visit potential watercourse crossings;
- inspect rock exposures and establish by probing an estimate overburden thickness;
- assess peat extent and depth, peat slide landslide risk, and site geomorphology;
- confirm substrate beneath areas of peat based on the type of refusal of peat depth probe; and
- allow appreciation of the Proposed Development Area, determine gradients, assess routes and ground conditions to assess the relative location of all the components of the Proposed Development.

9.5.14 The desk study and field surveys have been used to identify potential development opportunities and constraints and have been used to inform the Proposed Development design.

9.5.15 The data obtained as part of the desk study and collected as part of the field work has been processed and interpreted to complete the impact assessment and recommend mitigation measures where appropriate.

Assessment of Likely Effect of Significance

Significance Criteria

9.5.16 The significance of likely effects of the Proposed Development has been assessed by considering two factors: the sensitivity of the receiving environment and the potential magnitude of change, should that effect occur.

9.5.17 The assessment methodology has also been informed by experience of carrying out such assessments for a range of wind farm and other developments, knowledge of the geology and water environment characteristics in Scotland, and cognisance of good practice.

9.5.18 This approach provides a mechanism for identifying the areas where mitigation measures are required and for identifying mitigation measures appropriate to the significance of likely effects presented by the Proposed Development.

9.5.19 Criteria for determining the significance of effect are provided in **Error! Reference source not found.**, **Error! Reference source not found.** and **Error! Reference source not found.**.

Sensitivity Criteria

9.5.20 The sensitivity of the receiving environment (i.e., the baseline quality of the receiving environment) is defined as its ability to absorb an effect without a detectable change and can be considered through a combination of professional judgement and a set of pre-defined criteria which is set out in **Error! Reference source not found.**. Receptors in the receiving environment only need to meet one of the defined criteria to be categorised at the associated level of sensitivity.

Table 9.2 - Criteria for assessing sensitivity of receptor

Sensitivity	Definition
High	• soil type and associated land use is highly sensitive (e.g. unmodified blanket bog peatland); • SEPA Water Framework Directive Water Body Classification: High - Good or is close to the boundary of a classification Moderate to Good or Good to High; • receptor is of high ecological importance or national or international value (e.g., Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC), habitat for protected species) which may be dependent upon the geology or hydrology of the development area; • receptor is at high risk from flooding above 0.5% Annual Exceedance Probability (AEP) and/or water body acts as an active floodplain or flood defence; • receptor is used for public and/or private water supply (including Drinking Water Protected Areas (DWPA); • groundwater vulnerability is classified as high; and • if a GWDTE is present and identified as being of high sensitivity.
Medium	• soil type and associated land use moderately sensitive (e.g. arable, commercial forestry); • SEPA Water Framework Directive Water Body Classification Moderate or is close to the boundary of a classification Low to Moderate; • receptor is at moderate risk from flooding (0.1% AEP to 0.5% AEP) but does not act as an active floodplain or flood defence; and • moderate classification of groundwater aquifer vulnerability.
Low	• soil type and associated land use not sensitive to change in hydrological regime and associated land use (e.g. intensive grazing of sheep and cattle) • SEPA Water Framework Directive Water Body Classification Poor or Bad; • receptor is at low risk from flooding (less than 0.1% AEP); and • receptor not used for water supplies (public or private).

Magnitude of Change

9.5.21 The potential magnitude of change would depend upon whether the likely impact would cause a fundamental, material, or detectable impact. In addition, the timing, scale, size, and duration of the likely effect resulting from the Proposed Development are also determining factors. The criteria that have been used to assess the magnitude of impact are defined in **Error! Reference source not found.**.

Table 9.3 - Criteria for assessing magnitude of change

Magnitude	Criteria	Definition
High	Results in a loss of attribute	Fundamental (long term or permanent) changes to the baseline hydrology, hydrogeology, and geology such as: • permanent degradation and total loss of the soils habitat; • wholesale changes to watercourse channel, route, hydrology, or hydrodynamics; • changes to the Proposed Development resulting in an increase in run-off with flood potential and also significant changes to erosion and sedimentation patterns; • major changes to the water chemistry; and • major changes to groundwater levels, flow regime and risk of groundwater flooding.
Medium	Results in impact on integrity of attribute or loss of part of attribute	Material but non-fundamental and short to medium term changes to baseline hydrology, hydrogeology, and water quality, such as: • loss of extensive areas of soils habitat, damage to important geological structures/features; • some fundamental changes to watercourses, hydrology, or hydrodynamics. Changes to site resulting in an increase in run-off within system capacity; • moderate changes to erosion and sedimentation patterns; • moderate changes to the water chemistry of surface run-off and groundwater; and • moderate changes to groundwater levels, flow regime and risk of groundwater flooding.
Low	Results in minor impacts on attribute	Detectable but non-material and transitory changes to the baseline hydrology, hydrogeology, and water quality, such as: • minor or slight loss of soils or slight damage to geological structures / feature; • minor or slight changes to the watercourse, hydrology, or hydrodynamics; • changes to site resulting in slight increase in run-off well within the drainage system capacity; • minor changes to erosion and sedimentation patterns; • minor changes to the water chemistry of surface run-off and groundwater; and • minor changes to groundwater levels, flow regime and risk of groundwater flooding.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect the use/integrity	No perceptible changes to the baseline hydrology, hydrogeology, and water quality such as: • no impact or alteration to existing important geological environs; • no alteration, or very minor changes with no impact to watercourses, hydrology, hydrodynamics, erosion, and sedimentation patterns; • no pollution or change in water chemistry to either groundwater or surface water; and • no alteration to groundwater recharge or flow mechanisms.

Likely Effects

9.5.22 The sensitivity criteria together with the magnitude of change determines the significance of the effect, which can be categorised into level of significance as identified in **Error! Reference source not found.**. This also takes into account good practice measures implemented and embedded as part of the design of the Proposed Development and use of professional judgement where appropriate.

9.5.23 The significance of effect provides a guide to assist in decision making. However, it should not be considered as a substitute for professional judgment and interpretation. In some cases, the potential sensitivity of the receiving environment or the magnitude of effect cannot be quantified with certainty and therefore professional judgement remains the most robust method for identifying the predicted significance of a likely effect.

Table 9.4 - Significance of effect

		Magnitude of Change			
		High	Medium	Low	Negligible
Sensitivity	High	Major	Major/Moderate	Moderate	Moderate/Minor
	Medium	Major/Moderate	Moderate	Moderate/Minor	Minor
	Low	Moderate	Moderate/Minor	Minor	Minor/Negligible

9.5.24 Effects of **Major and Major/Moderate** significance are considered significant in terms of the EIA Regulations.

Requirements for Mitigation

9.5.25 Any likely effects of the Proposed Development on geology or the water environment identified by the assessment have been addressed and mitigated by the design and the application of good practice guidance to be implemented as standard during construction, operation, and decommissioning to prevent, reduce, or offset effects where possible. Where appropriate, furthermore tailored mitigation measures have been identified prior to determining the likely significance of residual effects.

9.5.26 Good practice measures would be applied in relation to pollution risk, sediment management, peat management, and management of surface run-off rates and volumes.

9.5.27 The final CEMP would include details and responsibilities for environmental management on-site and would outline the necessary surface water management, oil and chemical delivery and storage requirements, waste management, traffic, and transport management, and would specify monitoring requirements for waste water, water supply, and all appropriate method statements and risk assessments for the construction of the Proposed Development.

Assessment of Residual Effect of Significance

9.5.28 A statement of residual effects, following consideration of any further specific mitigation measures where identified, is then given.

Limitations to Assessment

9.5.29 The assessment uses site investigation and survey data and publicly available data sources, including but not limited to SEPA, SAC and EAC and commercial data supply companies, as well as additional information supplied from stakeholders during the scoping and consultation stages.

9.5.30 It is considered that the data and information used to complete this assessment is robust and that there are no significant data gaps or limitations.

9.6 Baseline

9.6.1 This section presents information gathered regarding the existing geological, hydrogeological and hydrological conditions with the Proposed Development Area and its immediate surrounding (the Study Area). The potential future baseline is also considered.

Site Setting

9.6.2 The Proposed Development is located approximately 16 km southeast of Ayr, on the border of South Ayrshire and East Ayrshire Councils, near Waterside. The Proposed Development is centred at National Grid Reference (NGR) NS 40700 07500 and occupies an area of approximately 1,000 ha.

9.6.3 An extract of Ordnance Survey (OS) mapping for the Proposed Development is presented in Figure 9.1 (Local Hydrology). The Proposed Development Area occupies forested hills and the River Doon valley is located east of the Proposed Development Area, with settlements at Dalmellington, Waterside and Patna. To the west is the Water of Girvan, which flows through the village of Straiton.

9.6.4 Ground elevations within the Proposed Development Area range between approximately 160 m Above Ordnance Datum (AOD) in the east at the proposed site entrance from the A713 (Dalmellington Road) rising to a maximum of 306 m AOD at Green Hill, in the centre of the Proposed Development Area. The proposed turbines are located across Lambdoughty Hill (in the west), Green Hill, and Keirs Hill (in the centre) and are located at elevations of between 250 – 280 m AOD.

9.6.5 A shallow valley associated with the Lochhead Burn runs in a northerly direction between Lambdoughty Hill and Green Hill and drains a number of minor watercourses to Loch Spallander Reservoir to the north-west of the Proposed Development.

9.6.6 The standard average annual rainfall (SAAR) for the Proposed Development Area, based on data obtained from the Flood Estimation Handbook (FEH) Web Service (CEH, 2022) confirms a relatively high annual rainfall of 1,385 mm.

9.6.7 The existing land use includes a mixture of rough grazing and commercial forestry. The majority of the Proposed Development is located within the commercial forest.

Statutory Designated Sites

9.6.8 Review of the NatureScot Sitelink (NatureScot, 2022) and Magic Map (DEFRA, 2022) webpage confirms that the Proposed Development Area contains no statutory designated sites, nor are there any within the Study Area.

9.6.9 The location of statutory designated sites between 500 m and 5 km from the Proposed Development Area are summarised below:

- Dunaskin Glen Site of Special Scientific Interest (SSSI), a 26.09 ha site, is located approximately 1.2 km east of the Proposed Development, at its closest extent. The SSSI affords rock exposures of Upper Carboniferous sediments and Palaeozoic Palaeobotany. The nature of the Proposed Development would have no effect on the qualifying interests of the SSSI and therefore it is not considered further as part of this assessment.

- Dalmellington Moss SSSI, a 27.41 ha site, is located approximately 3 km east of the Proposed Development at its closest extent. The SSSI designation includes a raised bog surrounded by a wetland area developed in the valley of the River Doon. The Moss is located upstream of the Proposed Development Area, and therefore is not in hydraulic continuity with the Proposed Development. It is not considered further in this assessment.
- Bogton Loch SSSI, a 76.61 ha site, is located approximately 3.4 km southeast of the Proposed Development, at its closest extent. The SSSI designation includes a freshwater loch and associated wetland habitats, containing a diverse range of breeding birds. The SSSI is located upstream of the Proposed Development, not hydraulically linked, and therefore not considered further.
- Benbeoch SSSI, an 83.24 ha site, is located approximately 4.8 km east of the Proposed Development, at its closest extent. The SSSI designation includes the rock 'kylite' which was first found and described in this location. The SSSI is remote from, and not hydraulically linked to, the Proposed Development Area and it is therefore not considered further.

Geology

Soils

9.6.10 Review of the National Soils Map of Scotland indicates that the principal soil types underlying the Proposed Development Area are peaty gleys across the higher ground and the forested area within which the turbines would be located. Lower lying land in the east and south east are described as mineral gleys.

9.6.11 An extract of SNH's (now NatureScot) Peatland Classification mapping is reproduced as Figure 9.2 and shows that Class 1, 3, 4 and Class 5 peatland underlies the Proposed Development Area.

Superficial Geology

9.6.12 An extract of the 1:50,000 BGS superficial deposits mapping data is presented as Figure 03 in Technical Appendix 9.1 (PLHRA). Review of this and of the BGS Onshore Geoindex 1:50,000 data (BGS, 2022) shows that majority of the Proposed Development Area is underlain by glacial till which is overlain by large areas of peat south of Keirs Hill. Alluvial deposits are mapped along the Proposed Development Area boundary associated with larger local watercourses (principally along the River Doon valley but with localised areas associated with the Lochhead Burn, Lambdoughty Burn, Red Burn and Keirs Burn).

9.6.13 A comprehensive peat probing programme has been conducted and informs the PLHRA (Technical Appendix 9.1) and PMP (Technical Appendix 9.2). Figure 05 and 06 of the PLHRA (Technical Appendix 9.1) show peat depth plans and the results of the peat probing campaigns. In summary, these data show:

- the presence and depth of peat was assessed at more than 1,900 locations;
- 65% of all probes confirmed peaty soils;
- where recorded, the peat thickness varies from 0.5 m to 5.9 m;
- of the probe locations that intersected peat, approximately 80% recorded peat less than 1 m thick; and
- a hazard impact assessment has been completed which concludes that subject to the employment of appropriate mitigation measures, the presence of peat and potential peat slide instability are not development constraints.

Bedrock and Linear Features

9.6.14 An extract of the 1:50,000 BGS bedrock and linear features data is presented as Figure 04 of the PLHRA (Technical Appendix 9.1). Bedrock beneath the Proposed Development comprises predominately of Devonian to Carboniferous age sedimentary rocks.

9.6.15 Sedimentary rock cycles (mudstone, siltstone, limestone, sandstone) of the Inverclyde Group (Kinnesswood Formation and Ballagan Formation) are present in the south and west of the site. The high points of Keirs Hill and Green Hill are the remnants of a volcanic plug and associated vents (Ayrshire Basanitic And Foiditic Plugs And Vents). To the northeast, displaced by a normal fault are the coal bearing rocks of the Clackmannan Group (Upper Limestone Formation, Limestone Coal Formation, Lower Limestone Formation).

9.6.16 The northeast of the Proposed Development Area is located with the Ayrshire Coalfield and there are a number of historic mine entries present within the Proposed Development Area and areas classified as Development High Risk by the Coal Authority. Limestone quarrying has also been previously undertaken within the Proposed Development Area.

9.6.17 A site specific Coal Mining Risk Assessment (CMRA) has been prepared and is presented as Technical Appendix 9.3. Review of which confirms there are no underground mine workings beneath the proposed turbine development area, and that the Proposed Development is in an area of No Risk from historic mining.

Hydrogeology

Aquifer Characteristics and Groundwater Vulnerability

9.6.18 Where not degraded or eroded, peat is characteristically wet underfoot and dominated by Sphagnum. Typically peat consists of two layers: the upper very thin (up to 30cm) acrotelm layer contains upright stems of Sphagnum mosses and allows relatively free water movement and the lower catotelm layer comprising the thicker bulk of peat where individual plant stems have collapsed. Water movement in the catotelm layer is very slow and normally the water table in a peat never drops below the acrotelm layer.

9.6.19 Clay within the glacial till acts as an aquitard to the more discrete permeable sand and gravel lenses and will hinder/prevent large scale groundwater movement in the till. Regionally, groundwater flow will be limited by the variability of these deposits and consequently any groundwater yields are normally low.

9.6.20 Groundwater storage and movement will occur in the alluvial deposits and be in hydraulic continuity with the water in the adjacent watercourse. It is likely that this groundwater will be perched above the glacial till and above the regional groundwater table in the bedrock deposits.

9.6.21 Regional BGS mapping (Figure 9.3) shows that the Carboniferous and Devonian bedrock deposits are considered as a locally important aquifer in which groundwater flow can occur in fissures and other discontinuities. Both are considered moderately productive aquifers.

9.6.22 BGS groundwater vulnerability mapping (Figure 9.4) classifies the underlying aquifer (superficial and bedrock) according to the predominant groundwater flow mechanism (fracture or intergranular) and the estimated groundwater productivity. Groundwater vulnerability is divided into five classes (1 to 5) with 1 being least vulnerable and 5 being most vulnerable.

9.6.23 The vulnerability mapping shows that with the exception of the alluvial deposits, the superficial deposits are not considered a significant aquifer. The Devonian bedrock is recorded to have a high aquifer productivity and the Carboniferous bedrock a moderate aquifer productivity. The groundwater vulnerability beneath the Proposed Development Area is classified as 4a and 4b (vulnerable to pollution). Discrete areas in the north of the Proposed Development Area are ascribed Class 5 (most vulnerable) and correspond to areas where there is an absence of superficial deposits.

Groundwater Levels and Quantity

9.6.24 Baseline factors that inhibit groundwater recharge with the Proposed Development Area include the following:

- steeper topographic gradients present in parts of the Proposed Development Area encourage the formation of surface water runoff; and
- the peat and glacial till deposits inhibit infiltration owing to their generally low bulk permeability.

9.6.25 SEPA have not provided any information regarding groundwater levels and quality within or near to the Proposed Development Area.

9.6.26 In the absence of published information or data held by SEPA, it is inferred that groundwater will be present as perched groundwater within more permeable horizons (sand and gravels) of the glacial till deposits, in the alluvial deposits, and in the bedrock.

9.6.27 Groundwater flow is likely to follow the local topography.

9.6.28 All of Scotland's groundwater bodies have been designated as Drinking Water Protected Areas under the Water Environment (Drinking Water Protected Area) (Scotland) Order 2013 and require protection for their current use or future potential as drinking water resources.

9.6.29 The current status of groundwater bodies in Scotland has been classified by SEPA (SEPA, 2017) in accordance with the requirements of the Water Framework Directive (WFD). SEPA identify two groundwater bodies that underly the Proposed Development:

- Crosshill (SEPA ID 150566), classified in 2020 with an Overall Status of Good and no pressures are identified; and
- Cumnock (SEPA ID 150646), classified in 2020 with an Overall Status of Poor due to elevated electrical conductivity leading to poor water quality.

Groundwater Dependant Terrestrial Ecosystems

9.6.30 A habitat and National Vegetation Classification (NVC) mapping exercise has been undertaken and is reported in Chapter 7 (Ecology Assessment).

9.6.31 In accordance with SEPA guidance (SEPA, 2014) the NVC mapping has been used to identify habitats which may be sustained by groundwater. These habitats (M6, M15. M23, M25 and MG10) and their distribution are shown on Figure 9.5.

9.6.32 Figure 9.5 confirms that no potential GWDTE is recorded where there is existing commercial forestry within the Proposed Development Area. The proposed site entrance from Waterside is shown to pass over isolated areas of potentially

Moderate GWDTE, and the site access from B741 in the south, to pass adjacent to an area of High potential GWDTE.

9.6.33 The location of the potential Moderate GWDTE on the northern proposed site entrance corresponds to an area of shallow relief and peat soils at a high elevation. The distribution of the potential Moderate habitat is not consistent with that supported by groundwater, such as a spring or groundwater discharge zone, and instead is considered to be supported by incident rainfall and the localised waterlogging of soils.

9.6.34 The potential High GWDTE adjacent to the proposed southern access is located adjacent to an existing track. It has formed in an area of waterlogged soils which is fed by surface water drainage form the adjacent, and upstream commercial forest. It is not sustained by groundwater.

9.6.35 In summary, it is concluded that areas of potential GWDTE are not sustained by groundwater but by surface water, and therefore the 100 m and 250 m buffers specified in SEPA guidance to potential GWDTE habitats need not be applied. Safeguards, however, will need to be included in the Proposed Development design to maintain existing surface water flow paths so that existing habitats are sustained.

Hydrology

Local Hydrology

9.6.36 The Proposed Development Area is drained by two main surface water catchments, the River Doon to the east and the Water of Girvan to the west. There are several sub-catchments which drain the Proposed Development Area including the Lochhead Burn and Lambdoughty Burn in the west and centre of the Proposed Development Area which ultimately discharge into the Water of Girvan and the Meikleholm Burn, Keirs Burn and Red Burn in the north east, east and south east respectively which discharge into the River Doon.

9.6.37 The local hydrology is shown in Figure 9.1.

River Doon

9.6.38 The River Doon flows from Loch Doon, approximately 8 km to the south east of the Proposed Development Area, at its closest, and flows in a broadly northerly direction past the eastern boundary of the Proposed Development Area and through the village of Patna before discharging to the Firth of Clyde at Ayr. As it passes the Proposed Development Area the River Doon is joined by the Meikleholm Burn, Keirs Burn, and Red Burn which all rise within the Proposed Development Area.

9.6.39 The River Doon has an overall catchment size of 322 km^2.

9.6.40 A crossing of the River Doon is proposed north-west of Waterside (WC4).

Meikleholm Burn

9.6.41 The Meikleholm Burn drains the north eastern of the Proposed Development Area. It rises to the east of Keirs Hill and drains in a predominantly north easterly direction to its confluence with the River Doon to the north east of the Proposed Development Area.

9.6.42 The Meiklehom Burn has a catchment area of 1.85 km^2 to its confluence with the River Doon. A significant proportion of the watercourse's catchment, and therefore a number of its tributaries, rise within the Proposed Development Area.

9.6.43 Within the Proposed Development Area, the Meikleholm Burn catchment is forested, and has much artificial drainage which has been developed to increase the yield of the commercial forest.

9.6.44 Turbines T5, T6 and T7, as well as both the borrow pit search areas are located in the headwaters of this catchment. There are no crossings of this burn or of its tributaries.

Keirs Burn

9.6.45 Keirs Burn drains the east of the Proposed Development Area which comprises areas of rough grazing sloping towards the River Doon Valley.

9.6.46 Keirs Burn has a catchment area of 1.22 km^2 to its confluence with the River Doon. The proposed access track from the A713 and substation, temporary construction and battery energy storage system compounds are located in this catchment. There is one proposed watercourse crossing in the catchment, WC3. There are no proposed turbines in this surface water catchment.

Red Burn

9.6.47 Red Burn flows in a predominantly easterly direction along the south eastern edge of the Proposed Development Area and rises just north of the proposed access from the B741.

9.6.48 Red Burn has a catchment area of 4.76 km^2 to its confluence with the River Doon, however the majority of this catchment is outside of the Proposed Development Area. There is one proposed turbine located within this catchment (T9) along with an upgraded water crossing of a minor tributary of the Burn close to the junction with the B741 on the southern boundary of the Proposed Development Area.

Water of Girvan

9.6.49 The Water of Girvan flows 45 km from its source at Loch Braden Reservoir, heading west through Straiton and Dailly before discharging to the Firth of Clyde. It passes approximately 2.5 km to the west of the Proposed Development Area.

9.6.50 Tributaries of the Water of Girvan which rise within the Proposed Development Area include the Lambdoughty Burn and the Lochhead Burn.

9.6.51 The Water of Girvan has a total catchment of 252.92 km^2.

Lambdoughty Burn

9.6.52 Lambdoughty Burn rises in the south west of the Proposed Development Area and flows in a predominantly south westerly then westerly to its confluence with the Water of Girvan to the west of Straiton.

9.6.53 Within the Proposed Development Area the catchment of the Lambdoughty Burn comprises commercial forestry, and as a result has been modified by artificial drainage. Turbines T1 and T8 are located within this catchment.

Lochhead Burn

9.6.54 Lochhead Burn rises roughly in the centre of the Proposed Development Area between Green Hill (to the north east) and Lambdoughty Hill (to the south west) and flows in a north westerly direction into Loch Spallander Reservoir located on the north western boundary of the Proposed Development Area.

9.6.55 The Lochhead Burn has a catchment area upstream of the Loch Spallander Reservoir of 2.26 km^2. Three turbines (T2, T3 and T4), one borrow pit search area and one proposed watercourse crossing (WC2) are located in this catchment.

Loch Spallander Reservoir

9.6.56 Loch Spallander Reservoir is impounded by an earth embankment dam at its western end and extends to an area of 55.8 ha, it is the source of the Spallander Burn and the Muirsmill Burn that join the Water of Girvan 1.5 km northeast of Kirkmichael.

9.6.57 It is understood that the reservoir is no longer used by Scottish Water as a drinking water supply source.

Surface Water Flow

9.6.58 Table 9.5 presents catchment areas and the key catchment descriptors from the FEH Web Service (CEH, 2022) for watercourse within the Proposed Development Area which can be used to describe the catchments' anticipated response to rainfall.

Table 9.5 – Surface water catchment descriptors[1]

Watercourse	Downstream Point (NGR)	Area (km^2)	SAAR (mm)	ALTBAR (mASL)	DPSBAR (m/km)	LDP (km)	BFIHOST (dim)
Meikleholm Burn	NS 42300 09450	1.85	1,388	258	82.60	3.11	0.295
Keirs Burn	NS 43050 08700	1.22	1,375	246	117.3	2.21	0.313
Red Burn	NS 43100 06350	1.12	1,445	278	48.60	1.81	0.261
Lochhead Burn	NS 39850 08050	2.26	1,385	259	58.70	3.04	0.245
Lambdoughty Burn	NS 40250 05700	5.57	1,418	272	83.20	4.40	0.279

Surface Water Quality

9.6.59 SEPA has classified larger watercourses in terms of their quality as part of their responsibilities under the WFD. The River Doon (ID: 10924) was classified with an overall status of Moderate in 2020, with pressures identified on overall ecology and hydromorphology. The Water of Girvan (ID: 10455) was classified with an overall status of Good Ecological Potential in 2020, with pressures identified on overall ecology and hydromorphology.

9.6.60 Smaller watercourses within the Proposed Development, including those that rise within the Proposed Development Area, are not monitored nor classified by SEPA.

Fisheries

9.6.61 Fisheries in the Water of Girvan and the River Doon are managed by the Ayrshire Rivers Trust and have been identified as important fisheries with populations of Salmon and Sea Trout. One of the main aims of the Ayrshire Trust Fishery Management Plan is to conserve and restore indigenous fish populations and the habitats that support them.

9.6.62 The River Doon has also been identified as a fishery with populations of Salmon, Brown and Sea Trout, Arctic Charr, Stone Loach, Minnows, Sticklebacks, Eels, Lampreys, Pike and Perch. The main stem of the Doon has an abundant population of Saucer bugs. Saucer bugs, require high quality water, and are only found in 5 or 6 rivers in Scotland.

[1] NOTE: Grid reference of downstream maximum extent of catchment as denoted by either the Proposed Development site boundary or confluence with another watercourse; SAAR – surface average annual rainfall between 1961 and 1990; ALTBAR – mean catchment altitude (metres above sea level); DPSBAR – index of catchment steepness; and LDP – longest drainage path; BFIHOST - base flow index is a measure of catchment responsiveness to precipitation.

9.6.63 The River Doon is fed from Loch Doon which is a storage reservoir for the Galloway Hydro Power scheme but has a compensation flow for sustaining the aquatic ecology. Fishery interests are discussed in detail and assessed within Chapter 7 (Ecology Assessment).

Flood Risk

9.6.64 SEPA has developed national flood maps (SEPA, 2018a) that present modelled flood extents for river, coastal, surface water, and groundwater flooding. The river, coastal, surface water, and groundwater maps were developed using a consistent methodology to produce outputs for the whole of Scotland, supplemented with more detailed, local assessments where available and suitable for use. Flood extents are presented in three likelihoods:

- High likelihood: A flood event is likely to occur in the defined area on average more than once in every ten years (1:10). Or a 10% chance of happening in any one year.
- Medium likelihood: A flood event is likely to occur in the defined area on average more than once in every two hundred years (1:200). Or a 0.5% chance of happening in any one year.
- Low likelihood: A flood event is likely to occur in the defined area on average more than once in every thousand years (1:1000). Or a 0.1% chance of happening in any one year.

9.6.65 The flood risk from each of these potential sources is discussed below. Consultation with South and East Ayrshire Council and SEPA has been conducted and used to inform this assessment.

Flooding from the sea or tidal flooding

9.6.66 The SEPA coastal flood maps confirm that the Proposed Development Area is not at risk from coastal flooding extents.

Flooding from rivers or fluvial flooding

9.6.67 SEPA mapping has identified that the main floodplain extents within the surface water catchments are local, never extending far from the watercourses or waterbodies.

9.6.68 High risk areas associated with flooding are located along the larger watercourse corridors including the River Doon, Muirsmill Burn (down-stream of Loch Spallander Reservoir), and Lambdoughty Burn. None of the flood extents are close to any element of the Proposed Development.

Flooding from surface water

9.6.69 SEPA has modelled a few localised surface water flood extents within the Proposed Development Area, largely coinciding with watercourse channels. The flood extents are minor and localised, never forming large-linked areas or flow paths, and do not pose a development constraint.

Flooding from groundwater

9.6.70 The SEPA groundwater flood map illustrates that the Proposed Development Area is in a potentially vulnerable groundwater flooding area. However, given the elevation of the Proposed Development, above the River Doon and Water of Girvan main watercourses, it is considered that the Proposed Development is not at risk of groundwater flooding as any groundwater will discharge to these watercourse rather than emerge and cause flooding within the Proposed Development Area.

Flooding from infrastructure failure

9.6.71 SEPA has produced reservoir inundation maps (SEPA, 2018b) for those sites currently regulated under the Reservoirs Act 1975. Review of the SEPA Inundation Mapping highlights that there is no risk of reservoir inundation of the Proposed Development Area.

Historical flooding records

9.6.72 Consultation with South and East Ayrshire Councils confirms that there are recorded instances of flooding within the Proposed Development Area. It is noted that there have been localised recorded instances of flooding downstream of the Study Area.

Private Water Supplies and Licenced Sites

9.6.73 Consultation with Scottish Water has confirmed that no public water supplies exist within the Proposed Development Area and Study Area. The Proposed Development Area is not located in a Drinking Water Protected Area (DWPA).

9.6.74 East Ayrshire Council and South Ayrshire Council were contacted regarding the presence of private water supplies within 2 km of the Proposed Development Area. This information, and details presented in the Keirs Hill Environmental Statement (RES, 2003) confirms no private water supplies within the Proposed Development Area and 6 potential registered private water supplies within the Study Area.

9.6.75 Details of the private water supplies identified, and a risk assessment the Proposed Development poses to the water sources, is presented in **Error! Not a valid bookmark self-reference.**.

Table 9.6 – Private water supply risk assessment

Label	Name	Type	Distance (m) and Direction from Nearest Component of the Proposed Development	Risk Assessment
PWS01	Glenhead Cottage	Spring	1900 SW	All sources are located in a different water catchment to the Proposed Development and therefore there is no pathway between the development and the private water sources. No complete source-pathway-receptor linkage and therefore no risk to the private water supply sources.
PWS02	Glenash	Spring/surface	2100 SW	
PWS03	Land of Largs, Largs Farm	Spring	2400 SW	
PWS04	Glentagen	Spring	1100 S	
PWS05	Gass Farm	Spring	1100 S	
PWS06	Gass Cottage	Spring	1100 S	

9.6.76 Review of Table 9.7 confirms that all the private water supply sources are located more than 250 m from the Proposed Development, and all are located in different water catchments to the Proposed Development. It is concluded, therefore, that none of the private water supply sources are at risk from the Proposed Development.

9.6.77 SEPA provided details of CAR registrations/licences within 500 m of the Proposed Development Area; these are shown on Figure 9.1. SEPA has not been able to provide details which describe the activities authorised by the licences.

Future Baseline

9.6.78 Climate change studies predict a decrease in summer precipitation and an increase in winter precipitation, alongside slightly higher average temperatures. These changes suggest that there could be greater pressures on water supplies and water levels in summer months in the future. In addition, summer storms are predicted to be of greater intensity. Therefore, peak fluvial flows associated with extreme storm events could also increase in volume and velocity.

9.7 Receptors Brought Forward for Assessment

9.7.1 A summary of the receptors identified as being sensitive to the Proposed Development and which have been 'scoped-in' to the assessment include:

- peat soils and areas of deep peat that have been recorded within the Proposed Development Area and which are assessed as a High sensitivity receptor;
- groundwater quality which has been classified by SEPA as Good in the Devonian bedrock and as Poor in the Carboniferous bedrock, further groundwater is classified as vulnerable to pollution in both bedrock units, and is therefore considered a High sensitivity receptor; and
- surface water quality which has been classified by SEPA as moderate in the River Doon and good in the Water of Girvan downstream of the Proposed Development Area and therefore is assessed as a High sensitivity receptor.

9.8 Assessment of Potential Effects

Construction Effects

9.8.1 During the construction phase of the project the Proposed Development has the potential to result in the following significant effects:

- Pollution. A pollution event could result in a short term moderate adverse impact on surface water and groundwater which are High sensitivity receptors.
- Erosion and Sedimentation. Site traffic has the potential to cause erosion and increase sedimentation loading during earthworks. This could result in a short term moderate adverse impact on surface water and groundwater, valuable peat soils and deep peat, which are considered High sensitivity receptors.
- Drainage and Dewatering. Temporary drainage would be required to ensure construction areas are workable and not saturated. This could result in a short term moderate adverse impact on surface water and groundwater and areas of deep peat, which are considered High sensitivity receptors.

Operational Effects

9.8.2 During the operational phase of the Proposed Development, it is anticipated that routine maintenance of infrastructure would be required across the Proposed Development. This may include work such as maintaining access tracks and drainage and carrying out maintenance of turbines. The scale of potential works would be much less than the construction phase but includes effects resulting from localised and temporary pollution, erosion and sedimentation and drainage and dewatering which would result in a negligible adverse impact on surface water, groundwater, peat soils and deep peat which are considered High sensitivity receptors.

9.8.3 No significant operational effects are therefore anticipated and not discussed further in this chapter.

Decommissioning Effects

9.8.4 Potential significant decommissioning effects would be the same as potential construction effects, namely a temporary moderate adverse impact that effects surface water, groundwater, peat soils and deep peat, as a consequence of the following:

- the generation of pollution;
- erosion and sedimentation; and
- drainage and dewatering.

Potential Cumulative Effects

9.8.5 Potential significant cumulative construction effects associated with the Proposed Development are the same as the potential construction effects noted above, and include moderate adverse impacts on surface water, groundwater, peat soils and deep peat, resulting from pollution, erosion and sedimentation, drainage and dewatering.

9.8.6 There is only one cumulative development within 5 km of the Proposed Development Area, Dersalloch Wind Farm, which is located approximately 1 km to the south. The wind farm has been constructed and is operational. Like the Proposed Development, Dersalloch Wind farm lies within the surface water catchments of the River Doon and Water of Girvan.

9.8.7 It is understood that Dersalloch Wind Farm was constructed using industry standard controls to safeguard soil, peat, geology and the water environment.

9.9 Mitigation

Design Iterations

9.9.1 The Proposed Development has undergone design iterations and evolution in response to the geological, hydrological, and hydrogeological constraints identified as part of the baseline studies and field studies so as to avoid and/or minimise likely effects on receptors where possible. This has included areas of deep peat or potential peat instability, watercourse locations, areas of potential flooding, PWS and GWDTE.

9.9.2 The Proposed Development has made use of existing tracks wherever practical.

Good Practice Measures and Embedded Design

9.9.3 Examples of good practice measures and embedded mitigation included in the Proposed Development design includes the following:

9.9.4 Peat and Peat Management

9.9.5 The extent and depth of peat at the Proposed Development Area has been subject to much investigation. Where practically possible, areas of deep peat have been avoided by the Proposed Development design and a site-specific peat landslide and hazard risk assessment has been prepared to inform the Proposed Development design (see Technical Appendix 9.1).

9.9.6 Good construction practice and methodologies to prevent peat instability within areas that contain peat deposits are identified in the PLHRA. These include:

- measures to ensure a well-maintained drainage system, to include the identification and demarcation of zones of sensitive drainage or hydrology in areas of construction;
- minimisation of ‘undercutting’ of peat slopes, but where this is necessary, a more detailed assessment of the area of concern would be required;
- careful micro-siting of turbine bases, crane hardstands and access track alignments to minimise effects on the prevailing surface and sub-surface hydrology;
- raising peat stability awareness for construction staff by incorporating the issue into the Proposed Development Induction (e.g., peat instability indicators and good practice);
- introducing a ‘Peat Hazard Emergency Plan’ to provide instructions for site staff in the event of a peat slide or discovery of peat instability indicators;
- developing methodologies to ensure that degradation and erosion of exposed peat deposits does not occur as the break-up of the peat top mat has significant implications for the morphology, and thus hydrology, of the peat (e.g. minimisation of off-track plant movements within areas of peat);
- developing robust drainage systems that would require minimal maintenance; and
- developing drainage systems that would not create areas of concentrated flow or cause over-, or under-saturation of peat habitats.

9.9.7 Notwithstanding any of the above good construction practices and methodologies, detailed design and construction practices would need to take into account the particular ground conditions and the specific works at each location throughout the construction period. An experienced and qualified engineering geologist/geotechnical engineer would be appointed to provide advice during the setting out, micro-siting and construction phases of the Proposed Development.

9.9.8 A site-specific PMP has been prepared (see Technical Appendix 9.2) which shows that peat disturbed by the Proposed Development can be readily re-used for restoration purposes.

Buffer to Watercourses

9.9.9 In accordance with wind farm construction best practice guidelines, a 50 m buffer has been applied to watercourses (shown on OS 1:50,000 mapping) and, with the exception of 4 watercourse crossings, where practical any proposed construction activities or infrastructure has been located outside of this buffer.

9.9.10 The layout of the access track was designed to minimise the requirement for watercourse crossings.

Groundwater Dependent Habitats

9.9.11 It has been shown that areas identified as being potentially highly or moderately groundwater dependent are likely to be sustained by incident rainfall and local surface water runoff rather than by groundwater. Accordingly, the buffers proposed in SEPAs GWDTE guidance need not apply.

9.9.12 Measures, such as permeable access tracks and regular cross track drains, have been proposed to safeguard existing water flow paths and maintain existing water quality. It is considered therefore that the water dependent habitats identified by the NVC mapping can therefore be sustained. This would be confirmed, in accordance with good practice, by the Ecological Clerk of Works (ECoW) at the time of the construction of the Proposed Development who would ensure existing surface water flow paths and water flushes are maintained.

Good Practice Measures

9.9.13 Good practice measures would be applied in relation to pollution risk and management of surface run-off rates and volumes. This would form part of the final CEMP to be implemented for the Proposed Development.

9.9.14 Key good practice measures are stated below, and the assessment incorporates these measures as part of the Proposed Development.

Construction Site Licence

9.9.15 In accordance with Controlled Activity Regulations (CAR) prior to any construction at site a Construction Site Licence application would be made to SEPA. The Licence, which is regulated by SEPA, is used to ensure that runoff from a construction site does not cause pollution of the water environment. The Construction Site Licence requires the development of a Pollution Prevention Plan, which once agreed with SEPA is adhered to on site. The principles which would be adopted in the Plan are discussed in the good practice measures below.

General Measures

9.9.16 As a principle, preventing the release of any pollution/sediment is preferable to dealing with the consequences of any release. There are several general measures which cover all effects assessed within this chapter, details of which are given below.

9.9.17 Prior to construction, a site-specific drainage plan would be produced. This would take into account any existing local drainage which may not be mapped and incorporate any site-specific mitigation measures identified during the assessment.

9.9.18 Measures would be included in the final CEMP for dealing with pollution/sedimentation/flood risk incidents and would be developed prior to construction. This would be adhered to should any incident occur, reducing the effect as far as practicable.

9.9.19 The final CEMP would contain details on the location of spill kits, would identify 'hotspots' where pollution may be more likely to originate from, provide details to site personnel on how to identify the source of any spill and state procedures to be adopted in the case of a spill event. A specialist spill response contractor would be identified to deal with any major environment incidents.

9.9.20 A wet weather protocol would be developed. This would detail the procedures to be adopted by all staff during periods of heavy rainfall. Tool box talks would be given to engineering/construction/supervising personnel.

9.9.21 Roles would be assigned to different engineering/construction/supervising personnel and the inspection and maintenance regimes of sediment and runoff control measures would be adopted during these periods. In extreme cases, the above protocol would dictate that work on-site may have to be temporarily suspended until weather/ground conditions allow.

Water Quality Monitoring

9.9.22 Water quality monitoring during the construction phase would be undertaken for the surface water catchments that serve the Proposed Development to ensure that none of the tributaries of the main channels are carrying pollutants or suspended solids. Monitoring would be carried out at a specified frequency (depending upon the construction phase) on these catchments.

9.9.23 This monitoring would continue throughout the construction phase and immediately post construction. Monitoring would be used to allow a rapid response to any

pollution incident as well as assess the efficacy of good practice or remedial measures. Monitoring frequency would increase during the construction phase if remedial measures to improve water quality were implemented. Detailed water quality monitoring plans would be developed during detailed design. South and East Ayrshire Council, SEPA, Marine Scotland, and Ayrshire Rivers Trust would be consulted on the plans and would be contained within the final CEMP.

9.9.24 The performance of the good practice measures would be kept under constant review by the water monitoring programme, based on a comparison of data taken during construction with a baseline data set, sampled prior to the construction period.

Pollution Risk

9.9.25 Good practice measures in relation to pollution prevention would include the following:

- refuelling would take place at least 50 m from watercourses and where possible it would not occur when there is risk that oil from a spill could directly enter the water environment. For example, periods of heavy rainfall or when standing water is present would be avoided;
- foul water generated on-site would be managed in accordance with best practice and be drained to a sealed tank and routinely removed from site;
- drip trays would be placed under vehicles which could potentially leak fuel/oils when parked;
- areas would be designated for washout of vehicles which are a minimum distance of 50 m from a watercourse;
- washout water would also be stored in the washout area before being treated and disposed of;
- if any water is contaminated with silt or chemicals, run-off would not enter a watercourse directly or indirectly without treatment;
- water would be prevented as far as possible, from entering excavations;
- procedures would be adhered to for storage of fuels and other potentially contaminative materials in line with the CAR to minimise the potential for accidental spillage; and
- a plan for dealing with spillage incidents would be designed prior to construction, and this would be adhered to should any incident occur, reducing the effect as far as practicable. This would be included in the final CEMP.

9.9.26 Site investigation (e.g., trial pitting and/or boreholes) would be undertaken prior to any construction works where excavation would be required to establish the wind farm and it would inform detailed design and construction methods to ensure pollution risk is considered prior to construction. These methods would be specified in the final CEMP.

Erosion and Sedimentation

9.9.27 Good practice measures for the management of erosion and sedimentation would include the following:

- all stockpiled materials would be located out with a 50 m buffer from watercourses, including on up gradient sides of tracks and battered to limit instability and erosion;
- stockpiled material would either be seeded or appropriately covered, minimising the area of exposed bare ground;
- monitoring of stockpiles/excavation areas during rainfall events;
- water would be prevented as far as possible, from entering excavations through the use of appropriate cut-off drainage;
- where this is not possible, water that enters excavations would pass through a number of settlement lagoons and silt/sediment traps to remove silt prior to discharge into the surrounding drainage system. Detailed assessment of ground conditions would be required to identify locations where settlement lagoons would be feasible;
- clean and dirty water on-site would be separated, and dirty water would be filtered before entering the stream network;
- if the material is stockpiled on a slope, silt fences would be located at the toe of the slope to reduce sediment transport;
- the amount of ground exposed, and time period during which it is exposed, would be kept to a minimum and appropriate drainage would be in place to prevent surface water entering deep excavations;

- a design of drainage systems and associated measures to minimise sedimentation into natural watercourses would be developed - this may include silt traps, check dams and/or diffuse drainage;
- silt/sediment traps, single size aggregate, geotextiles or straw bales would be used to filter any coarse material and prevent increased levels of sediment. Further to this, activities involving the movement or use of fine sediment would avoid periods of heavy rainfall where possible; and
- construction personnel and the Principal Contractor would carry out regular visual inspections of watercourses to check for suspended solids.

Fluvial Flood Risk

9.9.28 Sustainable Drainage Systems (SuDS) would be incorporated as part of the Proposed Development.

9.9.29 SuDS techniques aim to mimic pre-development runoff conditions and balance or throttle flows to the rate of run-off that might have been experienced at the Proposed Development prior to development. Good practice in relation to the management of surface water run-off rates and volumes and potential for localised fluvial flood risk would include the following:

- drainage systems would be designed to ensure that any sediment, pollutants, or foreign materials which may cause blockages are removed before water is discharged into a watercourse;
- on-site drainage would be subject to routine checks to ensure that there is no build-up of sediment or foreign materials which may reduce the efficiency of the original drainage design causing localised flooding;
- appropriate drainage would attenuate run-off rates and reduce runoff volumes to ensure minimal effect upon flood risk;
- where necessary, check dams would be used within cable trenches in order to prevent trenches developing into preferential flow pathways and trenches shall be backfilled with retained excavated material; and
- as per good practice for pollution and sediment management, prior to construction, section specific drainage plans would be developed, and construction personnel made familiar with the implementation of these.

9.9.30 Further information on ground conditions and drainage designs would be provided in the final CEMP.

Water Abstractions

9.9.31 Any water abstraction would only be made with authorisation from SEPA and in accordance with the CAR.

9.9.32 Good practice that would be followed in addition to the CAR Licence regulations includes:

- water use would be planned so as to minimise abstraction volumes;
- water would be re-used where possible; and
- abstraction volumes would be recorded.

Watercourse Crossings

9.9.33 Two upgrades to existing watercourse crossings and two new watercourse crossings are required for the Proposed Development as detailed within Appendix 9.4.

9.9.34 The crossings would be designed to pass the 200-yr flood event and detailed design details would be agreed with South and East Ayrshire Council and SEPA as part of the final CEMP.

9.10 Assessment of Residual Effects

Construction

Generation of Pollution

9.10.1 The magnitude of a pollution event on peat soils, peat, groundwater and surface water is considered Negligible adverse following adherence to the good practice measures detailed in this chapter and implementation of the CEMP. The potential effect of a Negligible adverse magnitude event on these receptors of High sensitivity would be Moderate/Minor and not significant, therefore no further mitigation measures are required.

Erosion and Sedimentation

9.10.2 After consideration of good practice measures, the magnitude of impact associated with erosion and sedimentation is assessed as Negligible adverse and, therefore, with reference to the High sensitivity receptors described previously, the significance of effect without mitigation is assessed as Moderate/Minor and not significant. No further mitigation measures required.

Drainage and Dewatering

9.10.3 The sensitivity of the groundwater and surface water has been assessed as being High. With mitigation the magnitude of impact from drainage and dewatering is

assessed as Negligible adverse, therefore the potential significance of the effect of changing groundwater levels and flow due to dewatering or altering existing surface water drainage paths is considered Moderate/Minor, and therefore not significant and requires no further mitigation.

Operation

9.10.4 No significant effects are predicted during the operational phase of the proposed development.

Decommissioning

9.10.5 Potential residual decommissioning effects would be the same as potential residual construction effects. Mitigation specified for the construction phase of the project is applicable for the decommissioning phase.

9.10.6 The magnitude of a pollution event, erosion or sedimentation, drainage and dewatering on peat soils, peat, groundwater and surface water is considered Negligible adverse following adherence to the good practice measures detailed in this chapter and implementation of the CEMP. The potential effect of Negligible adverse magnitude event on High sensitivity receptors would be Moderate/Minor and not significant. No further mitigation measures are required.

9.11 Assessment of Cumulative Effects

Residual Cumulative Construction Effects

9.11.1 The magnitude of cumulative effect interactions and in-combination effects associated with pollution events, erosion or sedimentation, drainage and dewatering on peat soils, peat, groundwater, and surface water is considered Negligible adverse following adherence to the good practice measures detailed in this chapter and implementation of the CEMP. The potential effect of a Negligible adverse magnitude event on receptors of High sensitivity would be Moderate/Minor and not significant. No further mitigation measures are therefore required.

Residual Cumulative Operational Effects

9.11.2 No mitigation is required as there are no predicted significant cumulative operational effects as a result of operation of the Proposed Development with other developments in the area.

Residual Cumulative Decommissioning Effects

9.11.3 The magnitude of cumulative effect interactions and in-combination effects during decommissioning associated with pollution events, erosion or sedimentation, drainage and dewatering on peat soils, peat, groundwater, and surface water is considered Negligible adverse following adherence to the good practice measures detailed in this chapter and implementation of the CEMP. The potential effect of a Negligible adverse magnitude event on receptors of High sensitivity would be Moderate/Minor and not significant. No further mitigation measures are therefore required.

9.12 Summary

9.12.1 This chapter presents a detailed review of the Proposed Development Area geology, hydrology, and hydrogeology setting. The review has included data and information held by SAC, EAC and SEPA and as well as the findings from detailed and site specific field investigations.

9.12.2 The proven baseline conditions have informed the Proposed Development design. For example, areas of deep peat have been avoided, a standoff to watercourses has been provided and the number of required watercourse crossings has been minimised.

9.12.3 The location of private water supplies have been confirmed and none of the Proposed Development is in the water catchments to these. It has also been shown that there are no designated sites near the Proposed Development are hydraulically connected to the Proposed Development. Potential GWDTE has been identified and the source of water that sustains this habitat has been confirmed as surface water, not ground water.

9.12.4 This chapter has demonstrated that the effects of the Proposed Development would not have significant effects on soils, geology and water. The lack of significant effects relates primarily to the proposed ‘Good Practice Measures’ and the site design, which effectively act as ‘embedded’ mitigation.

9.12.5 Table 9.8 presents a summary of residual effects with regard to geology (inc. soils and peat), hydrogeology and hydrology (the water environment).

Table 9.7 - Summary of Residual Effects

Description of Effect	Significance of Likely Effect		Mitigation Measure	Significance of Residual Effect	
	Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse
Construction					
Pollution Erosion and Sedimentation Drainage and Dewatering	Moderate / Minor and not significant	Adverse	• **good practice techniques** • **confirmatory water quality monitoring of principal watercourses**	Moderate / Minor and not significant	Adverse
Operation					
Pollution Erosion and Sedimentation Infrastructure and Man-made Drainage	Moderate / Minor and not significant	Adverse	• **no additional mitigation measures required**	Moderate / Minor and not significant	Adverse
Decommissioning					
Same as construction effects					

9.12.6 It has been proposed in the final CEMP that a programme of water monitoring is undertaken prior to any construction activity and during construction of the Proposed Development. It is expected that the monitoring programme would be agreed with the local planning authorities in consultation with SEPA, NatureScot and Ayrshire Rivers Trust and would include monitoring watercourses within and downstream of the Proposed Development.

9.12.7 It is expected the scope of the monitoring programme would be secured by an appropriately worded planning condition.

9.12.8 As detailed in the PLHRA (Technical Appendix 9.1) it is proposed a geotechnical risk register is maintained during the construction and post-construction phases of the Proposed Development. It is expected that this would be maintained by the Applicant, and again, secured by an appropriately worded planning condition.

9.12.9 During and following construction the drainage measures deployed at Proposed Development (temporary and permanent) would be subject to routine inspection by the dedicated site ECoW and Applicant as specified in the final CEMP and which would be secured by an appropriately worded planning condition.

9.12.10 The performance of the good practice measures would be kept under constant review by the water monitoring programme, based on a comparison of data taken during construction with a baseline data set, sampled prior to the construction period.

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10 Forestry

10.1 Introduction

10.1.1 This chapter considers the potential implications of the Proposed Development on the woodland resource within the Proposed Development Area and its long-term management. This chapter was prepared by DGA Forestry LLP.

10.1.2 Forestry is not being regarded as a receptor for EIA purposes. Commercial forests are dynamic and their structure continually undergoes change due to:

- normal felling and restocking by the landowner;
- natural events, such as storm damage, pests or diseases; and
- external factors, such as a wind farms or other development.

10.1.3 This chapter therefore describes:

- the plans as a result of the Proposed Development for felling, restocking and forest management practices;
- the process by which these were derived; and
- the changes to the physical structure of the forestry within the Proposed Development Area.

10.1.4 It further discusses the issue of forestry waste arising from the Proposed Development. The forestry proposals are interrelated with environmental effects, which are assessed separately in the EIA Report. This chapter should therefore be read in conjunction with the EIA Report chapters, for example, Chapter 3: Design Evolution and Alternatives; Chapter 5: Landscape & Visual Impact Assessment; Chapter 7: Ecology Assessment; Chapter 8 Ornithology Assessment; and Chapter 9: Geology, Hydrology and Hydrogeological Assessment as they are interrelated to the proposed changes in the forest structure.

10.1.5 The responsibility for the management of the remainder of the forest outwith the Proposed Development lies with the landowner and therefore the wider felling operations, restocking, and aftercare operations do not form part of the Proposed Development for which consent is sought.

10.1.6 The Proposed Development (as shown in Figure 1.3) lies mainly within existing commercial forestry plantations. The woodlands are privately owned and managed. The forestry proposals have been developed to:

- Identify areas of forest to be removed for the construction and operation of the Proposed Development;
- Identify those areas which may or may not be replanted as part of the Proposed Development; and
- Propose management practices for the forestry works.

10.1.7 In general, throughout this chapter data labelled "baseline" refers to the current crop composition and any existing plans without any modification as a result of the Proposed Development. Data labelled "windfarm" or “Proposed Development” refers to the forestry plans incorporating the Proposed Development.

10.1.8 This chapter is structured as follows:

- Legislation, Policy and Guidance;
- Forestry Study Area;
- Forest Plans;
- Development of the Wind Farm Forest Plan;
- Baseline Conditions;
- Wind Farm Forest Plan;
- Requirement for Compensatory Planting;
- Forestry Waste;
- Forestry Management Practices; and
- Summary.

10.2 Legislation, Policy and Guidance

10.2.1 Relevant overarching planning policies for the Proposed Development are detailed within the Planning Statement that accompanies the application. A desktop study was undertaken drawing upon published National, Regional and local level publications, assessments and guidance to establish the broad planning and forestry context within which the Proposed Development is located.

10.2.2 Forestry related policies and documents listed below have been considered within the forestry assessment. The following section provides an outline of those planning policies which are relevant to the Proposed Development, and in particular to forestry.

Forestry and Land Management (Scotland) Act 2018

10.2.3 Until 1st April 2019, the Scottish Ministers owned the National Forest Estate (NFE), provided funding and had responsibility for forestry strategy and policy, but the management of the NFE and delivery of forestry functions had been the responsibility of the Forestry Commissioners.

10.2.4 The Forestry Commission was a cross-border public authority and a UK non-ministerial department with a statutory Board of Commissioners. The Commission was made up of a number of parts, including in Scotland:

- Forest Enterprise Scotland (FES), which carried out forestry operations and managed the NFE on Scottish Ministers' behalf; and
- Forestry Commission Scotland (FCS), which was responsible for the other forestry functions in Scotland.

10.2.5 When full devolution of forestry to the Scottish Government was completed on 1 April 2019, FCS and FES became two new agencies of the Scottish Government:

- Scottish Forestry (SF), responsible for regulatory, policy and support functions; and
- Forestry and Land Scotland (FLS), responsible for the management of the NFE and any other land managed for the purposes of the Forestry and Land Management (Scotland) Act 2018.

10.2.6 With the introduction of the Forestry and Land Management (Scotland) Act 2018[1] and its associated Regulations on April 1st 2019, the old regulatory regime of felling control under the Forestry Act 1967[2] was repealed in Scotland. From 1 April 2019, anyone wishing to fell trees in Scotland requires a Felling Permission issued by SF, unless an exemption applies or another form of felling approval such as a felling licence (including a forest plan) has previously been issued.

10.2.7 Under the new Regulations felling which is authorised by planning permission consent continues to be exempt from the Regulations and does not require a Felling Permission issued by SF.

Scotland's Forestry Strategy 2019 - 2029

10.2.8 Scotland's Forestry Strategy 2019 – 2029 (SFS)[3], was published in 2019 after a consultation period. The strategy provides an overview of contemporary Scottish forestry; presents the Scottish Government's 50-year vision for Scotland's forests and woodlands; and sets out a 10-year framework for action.

10.2.9 The vision is that *"...in 2070, Scotland will have more forests and woodlands, sustainably managed and better integrated with other land uses. These will provide a more resilient, adaptable resource, with greater natural capital value, that supports a strong economy, a thriving environment, and healthy and flourishing communities."*

10.2.10 It lists a number of objectives summarised below:

- Increase the contribution of forests and woodlands to Scotland's sustainable and inclusive economic growth;
- Improve the resilience of Scotland's forests and woodlands and increase their contribution to a healthy and high quality environment; and
- Increase the use of Scotland's forest and woodland resources to enable more people to improve their health, well-being and life chances.

10.2.11 It further describes the priorities as:

- Ensuring forests and woodlands are sustainably managed;
- Expanding the area of forests and woodlands, recognising wider land-use objectives;
- Improving efficiency and productivity, and developing markets;
- Increasing the adaptability and resilience of forests and woodlands;
- Enhancing the environmental benefits provided by forests and woodlands; and
- Engaging more people, communities and businesses in the creation, management and use of forests and woodlands.

10.2.12 There are ambitious targets included within the strategy for new woodland creation:

- 10,000 ha per year in 2018;
- 12,000 ha per year from 2020/21;
- 14,000 ha per year from 2022/23; and
- 15,000 ha per year from 2024/25.

10.2.13 The stated objective is to increase Scotland's woodland cover from the current 18.5% to 21% by 2032.

Scotland's Third Land Use Strategy 2021 - 2026

10.2.14 Scotland's Third Land Use Strategy 2021 – 2026[4] stresses the importance of forestry in the balancing the demands on land use in Scotland and its transition to a net zero economy. It states: *"…there will need to be a significant land use change from current uses to forestry and peatland restoration."* This will involve rapidly increasing the pace of woodland and forest creation. To support this, Scotland's Forestry Strategy 2019 – 2029 emphasises the continued protection of Scotland's forest resource.

Third National Planning Framework

1 The Scottish Government (2018). The Forestry and Land Management (Scotland) Act 2018, Edinburgh. Available at http://www.legislation.gov.uk/asp/2018/8/contents/enacted

2 UK Government (1967). Forestry Act 1967 (as amended). HMSO, London. Available at https://www.legislation.gov.uk/ukpga/1967/10/contents

3 The Scottish Government (2019). Scotland's Forestry Strategy 2019 -2029, Edinburgh.

4 Scottish Government (2021): Scotland's Third Land Use Strategy 2021 - 2026 https://www.gov.scot/publications/scotlands-third-land-use-strategy-2021-2026-getting-best-land/

10.2.15 Scotland's Third National Planning Framework (NPF3)[5] recognises that woodlands and forestry are an economic resource, as well as an environmental asset (NPF3 Paragraph 4.2). It further supports the continued expansion of Scotland's woodland and forestry resource (NPF3 Paragraph 4.23). A key action of NPF3 (NPF3 Paragraph 6.10) is a commitment to create on average 10,000 ha per annum of new woodland from 2015 onwards, a target which has been superseded by the Scottish Forestry Strategy.

Fourth National Planning Framework

10.2.16 The Scottish Government issued a draft consultation of Scotland 2045: Our Fourth National Planning Framework[6] on 10th November 2021. The document, in particular Policy 19: Green Energy refers to supporting the creation of new renewable energy developments as well as repowering and extension of existing wind farm. The document Under Policy 34: Trees, woodland and forestry the states:

- Local development plans should identify and protect existing woodland and potential for its enhancement or expansion
- Development proposals involving woodland removal should only be permitted where it would achieve significant and clearly defined additional public benefits. Where woodland is removed in association with development, developers will generally be expected to provide compensatory planting.
- Development proposals should not be supported where they would result in:
  - any loss of ancient woodlands, ancient and veteran trees, or adverse impact on their ecological condition;
  - adverse impacts on native woodlands, hedgerows and individual trees of high biodiversity value or identified for protection in the Forestry and Woodland Strategy;
  - fragmenting or severing woodland habitats, unless mitigation measures are identified and implemented;
  - conflict with Restocking Direction, Remedial Notice or Registered Notice to Comply issued by the Scottish Government Forestry Regulator, Scottish Forestry.

10.2.17 The document therefore supports the Scottish Government's other policies on the protection of the existing woodland resources.

Scottish Planning Policy

10.2.18 The Scottish Planning Policy (SPP)[7] includes a section on woodlands (SPP Paragraphs 216 - 218). This refers to the Scottish Government's Control of Woodland Removal Policy (Forestry Commission Scotland, 2009) which is discussed in more detail below. The SPP states that woodland removal should only be permitted where it would achieve significant and clearly defined additional public benefits. It further states that where woodland is removed in association with development proposals, developers will generally be expected to provide compensatory planting and that the acceptability of woodland removal, in the context of the Control of Woodland Removal Policy, should be taken into account in determining applications.

Right Tree in the Right Place

10.2.19 Right Tree in the Right Place - Planning for Forestry & Woodlands[8] sets out detailed guidance to planning authorities when considering development proposals involving forestry and woodland. It advises that planning authorities should:

- Assess the current and likely future public benefits (social, economic and environmental) deriving from the existing woodland;
- Determine whether the development should be modified or the woodland redesigned to avoid or reduce woodland loss (e.g. by accommodating new development within 'open space' within woodlands);
- Where woodland loss cannot be avoided, assess the public benefit of the proposed development to see if it would justify the loss of the woodland;
- Consider whether any loss of woodland should be mitigated by compensatory planting; and
- Consider whether any felling consent needs to specify the timing of forestry operations to avoid disturbance to wildlife present on the Site.

10.2.20 If an authority decides that a development proposal involving woodland loss should receive planning permission, it should specify the precise area of felling permitted and ensure that planning conditions and/or agreements would ensure the provision of any compensatory planting which is required.

Control of Woodland Removal Policy

10.2.21 In parallel with the SFS and other national policies on woodland expansion, there is a strong presumption against permanent deforestation unless it addresses other environmental concerns. In Scotland, such deforestation is dealt with under the

[5] The Scottish Government (2014). Scotland's Third National Planning Framework (NPF3). Edinburgh.
[6] Scottish Government (2021): Scotland 2045: Our Fourth National Planning Framework. Available at https://www.gov.scot/publications/scotland-2045-fourth-national-planning-framework-draft/
[7] The Scottish Government (2014). Scottish Planning Policy. Edinburgh.
[8] Forestry Commission Scotland (2010): Right Tree in the Right Place - Planning for Forestry & Woodlands. Forestry Commission, Edinburgh.

Scottish Government's 'Control of Woodland Removal Policy'[9]. The guidance relating to the implementation of the policy was revised and updated in 2019[10].

10.2.22 The purpose of the policy is to provide direction for decisions on woodland removal in Scotland. The policy document lays out the background to the policy, places it into the current policy and regulatory context, and discusses the principles, criteria and process for managing the policy implementation. The following paragraphs summarise the policy relevant to the Proposed Development.

10.2.23 The principal aims of the policy include:

- To provide a strategic framework for appropriate woodland removal; and
- To support climate change mitigation and adaptation in Scotland.

10.2.24 The guiding principles behind the policy include:

- There is a strong presumption in favour of protecting Scotland's woodland resources; and
- Woodland removal should be allowed only where it would achieve significant and clearly defined additional public benefits. In appropriate cases, a proposal for compensatory planting may form part of this balance.

10.2.25 Woodland removal, without a requirement for compensatory planting, is most likely to be appropriate where it would contribute significantly to:

- Enhancing priority habitats and their connectivity;
- Enhancing populations of priority species;
- Enhancing nationally important landscapes, designated historic environments and geological sites of special scientific interest (SSSI);
- Improving conservation of water or soil resources; or
- Public safety.

10.2.26 Woodland removal, with compensatory planting, is most likely to be appropriate where it would contribute significantly to:

- Helping Scotland mitigate and adapt to climate change;
- Enhancing sustainable economic growth or rural/community development;
- Supporting Scotland as a tourist destination;
- Encouraging recreational activities and public enjoyment of the outdoor environment;
- Reducing natural threats to forests or other land; or
- Increasing the social, economic or environmental quality of Scotland's woodland cover.

10.2.27 The consequences of the policy are stated as:

- Minimising the inappropriate loss of woodland cover in Scotland;
- Enabling appropriate woodland removal to proceed with no net loss of woodland -related public benefits other than in those circumstances detailed in the policy; and
- Facilitating achievement of the Scottish Government's woodland expansion ambition in a way that integrates with other policy drivers (such as increasing sustainable economic growth, tackling climate change, rural/community development, renewable energy and biodiversity objectives).

10.2.28 Addressing the policy requirements can be met through changes to forest design, increasing designed open space, changing the woodland type, changing the management intensity, or completing off site compensation planting.

The Ayrshire and Arran Forestry and Woodland Strategy

10.2.29 The approved Ayrshire and Arran Forestry and Woodland Strategy (AAFWS)[11] was launched in October 2014 (Ayrshire Joint Planning Unit, 2014). It supports national policies whilst integrating with other Ayrshire Councils' strategies and plans. The strategy is intended to guide woodland management and expansion in Ayrshire and Arran, providing a policy and a spatial framework to maximise the contribution of woodland and forestry to the people, environment and economy of the region.

10.2.30 The strategy forms statutory Supplementary Guidance to the three Ayrshire Local Proposed Development Plans. It is therefore a material consideration in planning decisions involving Proposed Development proposals affecting woodland. The strategy supports Scottish Ministers' desire to see an expansion in woodland cover, delivering multiple benefits across the country. It forms statutory Supplementary Guidance to the three Ayrshire Local Proposed Development Plans.

10.2.31 In parallel with national policies, there is a presumption against woodland loss. It is recognised that there has been pressure on woodland cover in the regions due to development, principally wind farms. Under the theme of "Climate Change" the strategy states that one of the key priorities is to ensure that reductions in woodland cover resulting from restructuring and development are more than compensated by

[9] Forestry Commission Scotland (2009). The Scottish Government's Policy on Control of Woodland Removal. Edinburgh.

[10] Forestry Commission Scotland (2019): Scottish Government's policy on control of woodland removal: implementation guidance. Available at https://forestry.gov.scot/publications/349-scottish-government-s-policy-on-control-of-woodland-removal-implementation-guidance

[11]

new woodland creation elsewhere within Ayrshire and Arran. This in turn leads to a number of Priority Key Actions including:

- CC1: Implement the woodland removal policy, with compensation planting required within Ayrshire and Arran; and
- CC5: Facilitate renewable energy development.

10.2.32 The strategy also recognises the importance of peatlands in the region many of which were planted with conifer forests. This results in a further Priority Key Action:

- CC7: Encourage the restoration of peatlands during forest redesign and restructuring in locations with suitable hydrological and soil and vegetation conditions.

10.2.33 The strategy sets out regional priorities for woodland expansion and management by broad landscape zones. The Proposed Development falls within the Ayrshire Uplands zone. Within this zone one of the key issues identified is the pressure for wind farm development and the importance of securing appropriate compensatory planting where net woodland removal takes place. The priorities in existing woodlands include:

- The management, expansion and linking of existing native and mixed woodlands within the river valleys; and
- Ensuring any reductions in the extent of woodland resulting from restructuring or wind energy development are compensated within Ayrshire where required by the Scottish Government Policy on the Control of Woodland Removal.

10.2.34 As the Ayrshire Upland zone already holds such a significant proportion of the region's woodlands, it is considered that ensuring an appropriate balance of land uses, particularly in relation to wind energy proposals, will be a key consideration. It is felt likely that much of the woodland expansion into this zone will largely be compensating for losses elsewhere due to wind energy development and restructuring of existing forests.

10.3 Forestry Study Area

10.3.1 The Forestry Study Area (FSA), as shown on Figure 10.1, extends to approximately 650.1 ha and comprises of privately owned and managed woodlands within the Proposed Development Area. The forestry consists of three contiguous woodlands under two separate ownerships. High Keirs Forest covers 311.9 ha and has a separate landowner to Sclenteuch and Lamerty Forest, which cover 338.2 ha. There is an active Forest Plan on High Keirs which expires in 2025. There is an expired Forest Plan on Sclenteuch and Lamerty Forest which expired in 2020 and at the time of preparing this chapter has not been renewed. The forests lie outwith the boundary of the larch dieback disease (*Phytophthora ramorum*) management zone and have been issued with Statutory Plant Health Notices for the clearance of infected larch.

10.3.2 There is a smaller, younger block of woodland forestry on Keirs Estate which is not covered by any management plan, nor affected by the Proposed Development so has been omitted from this assessment.

10.3.3 The forests contain a range of woodland types due to the original planting programme together with areas of unplantable land and open ground. The crops are comprised largely of commercial conifers with areas of both mixed conifers and mixed broadleaves and open ground. The woodlands are currently within the felling and restocking phase. There has also been limited felling to comply with Statutory Plant Health Notices served on diseased larch within the woodlands. Further information on the composition of the woodlands in the FSA is provided in the baseline description below.

10.4 Forest Plan

10.4.1 One of the original key objectives of the Forestry Commission was forest expansion, in both state and private forests, to produce a strategic reserve of timber, and consequently, a limited range of species was planted. More recently, greater emphasis has been placed on developing multi-purpose forests, which require a restructuring of age and species in existing woodlands. Restructuring is achieved through the forest planning process.

10.4.2 A Forest Plan relates to individual forests or groups of woodlands. It describes the woodlands, places them in context with the surrounding area, and identifies issues that are relevant to the woodland or forest. Forest Plans describe how the long-term strategy would meet the management objectives of the owner, the criteria of the UK Forestry Standard (UKFS)[12] and the UK Woodland Assurance Standard 4th Edition (UKWAS)[13], under which the woodlands would be managed if certificated.

10.4.3 The Forest Plan involves a scoping exercise whereby the views of Statutory Consultees, neighbours and stakeholders are sought, resulting in an agreed Scoping

[12] Forestry Commission (2017). The UK Forestry Standard: The Government's Approach to Sustainable Forestry, Forestry Commission, Edinburgh.

[13] UKWAS (2018). The UK Woodland Assurance Standard Fourth Edition, UKWAS, Edinburgh.

Report. The results of the scoping exercise are incorporated into the Forest Plan. The Forest Plan covers social and environment aspects, such as conservation, archaeology, landscape and the local community, in addition to forestry and silvicultural considerations.

10.4.4 Restructuring of age class and species are important factors in this process to ensure proposals meet the current standards. A Wind Farm Forest Plan is prepared along the same principles with the relevant information being provided by other members of the project team. A Forest Plan without wind farm will typically contain felling and restocking proposals covering a 10 year period in detail, with outline proposals for the remainder of the forest.

10.4.5 Restructuring presents forest managers with many challenges and opportunities, particularly in relation to the management of potential catastrophic wind blow due to storm damage. The forest planning process allows forest managers to review and revise proposals in a structured way to take account of such external factors. The inclusion of a wind farm within the forest is an example of one such external factor.

10.4.6 The current guidelines require diversification of species and woodland types as part of the forest planning process, specifically an increase in the proportion of broadleaf woodland, other conifers, and open ground. The incorporation of the Proposed Development into the forest would result in further restructuring of the forests.

10.4.7 As discussed above, High Keirs Forest is covered by Forest Plan submitted by the landowner and approved by Scottish Forestry, Case Reference: 4893521. The Forest Plan covering Sclenteuch and Lamerty expired in 2021.

10.5 Development of a Wind Farm Forest Plan

Introduction

10.5.1 This section describes the process by which a Wind Farm Forest Plan is prepared. Existing crop information would be collated from the landowner current forestry information, field surveys and a desk based assessment as necessary, including species, planting year and felling and restocking plans where available.

10.5.2 Details of wind turbine locations, new tracks, storage compounds, borrow pits, substation compound and other infrastructure would be provided by other disciplines within the project team. This data would then be amalgamated with the forestry data to construct the forestry proposals for the Proposed Development.

10.5.3 The location of wind turbines and infrastructure is heavily influenced by environmental constraints and technical considerations, e.g. sensitive habitats, wind capture, ground conditions, etc. The final location of wind turbines and infrastructure takes the various site constraints into consideration. Land management requirements associated with the construction of the Proposed Development would also be incorporated into the forestry proposals, where appropriate.

10.5.4 The felling programme for the Proposed Development would largely be driven by technical constraints both forestry and development. Within forests and woodlands, areas of crop may require to be felled to accommodate the construction and operation of the Proposed Development.

10.5.5 Taking into account the ecological constraints as mentioned in Chapter 7 : Ecology, a 2.9ha (97m radius) keyhole was adopted around wind turbines numbered 1-4 and wind turbine 8 and a 1.76ha (75m radius) keyhole was adopted around all other wind turbine locations. These keyholes differ due to the varied height of the wind turbines, with the larger keyholes around the shorter wind turbines. These keyholes are for construction, operation and environmental mitigation.

10.5.6 There would be an area of additional disturbance at each wind turbine location with a 75m keyhole, which would be required to accommodate the infrastructure required for the erection of the proposed wind turbines in this case.

10.5.7 A 10m buffer will be applied around each other item of temporary and permanent infrastructure, in addition to the area required for the infrastructure. An indicative 30m corridor has been applied to all new access tracks and upgraded existing tracks to be used for wind turbine delivery and construction purposes. This would be reviewed at the detailed design stage post consent and prior to construction. Please refer to Chapter 2: Proposed Development which contains information on all the infrastructure elements.

Wind Farm Felling Plan

10.5.8 Felling required for a development can be divided into two categories.

- Firstly, that required during the construction phase of the Proposed Development, which for the purposes of this assessment has been anticipated as commencing in 2025;
- Secondly, felling required during the operational period of the Proposed Development. In this case there is no felling required out with that required for the construction phase.

10.5.9 The crops were assessed to identify those areas which would require to be felled for a number of reasons as described above. Due to the crop growth rates and current crop height, it has been assessed that the infrastructure within woodland areas would require a combination of keyholing into younger crops and in the mature

crops, clear felling of entire coupes back to either a wind firm edge or management boundaries. Where entire coupes are to be felled, the infrastructure would be incorporated into the Wind Farm Restocking Plan as described below.

10.5.10 Additional minor felling would be required for forest management purposes, for example, to reduce the risk of subsequent windblow; to reduce coupe isolation and fragmentation; and to ensure access for future forest operations.

10.5.11 In addition, a small area of crop around Turbine 6 is to be felled for habitat management purposes (forest to bog proposals) as described in Chapter 7: Ecology Assessment.

10.5.12 The resultant wind farm felling plan shows which woodlands within the FSA would be felled as a result of the Proposed Development and when this felling would take place.

Wind Farm Species Restocking Plan

10.5.13 The wind farm species restocking plan shows which woodlands would be restocked and with which species. The majority of the areas to be felled for the Proposed Development would be restocked except for the areas detailed below:

- Land required for the Proposed Development's permanent infrastructure subject to the buffer zones described above; and
- Land to be left unplanted for forest management; or forest design purposes.

10.5.14 It has been assumed that, where possible, some temporary infrastructure such as edges of re-profiled borrow pits would be re-instated and available for restocking post construction. To ensure that the forestry establishes successfully, the soil should be restored to a depth of 1m.

10.5.15 In preparing Wind Farm Restocking Plan, a number of points would be considered as detailed below:

- Fragmentation of coupes to be minimised as much as possible;
- Coupe shapes would be modified to ensure that access for future forestry operations, principally harvesting, is maintained; and
- Coupe shapes and edges would be modified to follow good practice.

10.5.16 Species composition was considered taking into account the Proposed Development operational objectives, landowner objectives and forestry policies.

10.5.17 The forestry proposals have been assessed by each of the separate environmental disciplines / consultants as part of the EIA process (as mentioned above), and the effects are reported in individual chapters of this EIA Report and their supporting appendices.

10.6 Baseline Conditions

Baseline Planting Year/Age Class Structure

10.6.1 Many woodlands established in the mid to late 1900's, were planted in large contiguous blocks, often over a limited number of years and with a limited range of species. Such woodlands develop poor structural diversity, especially on upland sites. Restructuring the age class and species of such forests is desirable and would yield both forest management and environmental benefits.

10.6.2 The woodlands within the FSA have limited structural diversity as described above, however the restructuring process is underway through felling and restocking. The age class is detailed below in Table 10.1: Baseline Age Class Composition and shown in Figure 10.2.

Table 10.1: Baseline Age Class Composition

Age	Area (ha)	Area (%)
n/a	106.0	16.3
<5 years	130.5	20.1
5-10 years	147.0	22.6
30+ years	93.3	14.4
40+ years	173.2	26.6
Total	650.1	100.0

10.6.3 The current guidelines contained within the UKFS is that in forests characterised by a lack of diversity due to extensive areas of even-aged trees, stands adjoining felled areas should be retained for 7 years or until the restocking of the first coupe has reached a minimum height of 2m. For planning purposes, this is likely to be between 5 and 15 years depending on establishment success and growth rates. It is recognised that in large even-aged plantations, especially in the uplands, restructuring age class structure to meet this target may take more than one rotation.

Species Composition

10.6.4 The current baseline species composition of the woodlands within the FSA is shown in Figure 10.3 and illustrated in Table 10.2 below.

10.6.5 Please note there may be minor discrepancies in the totals within the tables contained in this chapter. This is due to rounding of the individual values for the different parameters in the database.

Table 10.2: Baseline Species Composition

Species	Area (ha)	Area (%)
Sitka spruce	451.1	69.4
Sitka spruce/Other conifer	9.1	1.4
Other conifer	46.0	7.1
Native broadleaves	15.3	2.4
Native broadleaves/Open ground	0.6	0.1
Open ground	57.7	8.9
Felled (awaiting restock)	70.2	10.8
Total	650.1	100.0

10.6.6 The main species are commercial conifers, principally Sitka spruce, which in pure or mixed stands, accounts for approximately 70% of the total FSA. Other conifers account for 7% of the FSA and broadleaf woodland 2.5%. Open ground accounts for approximately 9%.

10.6.7 The species composition reflects the practice and guidance which prevailed at the time the woodlands were established. Restructuring as part of a long term forest plan would aim to introduce an increased proportion of broadleaves and other conifers into the woodland composition.

Baseline Felling Plan

10.6.8 The baseline felling plan forms part of the current Forest Plans prepared by the forest managers. It considers the requirement to restructure the age class of even aged forests as described above. The baseline felling plan is illustrated in Figure 10.4 and presented in Table 10.3 below. The data is summarised in 5-year bands as per standard practice.

Table 10.3: Baseline Felling Plan

Fell Phase	Area (ha)	Area (%)
No felling	110.1	16.9
Phase 2: 2019-2023	27.6	4.2
Phase 3: 2024-2028	57.2	8.8
Phase 4: 2029-2033	55.0	8.5
Long Term Retention	27.1	4.2
Natural Reserves	10.3	1.6
Outside Plan Period	362.9	55.8
Total	650.1	100.0

10.6.9 A proportion of the FSA is designated as “No Felling” due either to open ground, land awaiting restocking or crops with no felling year assigned.

10.6.10 A large area of the FSA is designated as “Outside Plan Period”. These areas are generally immature crops whose prospective felling year lies outside of the current Forest Plan period. As there is currently no approved felling plan for Sclenteuch and Lamerty Forests, these woodlands have been assigned to Outside Plan Period unless they have been previously identified as Long Term Retentions or Natural Reserves.

10.6.11 Some areas of crop in the baseline felling plan have been assigned a delayed felling age by the forest managers. These areas are Long Term Retentions (LTR), crops to be retained beyond their age of economic or silvicultural maturity for conservation and biodiversity purposes. These woodlands would otherwise be managed as normal and would in due course be felled and replanted. The identification of LTRs is part of the requirements of UKWAS and the UKFS.

10.6.12 Other areas within the FSA have been designated as Natural Reserves (NR). These are areas which are considered of high conservation interest and are managed by minimum intervention unless alternative management has higher conservation or biodiversity value. The identification NRs is part of the requirements of UKWAS and the UKFS.

10.6.13 The baseline felling programme is designed to provide the required separation between felling coupes, where possible. This may take more than one rotation to achieve, especially in the uplands where wind firm boundaries between felling coupes are limited.

Baseline Restocking Species Composition

10.6.14 The baseline restocking species composition as detailed in the baseline Forest Plans is illustrated in Figure 10.5 and outlined in Table 10.4 below.

Table 10.4: Baseline Restocking Species Composition

Species	Area (ha)	Area (%)
Sitka spruce	411.6	63.3
Sitka spruce/Other conifer	37.0	5.7
Other conifer	42.9	6.6
Mixed woodland	6.6	1.0
Native broadleaves	39.8	6.1
Open ground	112.2	17.3
Total	650.1	100.0

10.6.15 The baseline restocking proposals illustrate how the forest would be structured at the end of the Forest Plan period if the entire plans were implemented. Table 10.5

below compares the baseline current species composition and the baseline restocking species composition at the end of the plan period without the implementation of the Proposed Development.

Table 10.5: Comparison of Baseline Species Composition

Species	Baseline Current Species	Baseline Restocking Species	Variance	
	Area (ha)	Area (ha)	Area (ha)	Area (%)
Sitka spruce	451.1	411.6	-39.5	-6.1
Sitka spruce/Other conifer	9.1	37.0	27.9	4.3
Other conifer	46.0	42.9	-3.1	-0.5
Mixed woodland	0	6.6	6.6	1.0
Native broadleaves	15.3	39.8	24.5	3.8
Native broadleaves/open ground	0.6	0	-0.6	-0.1
Open ground	57.7	112.2	54.4	8.4
Felled (awaiting restock)	70.2	0	-70.2	-10.8
Total	650.1	650.1		

10.6.16 The changes between the current baseline current species composition and that contained within the baseline restocking plan are discussed below:

- The proportion of primary conifer crops (Sitka spruce, Sitka spruce/Other conifer) remains roughly the same once restocking of felled areas is taken into account;
- The area of planned open ground increases by 54.4 ha; and
- The area of broadleaf woodland increases by 24.5 ha.

10.6.17 The majority of these changes reflect the ongoing proposed restructuring of the first rotation crops to meet current guidelines and the restocking of land felled and awaiting restocking.

10.7 Proposed Development Forest Plan

Introduction

10.7.1 The effect of the Proposed Development on the structure of the woodlands within the FSA has been compared against the baseline Forest Plan. This has concentrated on changes to the felling and restocking species plans required to accommodate the Proposed Development.

Proposed Development Felling Plan

10.7.2 The Proposed Development Felling Plan is shown in Figure 10.6 and summarised in Table 10.6 below.

Table 10.6: Proposed Development Felling Plan

Fell Phase	Area (ha)	Area (%)
No felling	107.5	16.5
Phase 2: 2019-2023	21.9	3.4
Phase 3: 2024-2028	170.7	26.3
Phase 4: 2029-2033	42.1	6.5
Long Term Retention	21.5	3.3
Natural Reserves	8.4	1.3
Outside Plan Period	278.0	42.8
Total	650.1	100.0

10.7.3 The baseline and Proposed Development felling plans are compared in Table 10.7 below.

Table 10.7: Comparison of Felling Plans

Fell Phase	Baseline Felling Plan	Proposed Development Felling Plan	Variance	
	Area (ha)	Area (ha)	Area (ha)	Area (%)
No felling	110.1	107.5	-2.6	-0.4
Phase 2: 2019-2023	27.6	21.9	-5.7	-0.9
Phase 3: 2024-2028	57.2	170.7	113.5	17.5
Phase 4: 2029-2033	55.0	42.1	-12.9	-2.0
Long Term Retention	27.1	21.5	-5.6	-0.9
Natural Reserves	10.3	8.4	-1.8	-0.3
Outside Plan Period	362.9	278.0	-84.9	-13.1
Total	650.1	650.1		

10.7.4 There would be advanced felling of 113.5 ha during Phase 3: 2024-2028, resulting from the construction of the Proposed Development. This is balanced out by reduced felling in other periods.

Proposed Development Restocking Species Plan

10.7.5 The baseline species plan has been amended to integrate the Proposed Development infrastructure requirements into the forest design and to take account of the site conditions. The Proposed Development restocking species plan is shown in Figure 10.7 and summarised in Table 10.8. Wind farm open ground refers to the permanent loss of crop to permanent infrastructure only of the Proposed Development.

Table 10.8: Proposed Development Restocking Species Composition

Species	Area (ha)	Area (%)
Sitka spruce	368.6	56.7
Sitka spruce/Other conifer	31.6	4.9
Other conifer	39.4	6.1
Mixed woodland	2.1	0.3
Native broadleaves	39.1	6.0
Open ground	115.7	17.8
Wind farm open ground	53.5	8.2
Total	650.1	100.0

10.7.6 The baseline and windfarm restocking species plans have been analysed to assess the changes construction of the Proposed Development would have on the species composition of the forests. These data are presented in Table 10.9.

Table 10.9: Restocking Species Plan Comparison

Species	Baseline Restocking Species Area (ha)	Development Restocking Species Area (ha)	Variance Area (ha)	Variance Area (%)
Sitka spruce	411.6	368.6	-43.0	-6.6
Sitka spruce/Other conifer	37.0	31.6	-5.4	-0.8
Other conifer	42.9	39.4	-3.6	-0.5
Mixed woodland	6.6	2.1	-4.5	-0.7
Native broadleaves	39.8	39.1	-0.6	-0.1
Open ground	112.2	115.7	3.6	0.5
Wind farm open ground	0	53.5	53.5	8.2
Total	650.1	650.1		

10.7.7 The change in area of stocked woodland in the forests due to the Proposed Development is shown in Table 10.10 below.

Table 10.10: Stocked Woodland Area Comparison

Woodland Type	Baseline Restocking Species Area (ha)	Wind farm Restocking Species Area (ha)	Variance Area (ha)	Variance Area (%)
Stocked	537.9	480.8	-57.1	-8.8
Unstocked	112.2	169.3	57.1	8.8
Total	650.1	650.1		

10.7.8 The changes in the structure of the woodlands are discussed below. The changes refer to a comparison of the Proposed Development restocking species plan against the baseline restocking species plan:

- there would be a net reduction in the area of conifer woodland of 52 ha;
- broadleaf woodland would decrease by 0.6 ha;
- open ground as part of the forest design would increase by 3.6 ha;
- Long term wind farm permanent open ground would total 53.5 ha; and
- the net reduction in stocked woodland area within the FSA would be 57.1 ha equivalent to 8.8% of the FSA.

10.8 Requirement for Compensatory Planting

10.8.1 As a result of the construction of the Proposed Development, there would be a net loss of woodland area. The area of stocked woodland in the study area would decrease by 57.1 ha.

10.8.2 In order to comply with the criteria of the Scottish Government's Control of Woodland Removal Policy, compensation planting would be required. The Applicant is committed to providing appropriate compensatory planting. The extent, location and composition of such planting to be agreed with SF, taking into account any revision to the felling and restocking plans prior to the commencement of construction of the wind farm.

10.9 Forestry Waste

10.9.1 The Scottish Environment Protection Agency (SEPA) guidance document WST-G-027, 'Management of Forestry Waste' (SEPA, 2017)[14] highlights that all waste producers have a statutory duty to adopt the waste hierarchy as per the Waste (Scotland) Regulations 2012 (the Scottish Government, 2012)[15], which amended Section 34 of the Environmental Protection Act (EPA) 1990 (duty of care) (UK Government, 1990)[16]. This places a specific duty on any person who produces, keeps or manages (controlled) waste to take all such measures available to them to apply the waste hierarchy in Article 4 (1) of the revised Waste Framework Directive[17] (rWFD), which is:

- Prevention;
- Preparing for re-use;
- Recycling;

[14] SEPA (2017): SEPA Guidance Notes WST-G-027 "Management of Forestry Waste". https://www.sepa.org.uk/media/28957/forestry_waste_guidance_note.pdf
[15] The Scottish Government (2012): The Waste (Scotland) Regulations 2012 No. 148 available at https://www.legislation.gov.uk/sdsi/2012/9780111016657
[16] UK Environmental Protection Act 1990 1990 c. 43 Part II Duty of care etc. as respects waste Section 34 available at http://www.legislation.gov.uk/ukpga/1990/43/section/34
[17] EU Waste Legislation Waste Framework Directive https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0098

- Other recovery, including energy recovery; and
- Disposal, in a way which delivers the best overall environmental outcome.

10.9.2 Further guidance is contained in the document LUPS-GU27, 'Use of Trees Clear Felled to Facilitate Proposed Development on Afforested Land'" (SEPA, 2014)[18].

10.9.3 A hierarchy of uses for forestry materials is proposed, derived from the waste hierarchy contained within the Regulations, summarised as follows:

- Prevention via the production of timber products and associated materials for use in timber and other markets;
- The re-use of materials on-site for a valid purpose, where such a use exists e.g. track construction including floating tracks;
- There is no valid re-cycling use for forestry residues;
- Other recovery via collection and use as biomass for energy recovery or other markets, where not included above; and
- Where no valid on-site or off-site use can be found for the material, disposal would be in a way that is considered to deliver the best overall environmental outcome.

10.9.4 Where no valid on-site or off-site use, or other disposal method can be found for the material, it should be regarded as waste and handled accordingly. Disposal of timber residues as waste in or on land requires a landfill permit or a waste exemption licence and should be considered the option of last resort.

10.9.5 As discussed in this chapter, the crops will be replanted except where required for infrastructure associated with the Proposed Development. Brash would be left in situ to provide nutrients for the next rotation where the crops are being replanted as per standard forestry practice. Where crops are not being replanted brash would be removed and treated in line with the proposed hierarchy described above.

10.9.6 Stumps would be left in situ as per good practice guidance, except where excavated as part of the construction activities. Excavated stumps would be treated in line with the proposed hierarchy described above.

10.9.7 In areas of lower yielding crops, into which the Proposed Development infrastructure would be keyholed, the objective would be to recover as much merchantable timber as possible. Failing that to treat them in line with the hierarchy outlined above. Where suitable, whole trees would be extracted and used in the biomass market. As a result, it is anticipated the forestry waste arising from the works will be minimal.

10.9.8 It is proposed that full consideration and further clarification on this issue would be included in a Forestry Waste Management Plan to form part of the Construction Environmental Management Plan (CEMP) following receipt of planning consent and prior to commencement of construction.

10.10 Forestry Management Practices

Crop Clearance

10.10.1 Areas of crops of sufficient tree size and standing volume would be harvested conventionally. Timber operations would be undertaken with conventional harvesting and forwarding equipment utilising flotation tracks as required. The flotation devices are fitted to each machine wheel which gives the machines very low ground pressure and minimises the ground disturbance during the forestry operations.

10.10.2 Stemwood down to 7 centimetres (cm) or below would be removed from Proposed Development Area and sold into the timber markets. The harvester would maximise timber recovery wherever possible, this would result in the maximum timber volume being recovered to ensure the volume used in the brash mats is kept to a minimum. On wetter ground the harvester would build stronger brash mats to ensure there would be minimal damage to the peat and soil structure by the forwarder during extraction. On soft ground, the bottom layers of brash mats become embedded into the soil and removal could result in more environmental damage than leaving the material to naturally degrade.

10.10.3 In areas of young or lower yield class crops, where little or no merchantable timber would be recovered, a number of options could be utilised depending on the factors prevailing at the time of clearance. The methodology used would depend on tree size; site conditions; the availability of suitable equipment; and the markets prevailing at the time of the works being carried out. Where there was suitable access and ground conditions the trees could be whole tree harvested and extracted to roadside for chipping as biomass.

10.10.4 Where trees are very small due to age or poor growth it may be more viable to fell the crop manually using scrub cutters or chainsaws. The end use of the material would depend on the factors mentioned above, but in some cases there would be no recoverable material. Where material was recoverable it could potentially be used

[18] SEPA (2014): LUPS-GU27 "Use of Trees Cleared to Facilitate Development of Afforested Land. https://www.sepa.org.uk/media/143799/use_of_trees_cleared_to_facilitate_development_on_afforested_land_sepa_snh_fcs_guidance-_april_2014.pdf

on-site in the base of floating roads; extracted and processed for biomass; or used for ecological enhancement if applicable.

10.10.5 Stumps would be left in situ as per the guidance contained in the Forestry Commission Research Note "Environmental effects of stump and root harvesting" (Forestry Commission, 2011)[19] except where they would be removed for borrow pits, excavated tracks, wind turbine foundations and other infrastructure requiring excavation. Such material would be treated as described above.

Restocking/Planting Methodology

10.10.6 Restocking would be carried out to current standard practice, the forest manager's internal guidance and practices and in accordance with the guidelines contained in the UKFS and UKWAS as a minimum, where applicable. Methodology would vary depending on the type of restocking being carried out. The following information is provided for guidance as to the restocking methodology which may be adopted.

10.10.7 On commercial conifer areas the methodology would normally include:

- Site preparation by machine cultivation and drainage;
- Manual planting;
- Subsequent follow-up establishment operations such as the replacement of failures, weeding and protection measures until the crops are satisfactorily established; and
- Replanting would be carried out with the conifer species identified in the restocking plan at the minimum density of 2,500 trees per hectare.

10.10.8 Restocking within the broadleaf woodland areas would be carried out to the same specification with the following changes:

- A lower planting density of 1,600 trees per ha; and
- The principal species would be mixed native broadleaves including, for example, downy and silver birch with small components of other species as appropriate to site such as oak, rowan, hazel, gean, grey willow, goat willow, alder and woody shrubs.

Aftercare Works

10.10.9 Aftercare establishment works would normally include, but are not limited to, the following:

- the woodlands would be beaten up (replacement of failures) to ensure satisfactory stocking levels by year 5, broadleaf woodlands by year 10;
- the woodlands would be weeded as necessary to ensure satisfactory establishment by year 5 / year 10 for broadleaf woodlands;
- the woodlands would be protected against pine weevils by management inspections and remedial treatment as necessary;
- the woodlands would be protected against browsing damage from wild and domestic animals;
- the woodlands would be protected against fire;
- fertiliser would be applied as necessary to ensure satisfactory establishment and growth; and
- other works as reasonably required ensuring satisfactory establishment of the woodlands.

Standards and Guidelines

10.10.10 All forestry operations would be carried out in strict accordance with current good practice and guidelines. This would include, but not be limited to:

- UK Forestry Standard (Forestry Commission 2017);
- Forest Industry Safety Accord Guides[20] (or equivalent) (FISA, 2014); and
- current relevant legislation including, but not limited to, Health and Safety at Work Act 1974 (UK Government, 2014)[21].

10.11 Summary

10.11.1 The total study area extends to 650.1. ha and is comprised of privately owned and managed woodlands.

10.11.2 Felling would be advanced on 113.5 ha for construction of the Proposed Development.

10.11.3 The species composition of the forest would change as a result of the Proposed Development forestry proposals. In particular, the area of conifer woodland would decrease by 52 ha.

10.11.4 The area of unplanted ground would increase and, as a result, there would be a net loss of woodland area of 57.1 ha.

10.11.5 In order to comply with the Scottish Government's Control of Woodland Removal Policy, compensation planting would be required to mitigate for the loss of woodland area. The Applicant is committed to providing appropriate compensatory planting. The extent, location and composition of such planting to be agreed with

[19] Forestry Commission Research Note "Environmental effects of stump and root harvesting" (Forestry Commission, 2011). https://www.forestry.gov.uk/pdf/FCRN009.pdf/$FILE/FCRN009.pdf

[20] Forest Industry Safety Accord (2014). FISA Safety Guides (various). Edinburgh.

[21] UK Government (1974): Health and Safety at Work etc. Act 1974 available at http://www.legislation.gov.uk/ukpga/1974/37/contents

SF, taking into account any revision to the felling and restocking plans prior to the commencement of construction.

11 Transport & Traffic

11.1 Introduction

11.1.1 This chapter considers the likely significant effects on receptors along the transport routes resulting from vehicle movements associated with the construction and operation of the Proposed Development. The specific objectives of the chapter are to:

- describe the current 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 the likely significant effects;
- assess the residual effects remaining following the implementation of mitigation measures.

11.1.2 The technical reviewer of the traffic and transport assessment is Gordon Buchan BEng (Hons), MSC, CMILT, FCIHT, Divisional Director of Pell Frischmann. He has over 25 years of undertaking the transport assessments associated with new developments and has worked on renewable energy and energy distribution projects across the UK, Ireland and Northern Europe. The author is Elaine Moran BEng (Hons), MSC, MCIHT, Transport Planner. She has over six years of experience in the transport planning industry.

11.1.3 A high-level overview of the effects of the traffic movements has been considered in accordance with Institute of Environmental Assessment (now Institute of Environmental Management and Assessment (IEMA)) Guidelines for the Environmental Assessment of Road Traffic. The document is referred to as the IEMA Guidelines in this chapter.

11.1.4 The chapter is supported by:

- Technical Appendix 11.1: Transport Assessment; and
- Technical Appendix 11.2: AIL Route Survey Report.

11.1.5 Figures 11.1 – 11.5 are referenced in the text where relevant.

11.2 Legislation, Policy and Guidance

Legislation

11.2.1 The assessment has been undertaken in accordance with the Town & Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017.

Policy

11.2.2 This assessment has been undertaken in accordance with policies outlined in the following plans:

- East Ayrshire Council Local Development Plan; and
- South Ayrshire Local Development Plan.

Guidance

11.2.3 This assessment has been carried out in accordance with the principles outlined in the following documents:

- Institute of Environmental Assessment, Guidelines for the Environmental Assessment of Road Traffic (1993);
- Institution of Environmental Management and Assessment (IEMA) 'Guidelines for Environmental Impact Assessment' (2005);
- Table 2.2 of Volume 11, Section 2, Part 5 of the Design Manual for Roads and Bridges (DMRB), Highways Agency (2008);
- Planning Advice Note (PAN) 75;
- Transport Assessment Guidance, (2012); and
- Onshore Wind Turbines; Online Renewables Planning Advice (2014).

11.3 Consultation

11.3.1 In undertaking the assessment, consideration has been given to the scoping responses and other consultation undertaken as detailed in Table 11.1 below.

Table 11.1: Consultation Responses

Consultee and Date	Scoping/Other Consultation	Issue Raised	Response/Action
East Ayrshire Council 30 September 2021	Scoping Opinion	Early contact with the Ayrshire Roads Alliance (ARA) is advised. Should any comments be subsequently received from ARA in respect of the Scoping Report these	Initial engagement with ARA was undertaken

Consultee and Date	Scoping/Other Consultation	Issue Raised	Response/Action
		will be sent on to the Energy Consents Unit.	
		The Planning Authority would advise that any assessment of traffic impacts should be based on a worst-case scenario which assumes 100 % of construction materials such as stone requiring to be imported to site. Any expected reduction in stone importation due to the use of borrow pits can be reported within the Environmental Impact Assessment (EIA) Report, along with the consequent effect this would have on traffic volumes. A worst-case scenario should nevertheless be presented in case any proposed borrow pits fail to provide the anticipated volume of stone to ensure a robust assessment of impacts.	It is anticipated that the borrow pit on-site will be capable of providing 100 % of aggregate material required for construction of the Proposed Development, however, to provide a robust assessment, the trip generation calculations provided as part of Volume 3 Technical Appendix 11.1: Transport Assessment assumes that 100 % of aggregate material will be imported to the Proposed Development Area.
		The EIA Report should identify potential sources of materials (e.g. stone quarries) if these are off-site and consider the impacts of those routes to site, including communities along those routes.	Potential sources of construction materials are presented in Technical Appendix 11.1. Details of the source of materials will be provided in the Construction Traffic Management Plan (CTMP) will be prepared post consent.
		Such assessment should also include cumulative impacts	A Sensitivity Review is presented in Section 11.9: Assessment of Cumulative Effects of this Chapter which reviews if consented onshore wind farms in the area are to be constructed concurrently. The peak month of each of the consented wind farms included in the Sensitivity Review is included in the assessment as a worst-case scenario. If any of the onshore wind farms were to be constructed at the same time as the Proposed Development, it is proposed that any impacts will be mitigated through the use of an overarching Traffic Management and Monitoring Plan for all of the sites, and by introducing a phased delivery plan which will be agreed with the local council roads department and Police Scotland. Information regarding other committed developments is presented in Technical Appendix 11.1.
		Any consented / under construction developments likely to generate large volumes of traffic should be taken into account in the cumulative traffic assessment and should not necessarily be limited to other wind farm developments.	Details of consented schemes which are included as committed developments in the traffic and transport assessment are presented in Technical Appendix 11.1.

Consultee and Date	Scoping/Other Consultation	Issue Raised	Response/Action
		Transport Scotland may provide advice in respect of the trunk road network.	Transport Scotland has been contacted as part of the Proposed Development's Scoping Opinion.
		The EIA Report should detail the port of entry and the delivery route for turbine components to site.	Volume 3: Technical Appendix 11.2 AIL Route Survey Report (RSR) details the proposed delivery route of Abnormal Indivisible Loads (AILs) from port of entry to the Proposed Development Area's main site entrance.
		Public Access:- The Applicant should summarise the measures taken to control public access during the construction period and during any operational period.	Section 11.7: Mitigation details mitigation measures to facilitate public access during the construction phase. Impacts during the operational phase are not considered to be significant and are estimated to be two trips per week for maintenance purposes.
South Ayrshire Council - Access Officer 08 October 2021	Scoping Opinion	The Traffic and Transport section of the report states that, once operational, there will be minimal vehicular traffic within the site. Therefore, the site is suitable for public access. There is a right of way (ref. SKC11)/ local path which runs through the western corner of the site. There is an ideal opportunity to connect the tracks/ access routes which may be constructed within the site to this	Both Core Path D6: Patna to Straiton and SKC11 are located within the in the northwest section of the Proposed Development Area. These paths will remain accessible to the public during construction and operation of the Proposed Development. A Path Management Plan will be produced post consent which will include mitigation measures that addresses the potential impacts between construction
			route and the wider paths network.	traffic and path users. Examples of the mitigation measures which will be included in the Path Management Plan are presented in Section 11.7: Mitigation.
The British Horse Society 06 September 2021	Scoping Opinion	The BHS expects developers to work with representatives of the local horse riding community to understand their road safety and countryside access concerns and facilitate engagement with other partners and consider whether any road safety interventions should be introduced, where there are significant numbers of horse riders and/or road traffic collisions involving horses.	Section 11.7: Mitigation details mitigation measures which are to be included in the Path Management Plan to address the potential impacts of interactions between construction traffic and horses and riders.
ScotWays 22 September 2021	Scoping Opinion	The right of way SKC11 as recorded in the National Catalogue of Rights of Way crosses or is close to the application site. The Heritage Path Old Road through Straiton crosses or is close to the application site. The Scottish Hill Track route 82 Barr to Straiton and Patna [HT385] which crosses or is close to the application site.	It is proposed that a Path Management Plan will be produced post consent. Section 11.7: Mitigation presents mitigation measures which address the potential impacts of interactions between construction traffic and core path / rights of way users. These measures will be included in the Path Management Plan.
Transport Scotland 21 September 2021	Scoping Opinion	We note that baseline traffic data for the A77(T) and A76(T) will be obtained from UK Government Department for Transport (DfT)	Noted. Details of the traffic data used in the assessment are presented in Technical Appendix 11.1.

Consultee and Date	Scoping/Other Consultation	Issue Raised	Response/Action
		traffic count data or the Traffic Scotland database. National Road Traffic Forecast (NRTF) Low Growth factors will be used to provide a future year baseline. Transport Scotland is satisfied with this approach.	
		The SR states that potential trunk road related environmental impacts such as driver delay, pedestrian amenity, severance, safety etc will be considered and assessed where appropriate (i.e. where IEMA Guidelines for further assessment are breached). These specify that road links should be taken forward for further detailed assessment if: • Traffic flows will increase by more than 30 %, or • The number of Heavy Goods Vehicles (HGV)s will increase by more than 30 %, or • Traffic flows will increase by 10 % or more in sensitive areas. This approach is considered acceptable and we are content that no further trunk road assessment is required if the above thresholds are not exceeded.	Noted.
		It is noted that any impacts associated with the operational phase of the development are to be scoped out of the Environmental Impact Assessment Report (EIAR). We would consider this to be acceptable in this instance.	
		The SR states that the Traffic and Transport EIA Report Chapter will be supported by an Abnormal Load Route Survey. In addition, detailed swept path analyses will be undertaken for the main constraint points on the route from the port of entry through to the site entrance to demonstrate that the turbine components can be delivered to site and to identify any temporary road works which may be necessary. Transport Scotland is satisfied with this approach but would add that any proposed changes to the trunk road network must be discussed and approved (via a technical approval process) by the appropriate Area Managers.	The proposed AIL delivery routes are presented in Technical Appendix 11.2. It is expected that the design of the AIL accommodation works would form a planning condition post consent. The access route arrangements for the AIL and construction vehicle deliveries will be detailed in the Abnormal Load Transport Management Plan which will be agreed post consent and will be informed by discussions with East Ayrshire Council, South Ayrshire Council and Transport Scotland.
Crosshill, Straiton and Kirkmichael Community Council 08 October 2021	Scoping	These questions cannot be answered as the information given is thin and not helpful. There is no indication of where the traffic would originate or how it would access the site from the A713. There is certainly no suitable bridge	Technical Appendix 11.1 shows the location of the accesses to the Proposed Development Area. Construction traffic's proposed trip generation and distribution are presented in

Consultee and Date	Scoping/Other Consultation	Issue Raised	Response/Action
		crossing the River Doon which could be used. Much more information is required.	Technical Appendix 11.1.

11.4 Methodology

Scope of Assessment

11.4.1 The following effects were identified at the scoping stage for consideration in this assessment:

- Direct effects during construction on Access, Traffic and Transport:
  - Traffic flows in the surrounding area;
  - Local road users; and
  - Local residents.
- Cumulative effects during construction on Access, Traffic and Transport.

11.4.2 The assessment scenarios used for this topic will be:

- Future Baseline Flows (2025) – which are estimated by applying National Road Traffic Forecast (NRTF) low growth factors to traffic flow information obtained from the Department for Transport (DfT) database and including committed development flows;
- Future Baseline + Development Flows (2025) – which are estimated by applying the distributed development trips to the future baseline traffic flow information; and
- Combined Scheme Sensitivity Review – a sensitivity review of the cumulative effects of local consented wind farm schemes.

Effects Scoped Out

11.4.3 On the basis of the desk based and field survey work undertaken, the professional judgement of the Environmental Impact Assessment (EIA) team, experience from other relevant projects and policy guidance or standards, and feedback received from consultees, the following topic areas have been 'scoped out' of detailed assessment, as proposed in the Scoping Report:

- Operational Phase: The traffic effects during the operational phase of the Proposed Development are likely to be insignificant as expected traffic flows will be less than two vehicle movements per week, far below the recognised thresholds for triggering a formal transport assessment. As such, the effects during the operation phase are scoped out of the assessment.
- Decommissioning Phase: The traffic effects during the decommissioning phase can only be fully assessed closer to that period. As elements of the Proposed Development are likely to remain in-situ (such as cable trenches, access tracks, etc), the traffic flows associated with the decommissioning works will be lower than those associated with the construction phase. The construction phase therefore represents a worst case assessment and as such, no further assessment of the decommissioning phase has been considered at this point in time and has been scoped out of the assessment.

Baseline Characterisation

Study Area

11.4.4 It is proposed that there will be two separate site entrances which will serve the Proposed Development. The main site entrance is located along the A713, to the east of the Proposed Development Area. A secondary site entrance will be located along the B714, at the existing forestry access to High Keirs Forest. The study area for this assessment is as follows:

- The B714, between Daily and Dalmellington;
- The A713, from Bankfield Roundabout to the south of Dalmellington;
- Along the A77, between Whitletts Roundabout and Bankfield Roundabout;
- Along the A70 between Cumnock and Ayr and
- Along the A76, between Auchinleck and Cumnock.

11.4.5 This study area includes areas of material supply (quarries, etc), the site entrances, the trunk road network and the construction material and abnormal load delivery routes. It is also of sufficient size to include the main areas of workforce accommodation during the construction period.

11.4.6 The study area is illustrated in Figure 11.1.

Desk Study / Field Survey

11.4.7 The desk study included reviews and identification of the following:

- Relevant transport planning policy;
- Accident data;
- Sensitive locations;
- Any other traffic sensitive receptors in the area (core paths, routes, communities, etc.);

- Ordnance Survey (OS) plans;
- Potential origin locations of construction staff and supply locations for construction materials to inform extent of local area roads network to be included in the assessment; and
- Constraints to the movement of Abnormal Invisible Loads (AIL)s through a route survey including swept path assessments.

11.4.8 Field surveys were also undertaken and comprised of a site visit to review the access routes and local road network.

Sensitivity Criteria

11.4.9 IEMA 'Guidelines for Environmental Impact Assessment' (2005) notes that the separate 'Guidelines for the Environmental Assessment of Road Traffic' (1993) document should be used to characterise the environmental traffic and transport effects (off-site effects) and the assessment of significance of major new developments. The guidelines intend to complement professional judgement and the experience of trained assessors.

11.4.10 In terms of traffic and transport impacts, the receptors are the users of the roads within the study area and the locations through which those roads pass.

11.4.11 The IEMA Guidelines includes guidance on how the sensitivity of receptors should be assessed. Using that as a base, professional judgement was used to develop a classification of sensitivity for users based on the characteristics of roads and locations. This is summarised in Table 11.2.

Table 11.2: Classification of Receptor Sensitivity

Receptor	Sensitivity			
	High	Medium	Low	Negligible
Users of Roads	Where the road is a minor rural road, not constructed to accommodate frequent use by HGVs. Includes roads with traffic control signals, waiting and loading restrictions, traffic calming measures.	Where the road is a local A or B class road, capable of regular use by HGV traffic. Includes roads where there is some traffic calming or traffic management measures.	Where the road is Trunk or A-class, constructed to accommodate significant HGV composition. Includes roads with little or no traffic calming or traffic management measures.	Where roads have no adjacent settlements. Includes new strategic trunk roads that would be little affected by additional traffic and suitable for Abnormal Loads and new strategic trunk road junctions capable of accommodating Abnormal Loads.
Users/ Residents of Locations	Where a location is a large rural settlement containing a high number of community and public services and facilities.	Where a location is an intermediate sized rural settlement, containing some community or public facilities and services.	Where a location is a small rural settlement, few community or public facilities or services.	Where a location includes individual dwellings or scattered settlements with no facilities.

11.4.12 Where a road passes through a location, users are considered subject to the highest level of sensitivity defined by either the road or location characteristics.

Magnitude of Effect

11.4.13 The following rules, also taken from the IEMA Guidelines are used to determine which links within the study area should be considered for detailed assessment:

- Rule 1 – include highway links where traffic flows are predicted to increase by more than 30 % (or where the number of heavy goods vehicles is predicted to increase by more than 30 %); and
- Rule 2 – include any other specifically sensitive areas where traffic flows are predicted to increase by 10 % or more.

11.4.14 Examples of sensitive areas are presented in the IEMA Guidelines as hospitals, churches, schools, historical buildings.

11.4.15 The IEMA Guidelines identify the key impacts that are most important when assessing the magnitude of traffic impacts from an individual development. The impacts and levels of magnitude are discussed in the following bullet points:

- Severance – the IEMA Guidance states that, "severance is the perceived division that can occur within a community when it becomes separated by a major traffic artery." Further, "Changes in traffic of 30 %, 60 % and 90 % are regarded as producing 'slight', 'moderate' and 'substantial' [or minor, moderate and major] changes in severance respectively". However, the Guidelines acknowledge that "the measurement and prediction of severance is extremely difficult".
- Driver delay – the IEMA Guidelines note that these delays are only likely to be "significant [or major] when the traffic on the network surrounding the development is already at, or close to, the capacity of the system.";
- Pedestrian delay – the delay to pedestrians, as with driver delay, is likely only to be major when the traffic on the network surrounding the development is already at, or close to, the capacity of the system. An increase in total traffic of approximately 30 % can double the delay experienced by pedestrians attempting to cross the road and would be considered major;

- Pedestrian amenity – the IEMA Guidelines suggests that a tentative threshold for judging the significance of changes in pedestrian amenity would be where the traffic flow (or its lorry component) is halved or doubled. It is therefore considered that a change in the traffic flow of -50 % or +100 % would produce a major change in pedestrian amenity;
- Fear and intimidation – there are no commonly agreed thresholds for estimating levels of fear and intimidation, from known traffic and physical conditions. However, as the impact is considered to be sensitive to traffic flow, changes in traffic flow of 30 %, 60 % and 90 % are regarded as producing minor, moderate and major changes respectively; and
- Accidents and safety – professional judgement would be used to assess the implications of local circumstances, or factors which may elevate or lessen risks of accidents.

11.4.16 While not specifically identified, as more vulnerable road user, cyclists are considered in similar terms to pedestrians.

Significance Criteria

11.4.17 To determine the overall significance of effects, the results from the receptor sensitivity and magnitude of change assessments are correlated and classified using a scale set out in Table 2.4 of Volume 11, Section 2, Part 5 of the Design Manual for Roads and Bridges (DMRB) and summarised in Table 11.3.

Table 11.3: Significance of Effects

		Magnitude of Change			
		High	Medium	Low	Negligible
Sensitivity	High	Major	Major/Moderate	Moderate	Moderate/Minor
	Medium	Major/Moderate	Moderate	Moderate/Minor	Minor
	Low	Moderate	Moderate/Minor	Minor	Minor/Negligible
	Negligible	Moderate/Minor	Moderate/Minor	Minor/Negligible	Negligible

11.4.18 In terms of the EIA Regulations, effects would be considered of significance where they are assessed to be Major or Major/Moderate. Where an effect could be one of Major/Moderate or Moderate/Minor, professional judgement would be used to determine which option should be applicable.

Assessment Limitations

11.4.19 The assessment is based upon average traffic flows in one month periods. During the month, activities at the Proposed Development may fluctuate between one day and another and it is not possible to fully develop a day by day traffic flow estimate as no contractor has been appointed and external factors can impact upon activities on a day by day basis (weather conditions, availability of materials, time of year, etc).

11.5 Baseline

Current Baseline

Existing Traffic Conditions

11.5.1 In order to assess the impact of development traffic on the study area, one Automatic Traffic Count (ATC) site was established between 26 November to 02 December 2021.

11.5.2 The count site used was as follows:

1. A713, to the north of the main site entrance.

11.5.3 In addition to the ATC data, further 2019 traffic count data was obtained from the DfT website count sites on the B741, A713, A77, A70 and A76.

11.5.4 The DfT count sites are as follows:

2. A713 (north of Patna) – Count Site ID No.10885;
3. A713 (near Ailsa Hospital) – Count Site ID No.74362;
4. A77 (between Bankfield and Holmston Roundabout) – Count Site ID No.50750;
5. A70 (west of Joppa) – Count Site ID No.1017;
6. A70 (west of Ochiltree) – Count Site No. 80519;
7. A76 (north of Dettingen Roundabout) – Count Site ID No. 80522;
8. A76 (south of Dettingen Roundabout) – Count Site ID No. 80521;
9. B741 (east of Cloyntie) – Count Site ID No. 930171;
10. A77 (T) (between Holmston and Whitletts Roundabout) – Count Site ID No. 74302; and
11. A713 (south of Dalmellington) – Count Site ID No. 30887.

11.5.5 The location of the traffic surveys is presented in Figure 11.2.

11.5.6 A NRTF low growth factor was applied to the 2019 traffic flows to forecast 2022 flows. The NRTF low growth factor for 2019 to 2022 is 1.022. A NRTF low growth factor of 1.005 was applied to the 2021 ATC flows to estimate 2022 traffic flows.

11.5.7 The traffic counters allowed the traffic flows to be split into vehicle classes and the data has been summarised into cars / light good vehicles (LGVs) and heavy goods vehicles (HGVs) (all goods vehicles >3.5 tonnes gross maximum weight).

11.5.8 Table 11.4 summarises the Annual Average Daily Traffic (AADT) traffic data estimated at the eleven sites for 2022.

Table 11.4: Existing Traffic Flow (2022)

Site Ref	Survey Location	Cars & Lights	HGV	Total
1	A713, North of Main Site Entrance	2,846	788	3,635
2	A713, North of Patna	3,681	276	3,957
3	A713, South of Ailsa Hospital	3,681	276	3,957
4	A77, between Bankfield and Holmston Rbt	22,661	1,428	24,089
5	A70, between Belston and Joppa	10,261	655	10,916
6	A70, west of Ochiltree	6,054	1,112	7,166
7	A76, north of Dettingen Rbt	7,113	838	7,951
8	A76, south of Dettingen Rbt	5,790	425	6,215
9	B741, east of Cloyntie	560	76	636
10	A77 (T), between Holmston and Whitletts Rbt	34942	2132	37074
11	A713, South of Dalmellington	1461	189	1651

Accident Review

11.5.9 Road traffic accident data for the period commencing 01 January 2018 through to 31 May 2021 along the A713, between Ayr and Dalmellington and along the B741 between Dalmellington and Straiton, was obtained from the online resource crashmap.co.uk which uses data collected by police about road traffic crashes occurring on British roads. It should be noted that at the time of writing, 2021 traffic information comprised provisional data until June. In order to ensure that a full three years' worth of accident data is reviewed, accidents recorded along the surveyed routes during 2018 are included in the analysis.

11.5.10 The statistics are categorised into three categories which include "slight" for damage only incidents, "serious" for injury accidents and "fatal" for accidents that result in death.

A summary of the recorded accidents is presented in Table 11.5 below.

Table 11.5: Summary of Accidents

Road Link	No. of Accidents Recorded	Casualty Types				Vehicle Types					
		Pedal Cycle	Child	Motorcycle	Pedestrians	Pedal Cycle	Motorcycle	Car	HGV	Bus	Young Driver
A713	19	0	1	2	1	0	2	19	1	2	5
B741	4	0	0	1	0	0	1	4	1	0	0

11.5.11 Further details on the recorded accidents are presented in Technical Appendix 11.1 and the locations and severity of the accidents are presented in Figure 11.3.

11.5.12 Details of accidents which were recorded in similar locations are presented below:

- A total of three accidents were recorded in the vicinity of A713 / B742 staggered junction, of which two accidents were recorded as serious and one accident was recorded as slight. Signage is located on both approaches to the junction to alert oncoming vehicles of the junction layout; and
- Two accidents were recorded at the A713 / Dalmellington Road signalised junction, which provides access to Alisa Hospital and University Hospital Ayr. The two recorded accidents were recorded as slight and involved cars; and
- Two accidents were recorded along the A713, at the A713 / Ayrshire Equestrian Centre access priority junction. One accident involved a car and a motorcycle and was classified as serious and one accident involved cars and was classified as slight.

Sustainable Links

11.5.13 A review of the online core path mapping available on East Ayrshire Council's website (https://webgis.east-ayrshire.gov.uk/webgis2016/) indicates that Core Path D6: Patna to Straiton is located within the Proposed Development Area. The core path is approximately 6.8km in length.

11.5.14 South Ayrshire Council's online core plan mapping (https://maps-south-ayrshire.opendata.arcgis.com/datasets/core-paths/) shows core paths within the South Ayrshire Council boundary and indicates that there are no Core Paths in the vicinity of the secondary site entrance, along the B741.

11.5.15 Right of Way SKC11/1 travels along part of the same route as Core Path D6, however, the routes slightly deviate from each other to the south west of Loch Spallander Reservoir. They both subsequently continue in a north-eastbound direction.

11.5.16 Both Core Path D6 and SKC11/1 travel through the northwest section of the Proposed Development Area.

11.5.17 Core Path D13: Auchenroy Hill and Dalcairnie Falls is located to the west of Dalmellington, and crosses the B741 in two locations between Doon Bridge and the B741 / A713 / Gateside Road junction. The core path is approximately 7.5 km in length.

11.5.18 Local core paths which are located within the vicinity of the Proposed Development Area are presented in Figure 11.4.

11.5.19 Along the A713, there is a narrow, substandard footway located along the western edge of the road between the main site entrance and Patna.

11.5.20 A review of Sustrans' Map of the National Cycle Network (https://www.sustrans.org.uk/national-cycle-network) indicates that there are no National Cycle Network routes in the vicinity of either of the site entrances.

Future Baseline

11.5.21 Construction of the project is expected to commence in 2025 if consent is granted and it is expected to take up to 14 months, depending on weather conditions and ecological considerations.

11.5.22 To assess the likely effects during the construction phase, base year traffic flows were determined by applying a NRTF low growth to the obtained traffic flows. The NRTF low growth factor for 2022 to 2025 is 1.016.

11.5.23 Traffic flows associated with committed developments were added to the 2025 baseline traffic flows. The committed development flows included in the baseline comprise development flows associated with the mixed-use residential (circa 250 dwellings) and neighbourhood / commercial development (20/00970/PPPM) which is located on land to the south-west of the A713, and forms part of the AYR4 (South East Ayr) proposed housing release site in South Ayrshire Local Development Plan (2014).

11.5.24 It should be noted that only consented developments can be considered as committed developments in transport assessments. The application of NRTF growth factors to background traffic accounts for smaller, non-significant traffic generating developments. Further details of consented schemes considered in the committed development assessment are provided EIAR Technical Appendix 11.1.

11.5.25 Construction traffic flows associated with consented onshore wind farm developments has not been included as committed development as these are short lived and temporary. The inclusion of these construction traffic trips in the baseline would dilute the potential impacts of the Proposed Development. To address the potential impact of these consented onshore wind farm schemes a sensitivity review is undertaken in Section 11.9 Assessment of Cumulative Effects, further in this chapter. The approach taken is therefore considered to be a robust assessment.

11.5.26 These factors were applied to the 2022 traffic data contained in Table 11.4 in order to estimate the 2025 Baseline traffic flows, which are shown in Table 11.6 below.

Table 11.6: 2025 Future Baseline Traffic Flow (including Committed Development Trips)

	Survey Location	Cars & Lights	HGV	Total
1	A713, North of Main Site Entrance	2,892	801	3,693
2	A713, North of Patna	3,740	280	4,020
3	A713, South of Ailsa Hospital	3,740	280	4,020
4	A77, between Bankfield and Holmston Rbt	23,431	1,451	24,881
5	A70, between Belston and Joppa	10,425	666	11,091
6	A70, west of Ochiltree	6,151	1,130	7,281
7	A76, north of Dettingen Rbt	7,227	851	8,078
8	A76, south of Dettingen Rbt	5,882	432	6,314
9	B741, east of Cloyntie	569	77	646
10	A77 (T), between Holmston and Whitletts Rbt	35,908	2,166	38,074
11	A713, South of Dalmellington	1485	192	1677

11.5.27 In the scenario if the Proposed Development did not proceed, traffic growth will occur and the links within the study network will experience increased traffic flows resulting from other development pressures, tourism traffic and population flows.

11.5.28 A review of sensitive receptors has been undertaken within the study area. Table 11.7 details the receptors and their sensitivities for use within the following assessment. A justification for the sensitivity has been provided, based upon the details contained in Table 11.2.

Table 11.7: Receptor Sensitivity Summary

Receptor	Sensitivity	Justification
A713 Users	Low	Where the road is Trunk or A-class, constructed to accommodate significant HGV composition.
B741 Users	Medium	Where the road is a local A or B class road, capable of regular use by HGV traffic.
A77(T) / A76(T) Users	Negligible	Where roads have no adjacent settlements.
A70 Users	Medium	Where the road is a local A or B class road, capable of regular use by HGV traffic
Residents along B741	Negligible	Where a location includes individual dwellings or scattered settlements with no facilities.
Waterside Residents	Low	Where a location is a small rural settlement, few community or public facilities or services.
Dalmellington Residents	Medium	Where a location is an intermediate sized rural settlement, containing some community or public facilities and services.
Straiton Residents	Low	Where a location is a small rural settlement, few community or public facilities or services.
Patna Residents	Medium	Where a location is an intermediate sized rural settlement, containing some community or public facilities and services.
Polnessan Residents	Negligible	Where a location includes individual dwellings or scattered settlements with no facilities.
Hollybush Residents	Low	Where a location is a small rural settlement, few community or public facilities or services.
Ailsa Hospital / University Hospital Ayr	Medium	Where a location is an intermediate sized rural settlement, containing some community or public facilities and services.
Joppa / Coylton / Hillhead Residents	Medium	Where a location is an intermediate sized rural settlement, containing some community or public facilities and services.
Coalhall Residents	Low	Where a location is a small rural settlement, few community or public facilities or services.
Ochilltree Residents	Medium	Where a location is an intermediate sized rural settlement, containing some community or public facilities and services
Core Paths Users	High	Minor path used by walkers and cyclists, not constructed to accommodate HGV traffic flows

11.5.29 Where a road passes through a location, users are considered subject to the highest level of sensitivity defined by either the road or location characteristics.

11.5.30 Based on the examples of sensitive areas (e.g. hospitals, churches, schools, historical buildings), as outlined in the Magnitude of Effect section earlier in this chapter, the following areas are considered sensitive and will be subject to subject to 'Rule 2' of the IEMA Guidelines which requires a full assessment of effects if the locations are subject to an increase in 10% of traffic:

- Waterside;
- Dalmellington;
- Straiton;
- Patna;
- Alisa Hospital / University Hospital Ayr;
- Joppa / Coylton / Hillhead; and
- Ochilltree.

11.5.31 All other locations within the study area are subject to 'Rule 1' and are assessed if traffic flows (or HGV flows) on highway links increase by more than 30 %.

11.6 Assessment of Potential Effects

Construction Effects

11.6.1 The assessment is based upon the construction effects that may occur within the study area. In order to assess the effects, it is necessary to determine the likely traffic generation associated with the Proposed Development.

11.6.2 During the assumed 14 month construction period, the following traffic would require access to the Proposed Development Area:

- Staff transport, either cars or staff minibuses;
- Construction equipment and materials, deliveries of machinery and supplies such as concrete raw materials;
- AILs consisting of the wind turbine components and heavy lift crane(s); and
- Escort vehicles for AIL deliveries.

11.6.3 Except for the turbine components, most traffic would be normal construction plant and would include grading tractors, excavators, high capacity cranes, forklifts and dumper trucks. Most would arrive at the Proposed Development on low loaders.

11.6.4 The turbines are delivered in component sections for transport and would be assembled at the Proposed Development. The nacelle, hub, drive train, blade, tower sections are classified as AIL due to their weight and/or length, width and height when loaded.

11.6.5 The components can be delivered on a variety of transport platforms with typical examples illustrated in the Technical Appendix 11.2: AIL Route Survey Report.

11.6.6 In addition to the turbine deliveries, two high capacity erection cranes would be needed to offload some components and erect the turbines. The crane is likely to be a mobile crane with a capacity up to 1,000 tonnes that would be escorted by boom and ballast trucks to allow full mobilisation on-site. A smaller erector / assist crane will also be present to allow the assembly of the main cranes and to ease overall erection of the turbines.

11.6.7 The resulting traffic generation profile is attached in Technical Appendix 11.1: Transport Assessment for review. The peak of construction occurs in Month 3 with 88 HGV movements per day (44 inbound and 44 outbound) and 35 Car / LGV movements (18 inbound trips and 17 outbound trips). These figures on average indicate approximately four HGVs arriving at the Proposed Development Area every hour at the peak period.

11.6.8 The distribution of development traffic on the network would vary depending on the types of loads being transported. The assumptions for the distribution of construction traffic during the peak months would be as follows:

- The main site entrance to the Proposed Development Area will be taken from a newly formed junction from the A713, near Waterside, and will be used by AIL delivery vehicles and construction delivery vehicles. The secondary site entrance will be located along the B741, at the existing forestry access to High Keirs Forest, and will provide access to plant and equipment for site establishment as well as a staff entrance. HGV traffic will arrive at secondary site entrance from the west due to the 13 tonne restriction on Doon Bridge.Cars and light goods vehicles can arrive from both the east and the west;
- It is assumed that deliveries associated with ready mix concrete will arrive via the A70, A77 (T) and A713;
- For the purposes of the assessment, it is assumed that 100 % of the required aggregate material will be taken from a quarry located near the A76 (T), to the north of Cumnock. The contractor will confirm final quarry and material sourcing with East Ayrshire Council (EAC) and South Ayrshire Council (SAC) in the Construction Traffic Management Plan (CTMP);
- HGV deliveries associated with the HV electrical installation, the substation building, batteries, etc will arrive via the A77 (T);
- It is assumed that forestry materials will be exported from the Proposed Development Area to the Port of Ayr;
- Staff working at the Proposed Development are likely to be based locally. It is assumed that 40 % of staff will arrive from Ayr, 20 % from the east near Auchinleck, 20 % from near Cumnock, 10% from the west, via the B741 and 10 % from the south, via the A713; and
- General deliveries will be from the north from Ayr via the A713 to the Proposed Development Area. These are generally smaller rigid HGV vehicles.

11.6.9 The routes which will be used by construction delivery traffic within the study area as well as AIL routes are illustrated in Figure 11.5.

11.6.10 In relation to AIL deliveries, it is proposed that turbine blades will be brought into KGV Dock in Glasgow due to constraints for this size of blade exiting the Port of Ayr. All other turbine components could be brought into either the Port of Ayr or Glasgow. All component deliveries will follow the same route to the Proposed Development Area from the A77 Whitletts Roundabout.

11.6.11 Details of the mitigation measures which are required to facilitate the AIL deliveries are presented in Appendix 11.2.

11.6.12 To estimate the total trips through the study area during the peak of the construction phase, traffic was distributed through the network and combined with the 2025 Baseline traffic data. The resulting figures were compared with the weekday 2025 Baseline traffic (Table 11.6) to provide a percentage change in movements.

Table 11.8: 2025 Baseline + Construction Development – Flows and Impact

	Survey Location	Cars & Lights	HGV	Total	% Increase Car & Lights	% Increase HGV	% Increase Total
1	A713, North of Main Site Entrance	2920	889	3808	1.0 %	10.9 %	3.1 %
2	A713, North of Patna	3768	368	4136	0.8 %	31.3 %	2.9 %
3	A713, South of Ailsa Hospital	3768	368	4136	0.8 %	31.3 %	2.9 %
4	A77 (T), between Bankfield and Holmston Rbt	23459	1538	24997	0.1 %	6.0 %	0.5 %
5	A70, between Belston and Joppa	10439	714	11153	0.1 %	7.2 %	0.6 %

6	A70, west of Ochiltree	6165	1178	7343	0.2 %	4.2 %	0.9 %
7	A76 (T), north of Dettingen Rbt	7234	899	8133	0.1 %	5.6 %	0.7 %
8	A76 (T), south of Dettingen Rbt	5889	432	6321	0.1 %	0.0 %	0.1 %
9	B741, east of Cloyntie	573	77	649	0.6 %	0.0 %	0.5 %
10	A77 (T), between Holmston and Whitletts Rbt	35923	2206	38128	0.0 %	1.8 %	0.1 %
11	A713, South of Dalmellington	1488	192	1680	0.2 %	0.0 %	0.2 %

11.6.13 The total traffic movements are not predicted to increase by more than 30 % on all of the study network, with the increase in total traffic levels all below 10% at the traffic count locations.

11.6.14 The HGV traffic along the A713, to the north of Patna and to the south of Ailsa Hospital is predicted to increase by over 30 %. Whilst the increases are statistically significant, they are generally caused by the relatively low HGV flows on these links, which would see an additional 88 HGV journeys (44 inbound and 44 outbound). This represents approximately four additional HGV journeys every hour during peak construction activities, which is not considered significant in terms of total flows.

11.6.15 Table 11.8 suggests that traffic passing through the locations identified as sensitive (Waterside, Dalmellington, Stration. Patna, Alisa Hospital / University Hospital Ayr, Joppa / Coylton / Hillhead and Ochilltree) would not increase by more than 10 % i.e. ‘Rule 2’.

11.6.16 However, HGV traffic is expected to increase by more than 30% i.e. ‘Rule 1’ along A713 which will impact the following receptors:

- A713 Users;
- Residents of Patna;
- Residents of Polnessan;
- Residents of Hollybush; and
- Ailsa Hospital / University Hospital Ayr.

11.6.17 It should be noted that the effects of Core Path Users are also included in the further assessment, as these are located within the Proposed Development Area which would see an increase in construction traffic.

11.6.18 A review of existing road capacity has been undertaken using the Design Manual for Roads and Bridges, Volume 15, Part 5 “The NESA Manual”. The theoretical road capacity has been estimated for each of the road links that makes up the study area. The results are summarised in Table 11.9.

Table 11.9: 2025 Future Baseline + Construction Development – Capacity Summary

Site Ref.	Survey Location	2025 Baseline Flow	2025 Base + Development Flows	Theoretical Road Capacity	% Used Capacity
1	A713, North of Main Site Entrance	3693	3808	21600	82.4 %
2	A713, North of Patna	4020	4136	28800	85.6 %
3	A713, South of Ailsa Hospital	4020	4136	21600	80.9 %
4	A77, between Bankfield and Holmston Rbt	24881	24997	36000	30.6 %
5	A70, between Belston and Joppa	11091	11153	28800	61.3 %
6	A70, west of Ochiltree	7281	7343	28800	74.5 %
7	A76, north of Dettingen Rbt	8078	8133	28800	71.8 %
8	A76, south of Dettingen Rbt	6314	6321	28800	78.1 %
9	B741, east of Cloyntie	646	649	21600	97.0 %
10	A77 (T), between Holmston and Whitletts Rbt	38074	38128	36000	-5.9 %
11	A713, South of Dalmellington	1677	1680	21600	92.2 %

11.6.19 The results indicate there are no road capacity issues caused by the Proposed Development and that ample spare capacity exists within the local road network to accommodate construction phase traffic. However, there would be a capacity issue on the trunk road network as Table 11.9 suggests that the capacity of the A77(T) between Holmston and Whitletts Roundabouts is currently operating over capacity.

11.6.20 The Proposed Development would see an additional 54 daily journeys (14 cars & lights journeys and 40 HGV journeys) on this section of road during peak construction

activities which is negligible in terms of overall flows and unlikely to cause a detrimental effect.

11.6.21 The significance of the potential effects has been determined using the rules and thresholds discussed previously. Table 11.10 summarises the significance on the receptors for the construction phase.

Table 11.10: Overall Construction Phase Effects

Receptors	Severance	Driver Delay	Pedestrian Delay	Amenity	Fear	Accidents & Safety
A713 Users	Minor	Minor	Minor	Minor	Minor	Moderate/ Minor
Residents of Patna	Moderate/ Minor	Minor	Minor	Moderate/ Minor	Moderate/ Minor	Moderate/ Minor
Residents of Polnessan	Minor/ Negligible	Negligible	Negligible	Minor/ Negligible	Minor/ Negligible	Minor/ Negligible
Residents of Hollybush	Minor	Minor/ Negligible	Minor/ Negligible	Minor	Minor	Minor
Ailsa Hospital / University Hospital Ayr	Moderate/ Minor	Moderate/ Minor	Moderate/ Minor	Moderate/ Minor	Moderate/ Minor	Moderate
Core Path Users	Major	Negligible	Moderate	Major	Major	Moderate

11.6.22 The assessment of significance suggests that Core Path Users would experience significant effects, prior to the application of mitigation measures.

11.6.23 It should be noted that the impacts relate solely to the peak of construction activities and that the construction period is short lived and the effects are transitory in nature.

Operational Effects

11.6.24 No potential significant operational effects are predicted as part of the Proposed Development and this topic has been scoped out of the assessment

Decommissioning Effects

11.6.25 No potential significant decommissioning effects are predicted as part of the Proposed Development and this topic has been scoped out of this assessment.

11.7 Mitigation

11.7.1 During the construction phase, total traffic levels do not exceed the IEMA Guidelines Rule 1, in that total traffic does not rise more 30 %. The increase in HGV traffic however exceeds the 30 % rule for road users on the A713 and in the communities of Patna, Polnessan, Hollybush and Ailsa Hospital / University Hospital Ayr during the construction period only.

General Construction Traffic

11.7.2 During the construction period, a project website, blog or Twitter feed would be regularly updated to provide the latest information relating to traffic movements associated with vehicles accessing the Proposed Development Area. This would be agreed with the local road's authority.

11.7.3 The following measures would be implemented during the construction phase through the CTMP:

- Where possible the detailed design process would minimise the volume of material to be imported to the Proposed Development to help reduce HGV numbers. This includes an investigation to determine if a concrete batching plant is feasible on-site;
- A on-site worker transport and travel arrangement plan, including transport modes to and from the worksite (including pick up and drop off times);
- A Traffic Management Plan (TMP) would be prepared for AIL traffic movement only. In preparing the TMP, consultation would be undertaken with NHS Ayrshire and Arran health board and the TMP would take consideration of peak demand pressures such as shift change times, etc;
- All materials delivery lorries (dry materials) should be sheeted to reduce dust and stop spillage on public roads;
- Specific training and disciplinary measures should be established to ensure the highest standards are maintained to prevent construction vehicles from carrying mud and debris onto the carriageway;
- Wheel cleaning facilities may be established at the site entrances, depending the views of EAC, SAC and Ayrshire Roads Alliance (ARA);
- Unless otherwise agreed with the roads authorities, normal site working hours would be limited to between 0700 and 1900 (Monday to Saturday) though component delivery and turbine erection may take place outside these hours;
- Appropriate traffic management measures would be put in place on the A713 and B741 to avoid conflict with general traffic, subject to the agreement of the roads

authority. Typical measures would include HGV turning and crossing signs and banksman where necessary;

- Provide construction updates on the project website and or a newsletter to be distributed to residents within an agreed distance of the Proposed Development Area.
- Adoption of a voluntary speed limit of 20 mph for all construction vehicles through Waterside, Patna, Polnessan and Hollybush;

11.7.4 All drivers would be required to attend an induction to include:

- A tool box talk safety briefing;
- The need for appropriate care and speed control;
- A briefing on driver speed reduction agreements (to slow construction traffic at sensitive locations through the villages); and
- Identification of the required access routes and the controls to ensure no departure from these routes.

11.7.5 The ARA may request that an agreement to cover the cost of abnormal wear on its network is made. Video footage of the pre-construction phase condition of the abnormal loads access route and the construction vehicles route would be recorded to provide a baseline of the condition of the road prior to any construction work commencing. This baseline would inform any change in the road condition during the construction phase. Any necessary repairs would be coordinated with EAC, SAC and ARA. Any damage caused by traffic associated with the Proposed Development during the construction period that would be hazardous to public traffic would be repaired immediately. Damage to road infrastructure caused directly by construction traffic would be made good and street furniture that is removed on a temporary basis would be fully reinstated. There would be a regular road review and any debris and mud would be removed from the carriageway using an onsite road sweeper to ensure road safety for all road users.

11.7.6 Before the AILs traverse the route, the following tasks would be undertaken to ensure load and road user safety:

- Ensure any vegetation, which could foul the loads, is trimmed back to allow passage;
- Confirm there are no roadworks or closures that could affect the passage of the loads;
- Check no new or diverted underground services on the proposed route are at risk from the abnormal loads; and
- Confirm the police are satisfied with the proposed movement strategy.

Abnormal Indivisible Loads

AIL Route Survey Report

11.7.7 The AIL Route Survey Report (RSR) highlights a number of constraint points which have been assessed within the report using swept path assessment software. The locations of the constraint points and the swept path drawings are included in Technical Appendix 11.2.

11.7.8 AIL mitigation works can be designed to be temporary in nature to enable the restoration to their original condition (if required by EAC, SAC and ARA).

AIL Management Plan

11.7.9 An AIL Management Plan would be developed. All abnormal load deliveries would be undertaken at appropriate times (to be discussed and agreed with the relevant roads authorities and police) with the aim of minimising the effects on the local and trunk road network. It is likely that the abnormal load convoys would travel in to avoid school drop off and pick up times. It is also likely that the abnormal load convoys would travel outwith the general morning and evening peak periods so as to avoid adding additional traffic along the A77 (T) between Holmston and Whittlets Roundabout during these times.

11.7.10 Most of the potential conflicts between construction traffic and other road users would occur with abnormal load traffic. General construction traffic is not likely to come into conflict with other road users as the vehicles are smaller and road users are generally more accustomed to them.

11.7.11 Advance warning signs would be installed on the approaches to the affected road network. This signage would assist in helping improve driver information and allow other road users to consider alternative routes or times for their journey (where such options exist).

11.7.12 The location and numbers of signs would be agreed post consent and would form part of the wider CTMP for the project.

11.7.13 The Abnormal Load Transport Management Plan would also include:

- Procedures for liaising with the emergency services to ensure that police, fire and ambulance vehicles are not impeded by the loads. This is normally undertaken by informing the emergency services of delivery times and dates and agreeing communication protocols and lay over areas to allow overtaking;
- A diary of proposed delivery movements to liaise with the communities to avoid key dates;
- A protocol for working with local businesses to ensure the construction traffic does not interfere with deliveries or normal business traffic; and

- Proposals to establish a construction liaison committee to ensure the smooth management of the project / public interface with the applicant, the construction contractors, the local community, and if appropriate, the police forming the committee. This committee would form a means of communicating and updating on forthcoming activities and dealing with any potential issues arising.

Onsite Measures delivered using a Path Management Plan (PMP)

11.7.14 Within the Proposed Development Area, consideration has been given to pedestrians and cyclists alike due to potential interactions between construction traffic and users of the paths.

11.7.15 Users of the Rights of Way/ Core Paths would be separated from construction traffic through the use of barriers. Crossing points would be provided where required, with path users having right of way. Appropriate Traffic Signs Manual Chapter 8 compliant temporary road signage would be provided to assist at these crossing for the benefit of all users.

11.7.16 The principal contractor would ensure that speed limits are always adhered to by their drivers and associated subcontractors. This is particularly important within close proximity to the Rights of Way / Core Paths and at crossing points. Advisory speed limit signage would also be installed on approaches to areas where path users may interact with construction traffic.

11.7.17 Signage would be installed on the exit that makes drivers aware of local speed limits and reminding drivers of the potential presence of pedestrians and cyclists in the area. This would also be emphasised in the weekly tool box talks.

11.7.18 The British Horse Society has made recommendations on the interactions between HGV traffic and horses. Horses are normally nervous of large vehicles, particularly when they do not often meet them. Horses are flight animals and could run away in panic if really frightened. Riders would do all they can to prevent this but, should it happen, it could cause a serious accident for other road users, as well as for the horse and rider.

11.7.19 The main factors causing fear in horses in this situation are:

- Something approaching them, which is unfamiliar and intimidating;
- A large moving object, especially if it is noisy;
- Lack of space between the horse and the vehicle;
- The sound of air brakes; and
- Anxiety on the part of the rider.

11.7.20 The British Horse Society recommends the following actions that would be included in the training for all HGV staff:

- On seeing riders approaching, drivers must slow down and stop, minimising the sound of air brakes, if possible;
- If the horse still shows signs of nervousness while approaching the vehicle, the engine should be shut down (if it is safe to do so);
- The vehicle should not move off until the riders are well clear of the back of the HGV;
- If drivers are wishing to overtake riders, please approach slowly or even stop in order to give riders time to find a gateway or lay by where they can take refuge and create sufficient space between the horse and the vehicle. Because of the position of their eyes, horses are very aware of things coming up behind them; and
- All drivers delivering to the Proposed Development must be patient. Riders would be doing their best to reassure their horses while often feeling a high degree of anxiety themselves.

A Staff Travel Plan

11.7.21 A Staff Travel Plan would be deployed where necessary, to manage the arrival and departure profile of staff and to encourage sustainable modes of transport, especially car-sharing. A package of measures could include:

- Appointment of a Travel Plan Coordinator (TPC);
- Provision of public transport information;
- Mini-bus service for transport of on-site staff;
- Promotion of a car sharing scheme; and
- Car parking management.

Mitigation during Operation

11.7.22 In terms of the IEMA Guidelines, such a small number of traffic movements and the associated percentage uplift over Baseline traffic movements are not considered significant.

Mitigation during Decommissioning

11.7.23 As decommissioning would result in fewer vehicle trips on the road network than the construction phase, the significance of any effects would not be greater. It can therefore be assumed that the assessment of the construction phase covers the worst-case scenario.

11.8 Assessment of Residual Effects

11.8.1 An evaluation of the potential effects of the increase in traffic on the study area roads used for construction traffic was undertaken. The summary of this assessment is provided in Table 11.13.

11.8.2 The assessment confirms the effects would be minor in nature and they would be not significant. The traffic effects are transitory in nature. No long-lasting detrimental transport or access issues are associated with the construction phase of the Proposed Development.

11.9 Assessment of Cumulative Effects

11.9.1 A review of the consented significant developments (both energy and non energy related) which have been considered as committed developments and cumulative development are presented in Technical Appendix 11.1.

11.9.2 As noted in Technical Appendix 11.1, there are eight other onshore wind farm developments which have been granted planning consent and are anticipated to use part of the proposed construction and AIL delivery route during their peak construction periods, which are:

- Knockshinnoch Wind Farm;
- Polquhairn Wind Farm;
- North Kyle Wind Farm;
- Over Hill Wind Farm;
- Enoch Wind Farm;
- Brockloch Rig Phase 3;
- Pencloe Wind Farm; and
- Lethans Wind Farm.

11.9.3 While it is unlikely that these all of these developments would be constructed concurrently and that their peak construction months would align, a combined sensitivity review has been undertaken to inform the planning authorities of possible issues if all eight of the sites were to be constructed concurrently.

11.9.4 The peak flows for the sites were obtained from their respective planning application documents (see Table 11.11a and Table 11.11b) and then compared to the 2025 future baseline year in Table 11.12.

Table 11.11a: Committed Development Traffic Summary (Part 1)

	Knockshinnoch		Polquhairn		North Kyle		Over Hill		Enoch	
	Cars & Lights	HGV	Cars & Lights	HGV	Cars & Lights	HGV	Cars & Lights	HGV	Cars & Lights	HGV
A713, North of Main Site Entrance					38	21		48		
A713, North of Patna	24	24			38	21		48		
A713, South of Ailsa Hospital	24	24			38	21		48		
A77, between Bankfield and Holmston Rbt	24	24			50	19				
A70, between Belston and Joppa	24	24	18	104	50	51				
A70, west of Ochiltree	24	24	18	104	50	51				
A76, north of Dettingen Rbt	24	24	18	104	50	54		48		180
A76, south of Dettingen Rbt	0	0						48		180
B741, east of Cloyntie	0	0								
A77, between Holmston and Whitletts Rbt	24	24			50	19				
A713, South of Dalmellington	0	0								

Table 11.11b: Committed Development Traffic Summary (Part 2)

	Brockloch Rig		Pencloe		Lethans		Sclenteuch		Total	
	Cars & Lights	HGV	Cars & Lights	HGV	Cars & Lights	HGV	Cars & Lights	HGV	Cars & Lights	HGV
A713, North of Main Site Entrance		40	65	40			28	88	155	261
A713, North of Patna		40	65	40			28	88	155	261

A713, South of Ailsa Hospital		40	65	40			28	88	155	261
A77, between Bankfield and Holmston Rbt							28	88	102	131
A70, between Belston and Joppa			65	40			14	48	171	267
A70, west of Ochiltree			65	40			14	48	171	267
A76, north of Dettingen Rbt			65	40	43	54	7	48	207	552
A76, south of Dettingen Rbt			65	40	43	54	7	0	115	322
B741, east of Cloyntie							4	0	4	0
A77, between Holmston and Whitletts Rbt							14	40	88	83
A713, South of Dalmellington		40	65	40			4	0	69	80

Table 11.12: Combined Scheme Sensitivity Review Peak Traffic Summary

		2025 Baseline + Wind Farm Trips			% Increase		
Site Ref.	Survey Location	Cars & Lights	HGV	Total	Cars & Lights	HGV	Total
1	A713, North of Main Site Entrance	3047	1062	4108	5.4 %	32.5 %	11.3 %
2	A713, North of Patna	3895	541	4436	4.1 %	93.0 %	10.3 %
3	A713, South of Ailsa Hospital	3895	541	4436	4.1 %	93.0 %	10.3 %
4	A77 (T), between Bankfield and Holmston Rbt	23533	1581	25114	0.4 %	9.0 %	0.9 %
5	A70, between Belston and Joppa	10596	933	11529	1.6 %	40.1 %	3.9 %
6	A70, west of Ochiltree	6322	1397	7719	2.8 %	23.6 %	6.0 %
7	A76 (T), north of Dettingen Rbt	7434	1403	8837	2.9 %	64.8 %	9.4 %
8	A76 (T), south of Dettingen Rbt	5997	754	6751	2.0 %	74.5 %	6.9 %
9	B741, east of Cloyntie	573	77	649	0.6 %	0.0 %	0.5 %
10	A77 (T), between Holmston and Whitletts Rbt	35997	2249	38245	0.2 %	3.8 %	0.4 %
11	A713, South of Dalmellington	1553	272	1825	4.6 %	41.6 %	8.9 %

11.9.5 The combined traffic flows indicates that there would be a large increase in traffic flows on all of the assessed links; however, there would be more than sufficient spare road capacity on the local road network to accommodate this in the event of all eight sites being constructed at the same time.

11.9.6 However, there would be an increase of traffic along the A77 (T) (between Holmston and Whitletts Roundabout) along the trunk road network, which is currently experiencing theoretical capacity issues. It should be noted that the increase of the combined impact is less than 1 % which is not considered significant in terms of total traffic flows.

11.9.7 Any effects of all eight sites being constructed at the same time would be mitigated through the use of an overarching Traffic Management and Monitoring Plan for all consented sites and by introducing a phased delivery plan which would be agreed with Transport Scotland, EAC, SAC and Police Scotland.

11.9.8 Cumulative traffic will dilute the impact of the Proposed Development traffic on the study area and as such no increase in severity of effect is anticipated.

11.9.9 Furthermore, it is not predicted that the potential traffic flow increases could ever occur within the study area for the following reasons:

- It is extremely unlikely that the peak traffic conditions would occur at the same time due to differences in construction programmes, material supplies and developer resources; and

- All abnormal load deliveries cannot occur at eight separate sites on the same day due to restrictions on the numbers of loads moving on the network at the same time set by Police Scotland.

11.10 Summary

11.10.1 The Proposed Development would lead to a temporary increase in traffic volumes on the study road network during the construction phase. Traffic volumes would fall considerably outside the peak period of construction.

11.10.2 The maximum traffic impact associated with construction is predicted to occur in Month 3 of the indicative construction programme. The greatest impact would occur along the A713, to the north of the main site entrance.

11.10.3 The Proposed Development traffic, at the peak of construction, would result in 88 HGV movements per day (44 inbound and 44 outbound) and 35 Cars & Lights (18 inbound and 17 outbound).

11.10.4 No significant capacity issues are expected on any of the roads within the study area due to the additional construction traffic movements associated with the Proposed Development as background traffic movements are low, the links are of reasonable standard and appropriate mitigation is proposed. However, the assessment of significance suggests that Core Path Users would experience significant effects, prior to the application of mitigation measures.

11.10.5 With the implementation of appropriate mitigation, no significant residual effects are anticipated in respect of traffic and transport issues. The residual effects are all assessed to be slight or insignificant but as they will occur during the construction phase only, they are temporary and reversible.

Table 11.13: Summary of Residual Effects

Likely Significant Effect	Mitigation	Means of Implementation	Residual Effect
Construction			
Severance	CTMP proposals	Via a condition of consent. CTMP to be agreed with Council Officers prior to construction activities commencing.	Not significant
Driver delay	CTMP Proposals and improved signage	Via a condition of consent. CTMP to be agreed with Council Officers prior to construction activities commencing.	Not significant
Pedestrian delay	CTMP and PMP proposals	Via a condition of consent. CTMP and PMP to be agreed with Council Officers prior to construction activities commencing.	Not significant
Pedestrian amenity	CTMP and PMP proposals	Via a condition of consent. CTMP and PMP to be agreed with Council Officers prior to construction activities commencing.	Not significant
Fear and intimidation	CTMP and PMP proposals	Via a condition of consent. CTMP and PMP to be agreed with Council Officers prior to construction activities commencing.	Not significant
Accidents and safety	CTMP Proposals and improved. Site Entrance Design to EAC standards.	CTMP Proposals, improved signage and develop signage strategy and agree works with EAC and SAC. Construction of EAC compliant access junctions.	Not significant
Severance	CTMP proposals	Implementation of CTMP via planning condition.	Not significant
Driver delay	CTMP Proposals and improved signage	CTMP Proposals and improved signage.	Not significant
Operation			
None	None	None	None
Decommissioning			
None	None	None	None

Table 11.14: Glossary

Acronyms & Abbreviations	Term in Full	Meaning/Definition
AADT	Annual Average Daily Traffic	The average traffic flow over the course of a full year which passes a particular location on the road network each day.
ARA	Ayrshire Roads Alliance	Ayrshire Roads Alliance

Acronyms & Abbreviations	Term in Full	Meaning/Definition
ATC	Automatic Traffic Counter	Equipment which is laid across a road and measures traffic characteristics such as the number of vehicles passing over it, speed and classification.
AIL	Abnormal Indivisible Load	Loads / vehicles which exceed the maximum vehicle weight, axle weight or dimensions which are set out in the Road Vehicles (Construction and Use) Regulations 1986 as amended.
CTMP	Construction Traffic Management Plan	Document which outlines traffic management measures to mitigate adverse impacts associated with construction related traffic.
DfT	Department for Transport	Department for Transport
DMRB	Design Manual for Roads and Bridges	Design Manual for Roads and Bridges
EIAR	Environmental Impact Assessment Report	A document detailing the effects a project would have on the environment.
HGV	Heavy Goods Vehicle	All goods vehicles > 3.5 tonnes gross maximum weight.
IEMA	The Institution of Environmental Management and Assessment	The Institution of Environmental Management and Assessment
Lights or LGV	Light goods vehicles	All commercial vehicles < 3.5 tonnes gross maximum weight.
NCR	National Cycle Route	Designated National Cycle Routes within the UK.
NRTF	National Road Traffic Forecast	Factors used to apply future year growth to traffic flows.
OS	Ordnance Survey	Great Britain's national mapping agency.
PoE	Port of Entry	Port from which AILs are to be delivered.
RSR	Route Survey Report	Report assessing the suitability of a route to transport abnormal loads.
T	Trunk Road	Strategic road
TPC	Travel Plan Coordinator	Personal responsible for updating, promoting and implementing the Travel Plan
TS	Transport Scotland	Transport Scotland

12 Noise

12.1 Introduction

12.1.1 This chapter contains an assessment of the acoustic impact of the proposed Sclenteuch Wind Farm (hereafter referred to as the Proposed Development). The chapter assesses wind farm operational noise and construction noise at the nearest residential properties. The specific objectives of the chapter are to:

- describe the current 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 the likely significant effects;
- assess the residual effects remaining following the implementation of mitigation measures.

12.1.2 This assessment has been undertaken by RES (hereafter referred to as the Applicant), with at least one in-house Member of the Institute of Acoustics involved in its production. The Applicant has undertaken acoustic impact assessments in every single one of its UK wind farm development applications since 2000. The Applicant 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.

12.1.3 Additionally, the Applicant 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;
- '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.

12.1.4 The chapter is supported by:

- Figure 12.1 – Predicted Noise Footprint due to Proposed Development;
- Figure 12.2 – Predicted Cumulative Noise Footprint;
- Technical Appendix 12.1 - Assessment of Energy Storage Facility;
- Technical Appendix 12.2 – Issues Scoped Out of Wind Farm Noise Assessment;
- Technical Appendix 12.3 – Calculating Standardised Wind Speed;
- Technical Appendix 12.4 – Propagation Height & Valley Effect;

[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/

- Technical Appendix 12.5 – Background Noise Survey Photos;
- Technical Appendix 12.6 – Instrumentation Records;
- Technical Appendix 12.7 – Charts;
- Technical Appendix 12.8 – Suggested Planning Conditions; and
- Glossary.

12.1.5 Figures and Technical Appendices are referenced in the text where relevant.

12.2 Legislation, Policy and Guidance

Operational Noise

12.2.1 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.

12.2.2 As described by Scottish Government Planning Advice for Onshore Wind Turbines[5]:

"Technically, there are two quite distinct types of noise sources 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. There has been significant reduction in the mechanical noise generated by wind turbines through improved turbine design."

12.2.3 Within Scotland, noise is defined within the planning context by 'Planning Advice Note 1/2011: Planning and Noise'[6]. This Planning Advice Note provides advice on the role of the planning system in helping to prevent and limit the adverse effects of noise. The Planning Advice Note 1/2011 states that:

"Good acoustical design and siting of turbines is essential to minimise the potential to generate noise."

12.2.4 Planning Advice Note 1/2011 refers to the use of the Department of Trade and Industry's 'The Assessment and Rating of Noise from Wind Farms' (ETSU-R-97), noting that further guidance is provided in the web based planning advice on renewable technologies for onshore wind turbines[5]. In relation to noise from wind farms the web-based renewables advice states:

"The Report, 'The Assessment and Rating of Noise from Wind Farms' describes a framework for the measurement of wind farm noise, which should be followed by applicants and consultees, and used by planning authorities to assess and rate noise from wind energy developments, until such time as an update is available."

12.2.5 It is therefore considered that the use of ETSU-R-97, as criteria for assessment of wind farm noise, fulfils the requirements of Planning Advice Note 1/2011.

12.2.6 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.

12.2.7 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.

12.2.8 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."

12.2.9 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.

12.2.10 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 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

[5] 'Onshore wind turbines: planning advice', Scottish Government, May 2014. Available at: https://www.gov.scot/publications/onshore-wind-turbines-planning-advice/

[6] 'Planning Advice Note 1/2011: Planning and Noise', Scottish Government, March 2011. Available at: https://www.gov.scot/publications/planning-advice-note-1-2011-planning-noise/

[7] 'Prediction and Assessment of Wind Turbine Noise', Bowdler et al, Acoustics Bulletin Vol 34 No 2 March/April 2009

to propagation modelling and wind shear. The assessment presented herein adopts the recommendations of the Good Practice Guide.

12.2.11 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.

12.2.12 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 Scottish 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 East & South Ayrshire Councils.

Construction Noise

12.2.13 In the web based Scottish Government technical advice on construction noise assessment in 'Appendix 1: Legislative Background, Technical Standards and Codes of Practice'[9] it is stated that:

"However, under Environmental Impact Assessments and for planning purposes i.e. not in regard to the Control of Pollution Act 1974, the 2009 version of BS 5228 is applicable."

12.2.14 Given that BS 5228-1:2009 'Code of practice for noise and vibration control on construction and open sites - Part 1: Noise'[10] is identified as being the appropriate source of guidance on appropriate methods for minimising noise from construction activities, it is adopted herein.

12.2.15 The Control of Pollution Act 1974 provides information on the need for ensuring that the best practicable means are employed to minimise noise[11].

12.2.16 BS 5228-2:2009 'Code of practice for noise and vibration control on construction and open sites - Part 2: Vibration'[12], provides a method for predicting vibration levels which has been adopted in this assessment.

12.2.17 BS 6472-2:2008 'Guide to evaluation of human exposure to vibration in buildings - Part 2: Blast-induced vibration'[13] has been used to set criteria for satisfactory magnitudes of vibration at nearby residential properties to ensure compliance with respect to human response.

12.3 Consultation

12.3.1 Details of the consultation undertaken are outlined in Table 12.1.

Table 12.1: Acoustic assessment consultation

Consultees	Date of Consultation	Nature and Purpose of Consultation
East & South Ayrshire Council's	01/09/21	Scoping opinion requested from environmental health departments on: proposed methodology, use of previously measured baseline data, maximum scaling factor for use when scaling consented sites to conditioned limits, use of Dersalloch limits and proposed lower fixed limits.
East Ayrshire Council	30/09/21	Consultation with Council's noise consultant recommended to agree methodology. Low frequency noise and amplitude modulation can be scoped out.
South Ayrshire Council	08/10/21	Council's consultant agrees with proposed methodology. Proposed maximum scaling factor of 3 decibel (dB) is appropriate. Cumulative limits based on Dersalloch conditioned limits also appropriate. More information on how site-specific shear effects shall be taken into account requested along with justification for proposed lower fixed limits.
East & South Ayrshire Council's	16/11/21	Planned acoustic assessment at the proposed Sclenteuch wind farm (03896-3123105-01) sent to environmental health departments. More detail on background noise survey plus information on how shear effects shall be accounted for and justification for proposed lower fixed limits provided.
East Ayrshire Council	29/11/21	Response from Council's acoustic consultant. Generally content with proposed approach including fixed limits and cumulative assessment. Further clarification of proposed updated background noise analysis requested. Note that data from High Keirs may not be representative of other properties.

[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] 'Assessment of noise: technical advice note', Scottish Government, March 2011. Available at: http://www.gov.scot/publications/technical-advice-note-assessment-noise/

[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] 'Control of Pollution Act', published by Her Majesty's Stationary Office, July 1974. Available at: https://www.legislation.gov.uk/ukpga/1974/40

[12] 'Code of Practice for Noise and vibration control on construction and open sites - Part 2: Vibration', British Standards Institution, BS 5228-2:2009

[13] 'Guide to evaluation of human exposure to vibration in buildings. Blast-induced vibration', BS 6472-2:2008

East Ayrshire Council	29/11/21	Response to Council's consultant confirming understanding of proposed updated background noise analysis is correct and agreeing that data from High Keirs shall not be used elsewhere.
East Ayrshire Council	30/11/21	Response from Council's consultant confirming they are content with methodology proposed.

12.4 Methodology

Scope of Assessment

12.4.1 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

12.4.2 To ensure adequate assessment of the potential impacts of the operational noise from the Proposed Development 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 Proposed Development 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.

12.4.3 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.

12.4.4 An acoustic assessment considering the operation of the proposed Energy Storage Facility can be found in Technical Appendix 12.1 which includes consideration of the cumulative impact with the proposed turbines.

12.4.5 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 Development 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 12.2.

12.4.6 A summary of the findings of a comprehensive study into wind turbine noise and associated health effects can be found in Technical Appendix 12.2.

Construction Noise

12.4.7 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.

12.4.8 Noise would also arise due to the temporary increase in construction traffic near the Proposed Development. This level would also depend on the particular construction phase of the Proposed Development.

12.4.9 Blasting is anticipated to be required in order to extract material from the proposed borrow pits. Vibration and air overpressure due to blasting could therefore arise at periods during construction.

12.4.10 To ensure adequate assessment of the potential impacts of the construction noise from the Proposed Development 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;
- The combined effect of on-site construction activities with construction traffic is compared with the target level specified by BS 5228-1:2009; and
- Predictions of the level of vibration due to blasting are made using BS 5228-2:2009 and the significance evaluated using BS 6472-2:2008.

12.4.11 The acoustic impact assessment of construction noise from the Proposed Development presented here is based on the Applicant'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 Proposed Development Area.

12.4.12 An assessment of the level of vibration at nearby properties due to blasting to release material from the proposed borrow pits shall be undertaken. Air overpressure due to blasting cannot be reliably predicted so is not assessed here although steps to limit any resulting impact through appropriate blast design can be adopted.

12.4.13 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.

Baseline Characterisation

12.4.14 Similar to other assessments of noise impacts (most notably BS 4142[14], 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).

12.4.15 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 Proposed Development Area rather than at the residential properties, since it is this wind speed that would subsequently govern the Proposed Development's noise generation. Often the residential properties themselves will be sheltered from the wind and may consequently have relatively low background noise levels.

12.4.16 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 Development Area and which are likely to be representative of other residential properties in the locale.

12.4.17 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.

12.4.18 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 12.3.

12.4.19 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 12.2:

Table 12.2: 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 Proposed Development Area 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.

[14] 'Method for Rating Industrial Noise affecting Mixed Residential and Industrial Areas', British Standards Institution, 1997

Modelling Noise Propagation

12.4.20 Whilst there are several sound propagation models available, the ISO 9613 Part 2 model has been used[15], this being identified as most appropriate for use in such rural sites[16]. 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.

12.4.21 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.

12.4.22 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.

12.4.23 The barrier attenuations predicted by ISO 9613 Part 2 have been shown to be significantly greater than those measured in practice under downwind conditions[16]. 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 decibel (dB) attenuation has been assumed as recommended in the IoA Bulletin and the IoA GPG.

12.4.24 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 Technical Appendix 12.4.

12.4.25 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.

12.4.26 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.

12.4.27 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[16]. 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;
- 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

12.4.28 Noise is measured in 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.

12.4.29 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.

12.4.30 Whilst ETSU-R-97 presents a comprehensive and detailed assessment methodology for wind farm noise, it also provides a simplified methodology:

[15] ‘Acoustics - Attenuation of Sound During Propagation Outdoors, Part 2: General Method of Calculation’, International Organisation for Standardisation, ISO 9613-2:1996

[16] ‘A Critical Appraisal of Wind Farm Noise Propagation’, ETSU Report W/13/00385/REP, January 2000

"if the noise is limited to an $L_{A90,10min}$ of 35 dB(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".

12.4.31 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 12.3 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 12.3: 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)

12.4.32 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.

12.4.33 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.

12.4.34 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.

12.5 Baseline

Operational Noise

12.5.1 The Proposed Development is located approximately 1 km south of Patna, East Ayrshire. The surrounding area is predominantly rural in nature and used for grazing sheep and cattle with an A-class road to the north-east. The general noise character is typical of a rural environment with noise from farm machinery, sheep, cattle, and birds, with the occasional overhead aircraft.

12.5.2 Background noise measurements were undertaken at six residential property locations in accordance with ETSU-R-97 as detailed in Table 12.4.

Table 12.4 - Background noise survey details

House Name	Measurement Period		
	Start	End	Duration (days)
Altizeurie Cottage	22/08/2012	02/10/2012	42
Barneil Farm	03/09/2012	12/10/2012	40
Gass Farm	22/08/2012	29/09/2012	39
Glenhead	22/08/2012	12/10/2012	52
High Keirs	22/08/2012	01/10/2012	41
Patna	22/08/2012	12/10/2012	52

12.5.3 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 - 1.5 m above ground and equipped with all-weather wind shields which also provide an element of water resistance.

12.5.4 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.

12.5.5 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).

12.5.6 The sound level meters were placed away from reflecting walls and vegetation. Photos of the equipment, in situ, may be seen in Technical Appendix 12.5. The apparatus were calibrated before and after the survey period and the maximum drift detected was 0.2 dB, 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 12.6.

12.5.7 Chart 12.1 (see Technical Appendix 12.7 for all charts) shows the measured wind rose over the background noise survey period, as measured by the meteorological mast located on-site.

12.5.8 For illustrative purposes, Chart 12.2 shows the measured wind rose over an extended period (22/12/11 – 21/01/13) by the meteorological mast located on the Proposed Development Area. As previously discussed, the noise prediction model employed is likely to overestimate the real noise immission levels for locations not downwind of the turbines. Chart 12.2 therefore may aid the reader as to the likelihood of over-estimation due to this factor.

12.5.9 The noise data has been cross-referenced with rainfall data measured at the on-site met mast using a rain gauge. Any noise data identified as having been affected by rainfall has been removed from the analysis as shown in Charts 12.3 to 12.14.

12.5.10 Short-term periods of increased noise levels considered to be atypical have been removed from the datasets. The excluded data is shown in Charts 12.3 to 12.14.

12.5.11 Periods of raised noise levels were removed from the datasets at Gass Farm, Glenhead and Patna. These periods were caused by raised water levels in a nearby watercourse at Glenhead and instrumentation faults at Gass Farm and Patna.

12.5.12 Charts 12.3 to 12.8 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.

12.5.13 Charts 12.9 to 12.14 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.

12.5.14 Table 12.5 and Table 12.6 detail the $L_{A90,10min}$ background noise levels calculated from the derived 'best fit' lines, as described above. They are provided as sound pressure levels in dB referenced to 20 micro Pascals (see Glossary for further detail):

Table 12.5 - Quiet daytime noise levels (dB(A) re 20 µPa)

House Name	Standardised 10 m Wind Speed (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
Altizeurie Cottage	22.8	24.7	26.5	28.2	29.9	31.7	33.6	35.6	37.8	40.2	42.8	45.8
Barneil Farm	27.6	27.8	28.4	29.3	30.6	32.2	34.1	36.2	38.4	40.9	43.4	43.4
Gass Farm	22.3	24.8	27.1	29.2	31.3	33.4	35.8	38.3	41.2	44.6	48.5	53.0
Glenhead	27.5	27.5	28.9	30.6	32.6	34.7	36.7	38.7	40.5	42.0	43.1	43.1
High Keirs	32.4	32.4	32.7	33.3	34.2	35.4	36.8	38.4	40.2	42.3	44.5	46.8
Patna	29.5	29.5	29.5	29.8	30.5	31.4	32.3	33.3	34.1	34.1	34.1	34.1

Table 12.6 - Night-time noise levels (dB(A) re 20 µPa)

House Name	Standardised 10 m Wind Speed (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
Altizeurie Cottage	25.4	25.4	25.4	25.9	26.9	28.3	30.1	32.3	34.9	37.7	40.8	40.8
Barneil Farm	25.6	26.1	26.9	27.9	29.0	30.3	31.8	33.3	35.0	36.7	38.5	38.5
Gass Farm	24.0	25.2	26.6	28.1	29.8	31.7	33.6	35.6	37.7	39.8	42.0	42.0
Glenhead	28.8	28.8	28.9	29.4	30.3	31.6	33.4	35.5	37.9	40.7	43.7	43.7
High Keirs	30.6	31.9	32.8	33.5	34.1	34.6	35.2	36.0	37.2	38.7	40.8	40.8
Patna	24.3	24.8	25.0	25.1	25.3	25.6	26.4	27.6	29.6	32.4	32.4	32.4

12.5.15 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 are shown in Table 12.7.

12.5.16 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. The used of baseline data measured at Gass Farm, Glenhead and High Kiers has been restricted as a conservative measure as the highest background noise levels, potentially due to location-specific noise sources, occurred at these properties.

Table 12.7 - Assumed representative background noise survey locations

House ID	House Name	Survey Location
H1	Glentaggan Bungalow	Gass Farm
H2	Gass Farmhouse	Gass Farm
H3	Gass Farm Cottage	Gass Farm
H4	Grimmet Farmhouse	Patna
H5	Grimmet Cottage	Patna
H6	The View	Patna
H7		Patna
H8		Patna
H9		Patna
H10		Patna
H11		Patna
H12		Patna
H13	The Old Institute	Patna
H14		Patna
H15	Glenview	Patna
H16	Barley Park Cottage	Patna
H17	Hillhead South	Patna
H18	Kirk Lodge	Patna
H19	Clover Park Cottage	Patna
H20	Doonlea	Patna
H21	Hillend	Patna
H22	Drumbui Farm	Patna
H23	Doonbank House	Patna
H24		Patna
H25		Patna
H26		Patna
H27		Patna
H28		Patna
H29		Patna
H30		Patna
H31		Patna
H32		Patna
H33		Patna
H34		Patna
H35		Patna
H36		Patna
H37		Patna
H38		Patna
H39		Patna
H40		Patna
H41		Patna
H42		Patna
H43		Patna
H44		Patna
H45		Patna
H46		Patna
H47		Patna
H48		Patna
H49		Patna
H50		Patna
H51		Patna
H52		Patna
H53	Carcloot House	Patna
H54	Silver Birches	Barneil Farm
H55	Drumbuie Farm	Barneil Farm
H56		Barneil Farm
H57	Cairnhill Cottage	Barneil Farm
H58	Cairnhill Farm	Barneil Farm
H59	Troquhain Farm	Barneil Farm
H60	Glenside Farm	Barneil Farm
H61	Dyrock Bank	Barneil Farm
H62	Glenbar Cottage	Barneil Farm
H63	Goosehill Bungalow	Barneil Farm
H64	Caml-Lann,	Barneil Farm
H65	Drumfad	Barneil Farm
H66	Cloncaird Straiton	Barneil Farm
H67	Butlers Cottage	Barneil Farm
H68	Cloncaird Mains	Barneil Farm
H69		Barneil Farm
H70	Cloncaird Mains	Barneil Farm
H71	Cloncaird House	Barneil Farm
H72	Altizeurie Cottage	Altizeurie Cottage
H73	Altizeurie Farm	Altizeurie Cottage

H74	Bishopland Lodge	Altizeurie Cottage
H75	Glenlea House	Altizeurie Cottage
H76	Balminnoch Farm	Altizeurie Cottage
H77	Balminnoch Cottage	Altizeurie Cottage
H78	Glenhead	Glenhead
H79	Sclenteuch Farm	Altizeurie Cottage
H80	Hazel Lodge	Altizeurie Cottage
H81	Largs Farm	Altizeurie Cottage
H82	Glenash Bungalow	Altizeurie Cottage
H83	High Keirs Farm	High Keirs
H84	High Keirs Cottage	High Keirs
H85	Low Keirs Farm	Patna
H86	New Patna Development	Patna

Construction Noise

12.5.17 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.

Future Baseline

12.5.18 The baseline conditions would not be expected to change under the "do nothing" scenario i.e. in the event that the Proposed Development does not go ahead.

12.6 Assessment of Potential Effects

Potential Operational Effects

Noise Propagation Modelling

12.6.1 The locations of the proposed turbines are provided in Table 12.8 and shown in Figure 12.1.

Table 12.8: Location of proposed turbines

Turbine	Co-ordinates	
	X (m)	Y (m)
T1	240561	606791
T2	240421	607686
T3	240939	607242
T4	241459	606902
T5	240860	608277
T6	241367	607831
T7	242026	607321
T8	242038	606687
T9	242550	606977

12.6.2 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 12.8 and are also shown in Figure 12.1. The proposed new housing development to the south of Patna is represented by H86 which is the location predicted to experience the greatest noise levels.

12.6.3 The distances from each residential property to the nearest turbine are given in Table 12.9. It can be seen that the minimum house-to-turbine separation is 1194 m.

Table 12.9: 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	Glentaggan Bungalow	241069	605637	1261	T1
H2	Gass Farmhouse	241176	605676	1258	T4
H3	Gass Farm Cottage	241216	605634	1291	T4
H4	Grimmet Farmhouse	244706	606400	2232	T9
H5	Grimmet Cottage	244742	606304	2293	T9
H6	The View	244698	606235	2273	T9
H7		245184	606134	2766	T9
H8		246254	607361	3724	T9
H9		245847	607678	3371	T9
H10		244390	608119	2166	T9
H11		243918	608517	2060	T9
H12		243691	608590	1976	T9
H13	The Old Institute	243825	608632	2089	T9
H14		243588	608680	1994	T9
H15	Glenview	243811	608691	2128	T9
H16	Barley Park Cottage	243831	608719	2162	T9
H17	Hillhead South	243657	608786	2121	T9
H18	Kirk Lodge	243620	608813	2125	T9

H19	Clover Park Cottage	243598	608878	2171	T9
H20	Doonlea	243527	608940	2193	T9
H21	Hillend	243424	609110	2270	T7
H22	Drumbui Farm	242828	609536	2245	T6
H23	Doonbank House	242564	609551	2096	T6
H24		242537	609575	2100	T6
H25		242468	609604	2085	T5
H26		241962	609281	1491	T5
H27		241932	609378	1537	T5
H28		241879	609388	1508	T5
H29		241827	609431	1506	T5
H30		241810	609468	1523	T5
H31		241793	609520	1554	T5
H32		241771	609557	1571	T5
H33		241711	609636	1603	T5
H34		241707	609654	1617	T5
H35		241698	609689	1642	T5
H36		241667	609718	1652	T5
H37		241623	609770	1677	T5
H38		241623	609836	1736	T5
H39		241561	609938	1803	T5
H40		241411	610086	1891	T5
H41		241522	610000	1846	T5
H42		241418	610185	1988	T5
H43		241385	610247	2039	T5
H44		241324	610435	2207	T5
H45		241272	610451	2213	T5
H46		241240	610493	2248	T5
H47		241216	610547	2298	T5
H48		241174	610606	2350	T5
H49		241165	610657	2399	T5
H50		241123	610666	2403	T5
H51		241048	610741	2471	T5
H52		241090	610754	2488	T5
H53	Carcloot House	240062	609994	1893	T5
H54	Silver Birches	238625	610696	3293	T5
H55	Drumbuie Farm	237659	610874	4122	T5
H56		237755	610001	3531	T2
H57	Cairnhill Cottage	236885	609477	3964	T2
H58	Cairnhill Farm	236942	609426	3890	T2
H59	Troquhain Farm	237548	609201	3248	T2
H60	Glenside Farm	237479	608915	3188	T2
H61	Dyrock Bank	236507	609296	4232	T2
H62	Glenbar Cottage	236516	608629	4017	T2
H63	Goosehill Bungalow	236196	608648	4333	T2
H64	Caml-Lann,	235977	608016	4456	T2
H65	Drumfad	235948	607992	4483	T2
H66	Cloncaird Straiton	235901	607851	4523	T2
H67	Butlers Cottage	235979	607787	4443	T2
H68	Cloncaird Mains	236139	607710	4282	T2
H69		235944	607700	4477	T2
H70	Cloncaird Mains	236320	607472	4107	T2
H71	Cloncaird House	235814	607555	4609	T2
H72	Altizeurie Cottage	237363	606687	3200	T1
H73	Altizeurie Farm	237419	606668	3144	T1
H74	Bishopland Lodge	236905	606433	3673	T1
H75	Glenlea House	237813	606067	2842	T1
H76	Balminnoch Farm	237951	605922	2751	T1
H77	Balminnoch Cottage	238012	605847	2718	T1
H78	Glenhead	238700	605583	2219	T1
H79	Sclenteuch Farm	239181	605501	1889	T1
H80	Hazel Lodge	238599	605369	2423	T1
H81	Largs Farm	238795	605048	2481	T1
H82	Glenash Bungalow	239300	605093	2115	T1
H83	High Keirs Farm	242959	608133	1226	T9
H84	High Keirs Cottage	243039	608066	1194	T9
H85	Low Keirs Farm	243315	608463	1671	T9
H86	New Patna Development	241468	609442	1314	T5

12.6.4 Although not finalised, the candidate turbine type used for the purposes of assessment for the Proposed Development is the Vestas V150 6 MW machine. This report uses the acoustic data from the manufacturer's performance specification for this machine for all analysis[17]. The manufacturer has identified these values as warranted although no independent test reports are available to indicate whether any margin has been incorporated. A 2 dB allowance for uncertainty has therefore

[17] 'Performance Specification EnVentus V150 - 6.0 MW 50/60 Hz', Vestas, Document ID: 0098-0749 V01, 2020-10-13

been added to the warranted levels as a conservative measure as recommended by the IoA GPG. Details used in this analysis are as follows:

- a mix of two hub heights (105 m & 125 m);
- a rotor diameter of 150 m;
- sound power levels (L_{WA}) for standardised 10 m height wind speeds (v_{10}) as shown in Table 12.10. Site specific shear data has been used to determine the acoustic emission at 105 m height relative to the 125 m reference height (to which the baseline data is referenced) as described in Technical Appendix 12.3;
- octave band sound power level data, at the wind speeds where it is available, as shown in Table 12.11;
- tonal emission characteristics such that no clearly audible tones are present at any wind speed.

Table 12.10 – A-Weighted sound power levels (dB(A) re 1 pW) for the Vestas V150 6 MW wind turbine

Standardised 10 m Height Wind Speed, v_{10} (ms^{-1})	105 m hub	125m hub
1	95.0	95.0
2	95.0	95.0
3	95.0	95.0
4	98.0	98.6
5	102.1	103.0
6	105.5	106.3
7	106.7	106.8
8	106.9	106.9
9	106.9	106.9
10	106.9	106.9
11	106.9	106.9
12	106.9	106.9

Table 12.11 - Octave band A-Weighted sound power levels (dB(A) re 1 pW) at standardised 10m height wind speeds for the Vestas V150 6 MW wind turbine

Octave Band (Hz)	8 ms^{-1}
63	87.9
125	95.6
250	100.3
500	102.0
1000	100.9
2000	96.8
4000	89.8
8000	79.8
OVERALL	106.9

Predictions of Noise Levels at Residential Properties

12.6.5 Table 12.12 shows the predicted noise immission levels at the nearest residential properties at each wind speed considered, calculated from the operation of the Proposed Development. The property with the highest predicted noise immission level of 36.7 dB(A) is H2 (Gass Farmhouse).

12.6.6 Figure 12.1 shows an isobel (i.e. noise contour) plot for the Proposed Development 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 12.12: 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	24.5	24.5	24.5	28.0	32.3	35.6	36.3	36.4	36.4	36.4	36.4	36.4
H2	24.8	24.8	24.8	28.3	32.7	36.0	36.6	36.7	36.7	36.7	36.7	36.7
H3	24.6	24.6	24.6	28.1	32.4	35.7	36.4	36.5	36.5	36.5	36.5	36.5
H4	16.3	16.3	16.3	19.5	23.8	27.1	28.0	28.2	28.2	28.2	28.2	28.2
H5	15.4	15.4	15.4	18.6	22.8	26.2	27.1	27.3	27.3	27.3	27.3	27.3
H6	14.5	14.5	14.5	17.8	22.0	25.3	26.2	26.4	26.4	26.4	26.4	26.4
H7	14.5	14.5	14.5	17.8	22.1	25.4	26.3	26.4	26.4	26.4	26.4	26.4
H8	11.6	11.6	11.6	14.9	19.1	22.4	23.3	23.5	23.5	23.5	23.5	23.5
H9	12.7	12.7	12.7	15.9	20.2	23.5	24.4	24.6	24.6	24.6	24.6	24.6
H10	17.5	17.5	17.5	20.7	24.9	28.3	29.2	29.4	29.4	29.4	29.4	29.4
H11	18.6	18.6	18.6	21.8	26.0	29.3	30.3	30.4	30.5	30.5	30.5	30.5
H12	19.3	19.3	19.3	22.5	26.7	30.0	31.0	31.1	31.2	31.2	31.2	31.2
H13	18.6	18.6	18.6	21.8	26.1	29.4	30.3	30.5	30.5	30.5	30.5	30.5
H14	19.4	19.4	19.4	22.6	26.8	30.2	31.1	31.3	31.3	31.3	31.3	31.3
H15	18.5	18.5	18.5	21.7	25.9	29.3	30.2	30.4	30.4	30.4	30.4	30.4

H16	18.4	18.4	18.4	21.6	25.8	29.1	30.1	30.2	30.3	30.3	30.3	30.3
H17	18.8	18.8	18.8	22.0	26.2	29.6	30.5	30.7	30.7	30.7	30.7	30.7
H18	18.8	18.8	18.8	22.1	26.3	29.6	30.6	30.7	30.7	30.7	30.7	30.7
H19	18.7	18.7	18.7	21.9	26.2	29.5	30.4	30.6	30.6	30.6	30.6	30.6
H20	18.8	18.8	18.8	22.0	26.2	29.6	30.5	30.7	30.7	30.7	30.7	30.7
H21	18.6	18.6	18.6	21.8	26.0	29.4	30.3	30.5	30.5	30.5	30.5	30.5
H22	18.8	18.8	18.8	22.0	26.2	29.5	30.5	30.6	30.7	30.7	30.7	30.7
H23	19.4	19.4	19.4	22.6	26.8	30.1	31.1	31.2	31.3	31.3	31.3	31.3
H24	19.3	19.3	19.3	22.5	26.8	30.1	31.0	31.2	31.2	31.2	31.2	31.2
H25	19.4	19.4	19.4	22.6	26.8	30.1	31.1	31.2	31.3	31.3	31.3	31.3
H26	21.6	21.6	21.6	24.7	28.9	32.3	33.3	33.4	33.5	33.5	33.5	33.5
H27	21.2	21.2	21.2	24.4	28.6	31.9	32.9	33.1	33.1	33.1	33.1	33.1
H28	21.3	21.3	21.3	24.4	28.6	32.0	33.0	33.2	33.2	33.2	33.2	33.2
H29	21.2	21.2	21.2	24.3	28.5	31.9	32.9	33.1	33.1	33.1	33.1	33.1
H30	21.3	21.3	21.3	24.5	28.7	32.0	33.0	33.2	33.2	33.2	33.2	33.2
H31	21.2	21.2	21.2	24.5	28.7	32.0	33.0	33.1	33.1	33.1	33.1	33.1
H32	21.1	21.1	21.1	24.3	28.5	31.9	32.8	33.0	33.0	33.0	33.0	33.0
H33	20.8	20.8	20.8	24.0	28.2	31.5	32.5	32.7	32.7	32.7	32.7	32.7
H34	20.7	20.7	20.7	23.9	28.1	31.5	32.4	32.6	32.6	32.6	32.6	32.6
H35	20.5	20.5	20.5	23.7	27.9	31.3	32.2	32.4	32.4	32.4	32.4	32.4
H36	20.4	20.4	20.4	23.6	27.8	31.2	32.1	32.3	32.3	32.3	32.3	32.3
H37	20.2	20.2	20.2	23.4	27.6	31.0	31.9	32.1	32.1	32.1	32.1	32.1
H38	19.9	19.9	19.9	23.1	27.3	30.6	31.6	31.7	31.8	31.8	31.8	31.8
H39	19.4	19.4	19.4	22.6	26.9	30.2	31.1	31.3	31.3	31.3	31.3	31.3

H40	18.8	18.8	18.8	22.0	26.3	29.6	30.5	30.7	30.7	30.7	30.7	30.7
H41	19.1	19.1	19.1	22.4	26.6	29.9	30.8	31.0	31.0	31.0	31.0	31.0
H42	18.3	18.3	18.3	21.6	25.8	29.1	30.0	30.2	30.2	30.2	30.2	30.2
H43	18.1	18.1	18.1	21.3	25.5	28.9	29.8	29.9	30.0	30.0	30.0	30.0
H44	17.2	17.2	17.2	20.5	24.7	28.0	28.9	29.1	29.1	29.1	29.1	29.1
H45	17.2	17.2	17.2	20.4	24.7	28.0	28.9	29.1	29.1	29.1	29.1	29.1
H46	17.0	17.0	17.0	20.2	24.5	27.8	28.7	28.9	28.9	28.9	28.9	28.9
H47	16.8	16.8	16.8	20.0	24.3	27.6	28.5	28.7	28.7	28.7	28.7	28.7
H48	16.5	16.5	16.5	19.8	24.0	27.4	28.2	28.4	28.4	28.4	28.4	28.4
H49	16.0	16.0	16.0	19.2	23.4	26.8	27.7	27.9	27.9	27.9	27.9	27.9
H50	16.0	16.0	16.0	19.2	23.4	26.8	27.7	27.9	27.9	27.9	27.9	27.9
H51	15.5	15.5	15.5	18.7	22.9	26.3	27.2	27.4	27.4	27.4	27.4	27.4
H52	15.4	15.4	15.4	18.7	22.9	26.2	27.2	27.3	27.3	27.3	27.3	27.3
H53	18.5	18.5	18.5	21.7	26.0	29.3	30.2	30.3	30.4	30.4	30.4	30.4
H54	11.1	11.1	11.1	14.4	18.7	22.0	22.8	23.0	23.0	23.0	23.0	23.0
H55	10.9	10.9	10.9	14.2	18.5	21.8	22.6	22.8	22.8	22.8	22.8	22.8
H56	12.7	12.7	12.7	16.0	20.3	23.6	24.4	24.6	24.6	24.6	24.6	24.6
H57	11.3	11.3	11.3	14.7	19.0	22.3	23.1	23.2	23.2	23.2	23.2	23.2
H58	11.5	11.5	11.5	14.9	19.2	22.5	23.3	23.4	23.4	23.4	23.4	23.4
H59	13.5	13.5	13.5	16.8	21.1	24.4	25.2	25.4	25.4	25.4	25.4	25.4
H60	13.2	13.2	13.2	16.6	20.9	24.2	25.0	25.1	25.1	25.1	25.1	25.1
H61	10.5	10.5	10.5	13.9	18.2	21.5	22.3	22.4	22.4	22.4	22.4	22.4
H62	11.0	11.0	11.0	14.4	18.7	22.0	22.7	22.9	22.9	22.9	22.9	22.9
H63	10.4	10.4	10.4	13.7	18.0	21.3	22.1	22.2	22.3	22.3	22.3	22.3

H64	10.1	10.1	10.1	13.5	17.8	21.1	21.8	22.0	22.0	22.0	22.0	22.0
H65	10.0	10.0	10.0	13.4	17.7	21.0	21.8	21.9	21.9	21.9	21.9	21.9
H66	9.9	9.9	9.9	13.2	17.5	20.9	21.6	21.7	21.8	21.8	21.8	21.8
H67	8.1	8.1	8.1	11.5	15.8	19.1	19.9	20.0	20.0	20.0	20.0	20.0
H68	8.6	8.6	8.6	11.9	16.2	19.6	20.3	20.5	20.5	20.5	20.5	20.5
H69	8.1	8.1	8.1	11.5	15.8	19.1	19.8	20.0	20.0	20.0	20.0	20.0
H70	11.1	11.1	11.1	14.5	18.8	22.1	22.8	23.0	23.0	23.0	23.0	23.0
H71	7.8	7.8	7.8	11.1	15.4	18.8	19.5	19.7	19.7	19.7	19.7	19.7
H72	13.7	13.7	13.7	17.2	21.5	24.8	25.5	25.6	25.6	25.6	25.6	25.6
H73	13.9	13.9	13.9	17.4	21.7	25.0	25.7	25.8	25.8	25.8	25.8	25.8
H74	12.3	12.3	12.3	15.7	20.0	23.4	24.1	24.2	24.2	24.2	24.2	24.2
H75	13.9	13.9	13.9	17.3	21.7	25.0	25.6	25.8	25.8	25.8	25.8	25.8
H76	13.2	13.2	13.2	16.7	21.0	24.3	25.0	25.1	25.1	25.1	25.1	25.1
H77	13.3	13.3	13.3	16.7	21.1	24.4	25.1	25.2	25.2	25.2	25.2	25.2
H78	15.8	15.8	15.8	19.3	23.6	26.9	27.6	27.7	27.7	27.7	27.7	27.7
H79	17.8	17.8	17.8	21.2	25.6	28.9	29.5	29.7	29.7	29.7	29.7	29.7
H80	14.9	14.9	14.9	18.4	22.7	26.0	26.7	26.8	26.8	26.8	26.8	26.8
H81	15.7	15.7	15.7	19.2	23.5	26.8	27.5	27.6	27.6	27.6	27.6	27.6
H82	17.7	17.7	17.7	21.1	25.5	28.8	29.4	29.6	29.6	29.6	29.6	29.6
H83	24.1	24.1	24.1	27.2	31.4	34.8	35.8	36.0	36.0	36.0	36.0	36.0
H84	23.5	23.5	23.5	26.7	30.9	34.2	35.2	35.4	35.4	35.4	35.4	35.4
H85	20.7	20.7	20.7	23.8	28.0	31.4	32.4	32.6	32.6	32.6	32.6	32.6
H86	22.3	22.3	22.3	25.9	30.3	33.6	34.1	34.2	34.2	34.2	34.2	34.2

12.6.7 Noise levels at 81 of the 86 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.

12.6.8 There are five properties that have predicted noise levels greater than this simplified noise criteria as indicated with grey shading in Table 12.12. Therefore the 'full' acoustic assessment need only be considered at these. However, as background noise measurements were carried out at additional locations, as agreed with the local authority, these properties have also been considered in the full acoustic assessment so as to provide a more comprehensive description of the acoustic impact of the Proposed Development.

Acoustic Acceptance Criteria

12.6.9 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 Proposed Development and the likely duration and level of exposure. Through consideration of these factors, along with consultation with East and South Ayrshire Councils, the Applicant have adopted a 35 dB(A) level.

12.6.10 During consultation with East and South Ayrshire Councils it was requested that a 38 dB(A) lower limit be adopted at night. Whilst not in accordance with ETSU-R-97 this has been adopted here as a conservative measure. The resulting criteria are shown in Table 12.13 where L_B is the level of background noise.

Table 12.13: Permissible noise level criteria

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	38 dB(A) for L_B less than 33 dB(A) L_B + 5 dB, for L_B greater than 33 dB(A)

Calculation of Acceptable Noise Limits from Baseline Conditions

12.6.11 The 'best-fit' lines of Technical Appendix 12.7 Charts 12.3-12.14 have been used to calculate the acceptable noise limits at the background noise measurement locations in line with the permissible noise level criteria set out in Table 12.13. Table 12.14 shows the proposed daytime noise limits (the higher of 35 dB(A) or background plus 5 dB(A)) and Table 12.15 the night time noise limits (the higher of 38 dB(A) or background plus 5 dB(A)).

Table 12.14 - Proposed daytime noise limits (dB(A) re 20 μPa)

House name	Standardised 10 m wind speed (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
Altizeurie Cottage	35.0	35.0	35.0	35.0	35.0	36.7	38.6	40.6	42.8	45.2	47.8	50.8
Barneil Farm	35.0	35.0	35.0	35.0	35.6	37.2	39.1	41.2	43.4	45.9	48.4	48.4
Gass Farm	35.0	35.0	35.0	35.0	36.3	38.4	40.8	43.3	46.2	49.6	53.5	58.0
Glenhead	35.0	35.0	35.0	35.6	37.6	39.7	41.7	43.7	45.5	47.0	48.1	48.1
High Keirs	37.4	37.4	37.7	38.3	39.2	40.4	41.8	43.4	45.2	47.3	49.5	51.8
Patna	35.0	35.0	35.0	35.0	35.5	36.4	37.3	38.3	39.1	39.1	39.1	39.1

Table 12.15 - Proposed night-time noise limits (dB(A) re 20 μPa)

House name	Standardised 10 m wind speed (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
Altizeurie Cottage	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	39.9	42.7	45.8	45.8
Barneil Farm	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.3	40.0	41.7	43.5	43.5
Gass Farm	38.0	38.0	38.0	38.0	38.0	38.0	38.6	40.6	42.7	44.8	47.0	47.0
Glenhead	38.0	38.0	38.0	38.0	38.0	38.0	38.4	40.5	42.9	45.7	48.7	48.7
High Keirs	38.0	38.0	38.0	38.5	39.1	39.6	40.2	41.0	42.2	43.7	45.8	45.8
Patna	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0

12.6.12 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 Proposed Development. 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

12.6.13 Table 12.16 shows a comparison of the predicted noise levels with the proposed daytime noise limits for each residential property where the full assessment procedure is being applied. 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 proposed limit. A negative value indicates that the predicted noise level is within the limit. Table 12.17 shows a comparison with the proposed night-time noise limits.

12.6.14 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 -2.4 dB(A). The minimum margin during night-time periods is 2.0 dB(A).

Table 12.16 - Comparison of predicted noise levels and daytime noise 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
H1	24.5	35.0	-10.5	24.5	35.0	-10.5	24.5	35.0	-10.5	28.0	35.0	-7.0
H2	24.8	35.0	-10.2	24.8	35.0	-10.2	24.8	35.0	-10.2	28.3	35.0	-6.7
H3	24.6	35.0	-10.4	24.6	35.0	-10.4	24.6	35.0	-10.4	28.1	35.0	-6.9
H32	21.1	35.0	-13.9	21.1	35.0	-13.9	21.1	35.0	-13.9	24.3	35.0	-10.7
H62	11.0	35.0	-24.0	11.0	35.0	-24.0	11.0	35.0	-24.0	14.4	35.0	-20.6
H72	13.7	35.0	-21.3	13.7	35.0	-21.3	13.7	35.0	-21.3	17.2	35.0	-17.8
H78	15.8	35.0	-19.2	15.8	35.0	-19.2	15.8	35.0	-19.2	19.3	35.6	-16.3
H83	24.1	37.4	-13.3	24.1	37.4	-13.3	24.1	37.7	-13.6	27.2	38.3	-11.1
H84	23.5	37.4	-13.9	23.5	37.4	-13.9	23.5	37.7	-14.2	26.7	38.3	-11.6

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	32.3	36.3	-4.0	35.6	38.4	-2.8	36.3	40.8	-4.5	36.4	43.3	-6.9
H2	32.7	36.3	-3.6	36.0	38.4	-2.4	36.6	40.8	-4.2	36.7	43.3	-6.6
H3	32.4	36.3	-3.9	35.7	38.4	-2.7	36.4	40.8	-4.4	36.5	43.3	-6.8
H32	28.5	35.5	-7.0	31.9	36.4	-4.5	32.8	37.3	-4.5	33.0	38.3	-5.3
H62	18.7	35.6	-16.9	22.0	37.2	-15.2	22.7	39.1	-16.4	22.9	41.2	-18.3
H72	21.5	35.0	-13.5	24.8	36.7	-11.9	25.5	38.6	-13.1	25.6	40.6	-15.0

H78	23.6	37.6	-14.0	26.9	39.7	-12.8	27.6	41.7	-14.1	27.7	43.7	-16.0
H83	31.4	39.2	-7.8	34.8	40.4	-5.6	35.8	41.8	-6.0	36.0	43.4	-7.4
H84	30.9	39.2	-8.3	34.2	40.4	-6.2	35.2	41.8	-6.6	35.4	43.4	-8.0

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	36.4	46.2	-9.8	36.4	49.6	-13.2	36.4	53.5	-17.1	36.4	58.0	-21.6
H2	36.7	46.2	-9.5	36.7	49.6	-12.9	36.7	53.5	-16.8	36.7	58.0	-21.3
H3	36.5	46.2	-9.7	36.5	49.6	-13.1	36.5	53.5	-17.0	36.5	58.0	-21.5
H32	33.0	39.1	-6.1	33.0	39.1	-6.1	33.0	39.1	-6.1	33.0	39.1	-6.1
H62	22.9	43.4	-20.5	22.9	45.9	-23.0	22.9	48.4	-25.5	22.9	48.4	-25.5
H72	25.6	42.8	-17.2	25.6	45.2	-19.6	25.6	47.8	-22.2	25.6	50.8	-25.2
H78	27.7	45.5	-17.8	27.7	47.0	-19.3	27.7	48.1	-20.4	27.7	48.1	-20.4
H83	36.0	45.2	-9.2	36.0	47.3	-11.3	36.0	49.5	-13.5	36.0	51.8	-15.8
H84	35.4	45.2	-9.8	35.4	47.3	-11.9	35.4	49.5	-14.1	35.4	51.8	-16.4

Table 12.17 - Comparison of predicted noise levels and 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
H1	24.5	38.0	-13.5	24.5	38.0	-13.5	24.5	38.0	-13.5	28.0	38.0	-10.0
H2	24.8	38.0	-13.2	24.8	38.0	-13.2	24.8	38.0	-13.2	28.3	38.0	-9.7
H3	24.6	38.0	-13.4	24.6	38.0	-13.4	24.6	38.0	-13.4	28.1	38.0	-9.9
H32	21.1	38.0	-16.9	21.1	38.0	-16.9	21.1	38.0	-16.9	24.3	38.0	-13.7
H62	11.0	38.0	-27.0	11.0	38.0	-27.0	11.0	38.0	-27.0	14.4	38.0	-23.6
H72	13.7	38.0	-24.3	13.7	38.0	-24.3	13.7	38.0	-24.3	17.2	38.0	-20.8
H78	15.8	38.0	-22.2	15.8	38.0	-22.2	15.8	38.0	-22.2	19.3	38.0	-18.7
H83	24.1	38.0	-13.9	24.1	38.0	-13.9	24.1	38.0	-13.9	27.2	38.5	-11.3
H84	23.5	38.0	-14.5	23.5	38.0	-14.5	23.5	38.0	-14.5	26.7	38.5	-11.8

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	32.3	38.0	-5.7	35.6	38.0	-2.4	36.3	38.6	-2.3	36.4	40.6	-4.2
H2	32.7	38.0	-5.3	36.0	38.0	-2.0	36.6	38.6	-2.0	36.7	40.6	-3.9
H3	32.4	38.0	-5.6	35.7	38.0	-2.3	36.4	38.6	-2.2	36.5	40.6	-4.1
H32	28.5	38.0	-9.5	31.9	38.0	-6.1	32.8	38.0	-5.2	33.0	38.0	-5.0
H62	18.7	38.0	-19.3	22.0	38.0	-16.0	22.7	38.0	-15.3	22.9	38.3	-15.4
H72	21.5	38.0	-16.5	24.8	38.0	-13.2	25.5	38.0	-12.5	25.6	38.0	-12.4
H78	23.6	38.0	-14.4	26.9	38.0	-11.1	27.6	38.4	-10.8	27.7	40.5	-12.8
H83	31.4	39.1	-7.7	34.8	39.6	-4.8	35.8	40.2	-4.4	36.0	41.0	-5.0
H84	30.9	39.1	-8.2	34.2	39.6	-5.4	35.2	40.2	-5.0	35.4	41.0	-5.6

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	36.4	42.7	-6.3	36.4	44.8	-8.4	36.4	47.0	-10.6	36.4	47.0	-10.6
H2	36.7	42.7	-6.0	36.7	44.8	-8.1	36.7	47.0	-10.3	36.7	47.0	-10.3
H3	36.5	42.7	-6.2	36.5	44.8	-8.3	36.5	47.0	-10.5	36.5	47.0	-10.5
H32	33.0	38.0	-5.0	33.0	38.0	-5.0	33.0	38.0	-5.0	33.0	38.0	-5.0
H62	22.9	40.0	-17.1	22.9	41.7	-18.8	22.9	43.5	-20.6	22.9	43.5	-20.6
H72	25.6	39.9	-14.3	25.6	42.7	-17.1	25.6	45.8	-20.2	25.6	45.8	-20.2
H78	27.7	42.9	-15.2	27.7	45.7	-18.0	27.7	48.7	-21.0	27.7	48.7	-21.0
H83	36.0	42.2	-6.2	36.0	43.7	-7.7	36.0	45.8	-9.8	36.0	45.8	-9.8
H84	35.4	42.2	-6.8	35.4	43.7	-8.3	35.4	45.8	-10.4	35.4	45.8	-10.4

The term L_p is used to denote the predicted noise level due to the operation of the Proposed Development

The term ΔL is used to denote the difference between the predicted wind farm noise level and the recommended limit

Construction Effects

Construction Noise Assessment

12.6.15 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 construction compounds. 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.

12.6.16 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

12.6.17 The plant assumed for each construction activity is shown in Table 12.18. 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 52281:2009.

Table 12.18: 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	
Enabling Works 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	100	122
	Dump truck	113	2	75	
	Tipper lorry	107	4	50	
	Dozer	109	1	100	
	Vibratory roller	102	1	75	
	Excavator mounted rock breaker	121	1	33	
Construct Substations	Tracked excavator	113	1	100	117
	Concrete mixer truck	108	2	50	
	Lorry	108	1	50	
	Telescopic Handler	99	1	100	
	Piling rig	117	1	50	
Construct crane hard-standings	Tracked excavator	113	3	100	120
	Dump truck	113	2	100	
	Tipper lorry	107	4	50	
	Vibratory roller	102	1	50	
Construct Turbine Foundations	Tracked excavator	113	2	75	123
	Dump truck	113	2	75	
	Concrete mixer truck	108	4	50	
	Mobile telescopic crane	110	1	50	
	Concrete pump	106	2	50	
	Water pump	93	1	100	
	Hand-held pneumatic breaker	111	1	75	
	Compressor	103	3	50	
	Piling rig	117	1	100	
	Poker vibrator	106	3	50	
	Excavator mounted rock breaker	121	1	50	
Excavate and Lay Site Cables	Tracked excavator	113	2	100	122
	Dump truck	113	2	75	
	Tractor (Towing Equipment)	108	1	75	
	Tractor (Towing Trailer)	107	1	75	
	Vibratory plate	108	1	50	
	Excavator mounted rock breaker	121	1	50	
Erect Turbine	Mobile telescopic crane	110	2	75	119
	Lorry	108	1	75	
	Diesel generator	102	1	100	
	Torque guns	111	4	100	
Reinstate Crane Bases	Tracked excavator	113	1	75	115
	Dump truck	113	1	75	
Lay Cable to Substations	Wheeled loader	108	1	100	117
	Saw	114	1	50	
	Hand-held pneumatic breaker	111	1	50	
	Dump truck	113	1	75	

	Tipper lorry	107	1	50	
	Vibratory plate	108	1	75	
	Tandem roller	102	1	75	
	Tractor (Towing Trailer)	107	1	50	
	Lorry	108	1	75	
Forestry Felling	Saw	114	1	100	116
	Harvester	108	2	100	
Borrow Pits	Excavator mounted rock breaker	121	1	100	126
	Dump truck	113	2	75	
	Dozer	109	1	100	
	Tracked semi-mobile crusher	124	1	100	
	Tracked excavator	113	1	100	
Construct New Water Crossing	Tracked Excavator	113	1	100	120
	Dump Truck	113	1	100	
	Tipper lorry	107	4	50	
	Dozer	109	1	75	
	Vibratory Roller	102	1	75	
	Telescopic Handler	99	1	100	
	Piling Rig	117	1	50	
	Concrete Pump	106	1	50	
	Concrete mixer truck	108	3	50	
	Poker vibrator	106	2	50	
	Water pump	93	2	100	

12.6.18 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 12.19.

12.6.19 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 12.19: Predicted sound pressure level due to construction noise (dB L_{Aeq})

Activity	H2	H4	H14	H26	H53	H79	H84	H85
Temporary Construction Compound	42.8	38.1	39.4	38.9	34.5	35.7	43.9	41.0
Temporary Enabling Works Compounds	43.4	40.0	64.8	43.0	34.9	35.2	49.8	59.2
Site Tracks	48.5	43.5	76.0	45.9	43.9	43.7	61.1	84.3
Substation Compound	40.1	36.1	37.2	36.4	31.9	33.1	41.7	38.8
Crane Hardstands	45.8	40.2	41.3	44.1	41.8	41.8	46.3	43.0
Turbine Foundations	48.8	43.2	44.3	47.1	44.8	44.8	49.3	46.0
Excavate and Lay Cables	47.8	42.2	43.3	46.1	43.8	43.8	48.3	45.0
Erect Turbine	44.4	38.8	39.9	42.7	40.4	40.4	44.9	41.6
Reinstate Crane Hardstands	40.4	34.8	35.9	38.7	36.4	36.4	40.9	37.6
Lay Cable to Substations	40.5	36.5	37.6	36.8	32.3	33.5	42.1	39.2
Forestry Felling	41.6	36.0	37.1	39.9	37.6	37.6	42.1	38.8
Borrow Pits	48.3	42.7	47.0	51.0	45.1	43.3	50.7	48.6
Water Crossing	44.6	41.0	65.5	43.5	36.9	39.5	58.7	58.4

Construction Traffic

12.6.20 Due to the delivery of construction material and wind farm components, vehicle movements either into or away from the Proposed Development shall increase levels of traffic flow on public roads in the area. Traffic regularly accessing the Proposed Development is shown in Chapter 11: 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 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 nine days during foundation pouring.

12.6.21 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 12.20. The maximum sound pressure level due to traffic flows during the most intensive period of activity is predicted to be 62.6 dB L_{Aeq}. The property where this occurs is adjacent to the proposed concrete delivery route and, as such, corresponds to the worst case.

[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

Table 12.20: Traffic noise predictions by activity (dB L_{Aeq})

House ID	Dump Truck	Lorries	Concrete Mixer
H2	60.3	55.7	55.7
H4	44.5	39.8	39.8
H14	60.3	55.7	55.7
H26	42.9	38.3	38.3
H53	38.0	33.3	33.3
H79	46.2	41.6	41.6
H84	45.3	40.6	40.6
H85	55.6	50.9	50.9

12.6.22 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 0.1 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

12.6.23 Worst case construction noise levels may arise when the following simultaneous activities occur: construction of nearest access tracks; 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 12.21.

12.6.24 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 12.21: Predicted noise due to combined traffic noise and turbine construction (dB L_{Aeq})

House ID	Construction Plant Noise	Traffic Noise	Combined Noise
H2	52.7	62.6	63.0
H4	47.3	46.7	50.0
H14	76.0	62.6	76.2
H26	50.6	45.2	51.7
H53	48.4	40.2	49.0
H79	48.4	48.5	51.5
H84	61.5	47.5	61.7
H85	84.3	57.8	84.3

Assessment of Construction Noise

12.6.25 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 evenings (1900-2300), Saturdays (1300-2300) and Sundays; and 45 dB(A) for night-time (2300-0700) periods.

12.6.26 Site operations would be limited to 0700-1900 Monday to Saturday except during turbine erection and commissioning or during periods of emergency work so an assessment against the 65 dB(A) and 55 dB(A) criteria has been undertaken.

12.6.27 Table 12.21 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 eight assessed residential properties.

12.6.28 Peak construction noise levels are predicted to exceed the 55 dB(A) threshold for evenings and weekends at four of the assessed properties although, of the times when this criterion applies, construction is only scheduled to take place on Saturdays 1300-1900 with the exception of turbine erection and commissioning or periods of emergency work.

12.6.29 An assessment against the night-time threshold has not been undertaken as construction work is not scheduled to take place during the night with the exception of turbine erection and commissioning or periods of emergency work. Predicted noise levels of less than 45 dB(A) due to turbine erection imply that this activity can be undertaken at night if necessary.

12.6.30 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.

[19] Calculation of Road Traffic Noise (CRTN), HMSO Department of Transport, 1988.

Assessment of Vibration due to Blasting

12.6.31 BS 5228-2:2009 provides guidance on the assessment of vibration due to blasting. A scaled distance graph is shown in Figure E.1 in Annex E of BS 5228.2:2009 which provides an indication of likely vibration magnitudes at various distances. This figure can be used to determine the level of vibration which would not be expected to be exceeded in 95 % of blasts for a given distance and charge size.

12.6.32 BS 6472-2:2008 details the maximum satisfactory magnitudes for vibration measured on a firm surface outside buildings with respect to human response. For up to three blast vibration events per day the generally accepted maximum satisfactory magnitude at residential premises during daytime periods (0800-1800 Monday to Friday and 0800-1300 on Saturdays) is a peak particle velocity (ppv) of 6.0 to 10.0 mms^{-1}. In practice, the lower satisfactory magnitude should be used with the higher magnitude being justified on a case-by-case basis.

12.6.33 For a charge size of 1000 kg the estimated vibration magnitude is 4.08 mms^{-1} at the nearest residential property to the borrow pit which is approximately 1383 m away. This suggests that the probability of adverse comment is low.

12.7 Mitigation

Operational Noise

12.7.1 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.

12.7.2 Due to this consideration of the noise impacts in the design of the Proposed Development, 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.

12.7.3 It is worth noting that the operation of 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.

12.7.4 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.

12.7.5 Technical Appendix 12.8 contains a set of conditions that the Applicant considers appropriate.

Construction Noise

12.7.6 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 Section 72 of the Control of Pollution Act 1974.

12.7.7 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 is recommended 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-site.

12.7.8 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 where necessary and appropriate, acoustic barriers could be used to screen them; and
- The movement of vehicles to and from the Proposed Development would be controlled and employees instructed to ensure compliance with the noise control measures adopted.

12.7.9 Site operations would be limited to 0700-1900 Monday to Saturday except during turbine erection and commissioning or during periods of emergency work. Should it be considered necessary to reduce noise levels from the conservative predicted levels to adhere to the 55 dB(A) target level for Saturdays 1300-1900, the following mitigation measures would be considered:

- Reduce the number of construction activities occurring simultaneously;

- Restrict the distance of construction activity from nearby properties during these times; &
- Reduce construction traffic as appropriate.

12.7.10 The exceedance of the 65 dB(A) daytime target level at H85 is predicted to last for seven days whilst site tracks are constructed or upgraded within a certain distance of the property. The daytime target level is predicted to be exceeded for a period of ten weeks at the properties nearest to the main site entrance e.g. H14. This allows for ten days to construct the main site entrance, eight weeks to construct the bridge, four days to construct or upgrade the site tracks within a certain distance of the properties and two days to construct the enabling works compound. This is a worst case as it assumes that these activities are undertaken sequentially whereas some of the work may be able to be done in parallel.

12.7.11 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.

12.7.12 With specific regard to blasting, it is proposed that the following mitigation measures are implemented:

- Good practice on blasting, as recommended by Planning Advice Note (PAN) 50 'Controlling the environmental effects of surface mineral workings'[20] shall be followed;
- The vibration and air overpressure reduction methods outlined in Section 8.6.9.2 of BS 5228-2:2009 shall be adhered to where appropriate;
- Advance warning shall be given to nearby residents;
- Blasting should only occur between the hours of 0800-1800 on Mondays-Fridays or between the hours of 0800-1300 on Saturdays; and
- No more than three blasts per day should occur.

12.7.13 Depending upon the charge sizes required it may be prudent to perform trial blasts with smaller amounts of explosive and measure vibration magnitudes at various distances to more accurately determine how vibration propagates at the Proposed Development.

12.8 Assessment of Residual Effects

Operational

12.8.1 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

12.8.2 The daytime criteria noise level is predicted to be temporarily exceeded at the properties nearest the main site entrance along with H85. Construction noise levels above the criteria level for Saturdays 1300-1900 are also predicted at the properties nearest the mains site entrance along with three other locations although this can be mitigated by restricting the activities that are allowed to take place as necessary. At all other locations predicted noise from worst case combination of increased traffic and site construction noise would not exceed relevant criteria and therefore no significant impacts are expected.

12.9 Assessment of Cumulative Effects

Cumulative Operational Noise Assessment

12.9.1 An assessment of the cumulative acoustic impact of the Proposed Development in conjunction with the existing Dersalloch Wind Farm has been undertaken in accordance with the guidance on wind farm noise assessment; ETSU-R-97 and the IoA GPG.

12.9.2 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."

[20] 'Planning Advice Note 50: Controlling the environmental effects of surface mineral workings', Scottish Government, October 1996. Available at: https://www.gov.scot/publications/planning-advice-note-pan-50-controlling-environmental-effects-surface-mineral/

12.9.3 The locations of the nine turbines making up the Proposed Development, along with the other turbines considered in the cumulative assessment, are shown in Figure 12.2.

12.9.4 The residential properties considered in the cumulative assessment are those detailed in Table 12.9. The distances to the nearest turbine included in the cumulative assessment are given in Table 12.22.

Table 12.22: Distances from Residential Properties to Nearest Cumulative Turbine

House ID	House Name	Distance (m)	Nearest Turbine
H1	Glentaggan Bungalow	1179	D8
H2	Gass Farmhouse	1191	D8
H3	Gass Farm Cottage	1143	D8
H4	Grimmet Farmhouse	1995	D17
H5	Grimmet Cottage	1965	D17
H6	The View	1889	D17
H7		2255	D17
H8		3724	T9
H9		3371	T9
H10		2166	T9
H11		2060	T9
H12		1976	T9
H13	The Old Institute	2089	T9
H14		1994	T9
H15	Glenview	2128	T9
H16	Barley Park Cottage	2162	T9
H17	Hillhead South	2121	T9
H18	Kirk Lodge	2125	T9
H19	Clover Park Cottage	2171	T9
H20	Doonlea	2193	T9
H21	Hillend	2270	T7
H22	Drumbui Farm	2245	T6
H23	Doonbank House	2096	T6
H24		2100	T6
H25		2085	T5
H26		1491	T5
H27		1537	T5
H28		1508	T5
H29		1506	T5
H30		1523	T5
H31		1554	T5
H32		1571	T5
H33		1603	T5
H34		1617	T5
H35		1642	T5
H36		1652	T5
H37		1677	T5
H38		1736	T5
H39		1803	T5
H40		1891	T5
H41		1846	T5
H42		1988	T5
H43		2039	T5
H44		2207	T5
H45		2213	T5
H46		2248	T5
H47		2298	T5
H48		2350	T5
H49		2399	T5
H50		2403	T5
H51		2471	T5
H52		2488	T5
H53	Carcloot House	1893	T5
H54	Silver Birches	3293	T5
H55	Drumbuie Farm	4122	T5
H56		3531	T2
H57	Cairnhill Cottage	3964	T2
H58	Cairnhill Farm	3890	T2
H59	Troquhain Farm	3248	T2
H60	Glenside Farm	3188	T2
H61	Dyrock Bank	4232	T2
H62	Glenbar Cottage	4017	T2
H63	Goosehill Bungalow	4333	T2
H64	Caml-Lann,	4456	T2
H65	Drumfad	4483	T2
H66	Cloncaird Straiton	4523	T2

H67	Butlers Cottage	4443	T2
H68	Cloncaird Mains	4282	T2
H69		4477	T2
H70	Cloncaird Mains	4107	T2
H71	Cloncaird House	4609	T2
H72	Altizeurie Cottage	3200	T1
H73	Altizeurie Farm	3144	T1
H74	Bishopland Lodge	3673	T1
H75	Glenlea House	2842	T1
H76	Balminnoch Farm	2751	T1
H77	Balminnoch Cottage	2718	T1
H78	Glenhead	2219	T1
H79	Sclenteuch Farm	1804	D6
H80	Hazel Lodge	2210	D6
H81	Largs Farm	1894	D6
H82	Glenash Bungalow	1465	D6
H83	High Keirs Farm	1226	T9
H84	High Keirs Cottage	1194	T9
H85	Low Keirs Farm	1671	T9
H86	New Patna Development	1314	T5

Cumulative Assessment Methodology

12.9.5 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.

12.9.6 The methodology is therefore to:

- Predict noise emission 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.

12.9.7 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

12.9.8 The noise limits contained in the Decision Notice[21] are used to calculate the worst case predicted noise levels from the existing Dersalloch Wind Farm using the 'Controlling Property' method outlined in the IoA GPG as follows:

- Predictions are made using appropriate turbine noise data;
- Comparison is made between the predictions and the limits from the planning conditions in order to identify the controlling property; and
- The predictions are scaled by the margin between the predictions and the conditioned noise limits at the controlling property.

12.9.9 The above process would yield predicted noise levels which are equal to the conditioned noise limit at the controlling property which in this case is Gass Farm. However, given the significant headroom between the predicted noise levels and the limits this would be an unrealistic assumption and the scaling factor has been limited to 3 dB.

12.9.10 The turbine installed at Dersalloch Wind Farm is the Siemens D3 turbine. Warranted acoustic data for this machine is taken from the manufacturer's general specification[22] and an uncertainty of 1 dB has been added as independent test reports indicate that some allowance for uncertainty has already been included. Details used in this analysis are as follows:

- a mix of two hub heights (64.5 m & 74.5 m);
- a rotor diameter of 101 m (worst case of 101 m, 108 m & 113 m options);
- sound power levels, L_{WA}, for standardised 10 m height wind speeds (v_{10}) as shown in Table 12.23. Site specific shear data has been used to determine the acoustic emission at 64.5 m & 74.5 m height relative to the 125 m reference height (to which the baseline data is referenced) as described in Technical Appendix 12.3; and
- octave band sound power level data, at the wind speeds where it is available, as shown in Table 12.24.

[21] Scottish Government, Decision Notice for Dersalloch, 23 July 2014.

[22] "SWT-3.0-101, Hub Height 79.5 m, Acoustic Emission", Document ID: E R WP SP EN-10-0000-0085-00, 2010-08-25

Table 12.23: A-Weighted Sound Power Levels (dB(A) re 1 pW) for the Siemens D3 Wind Turbine

Standardised 10m Height Wind Speed, v_{10} (ms^{-1})	64.5 m Hub	74.5 m Hub
1	96.1	96.1
2	96.1	96.1
3	96.1	96.1
4	96.1	96.1
5	98.7	99.3
6	103.0	104.0
7	106.4	107.1
8	108.1	108.4
9	108.9	108.9
10	109.0	109.0
11	109.0	109.0
12	109.0	109.0

Table 12.24: Octave band A-Weighted sound power levels (dB(A) re 1 pW) at 10 m standardised wind speeds for the Siemens D3 wind turbine

Octave Band (Hz)	64.5 m Hub		74.5m Hub	
	6 ms^{-1}	8 ms^{-1}	6 ms^{-1}	8 ms^{-1}
63	82.9	79.0	83.3	80.0
125	94.8	90.2	95.2	91.2
250	101.5	94.3	101.9	95.3
500	104.8	97.9	105.2	98.9
1000	101.5	98.1	101.9	99.1
2000	93.6	94.7	94.0	95.7
4000	82.7	87.3	83.1	88.3
8000	79.4	83.0	79.8	84.0
OVERALL	103.0	108.1	104.0	108.4

12.9.11 The cumulative 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 12.25.

12.9.12 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.

Table 12.25: 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	33.2	33.2	33.2	33.9	37.1	41.2	44.8	46.2	46.8	46.9	46.9	46.9
H2	33.3	33.3	33.3	34.0	37.2	41.4	44.9	46.3	46.9	47.0	47.0	47.0
H3	33.6	33.6	33.6	34.3	37.4	41.6	45.2	46.6	47.2	47.3	47.3	47.3
H4	24.1	24.1	24.1	24.9	28.1	32.2	35.9	37.3	37.9	37.9	37.9	37.9
H5	24.1	24.1	24.1	24.7	27.8	32.0	35.9	37.3	37.9	37.9	37.9	37.9
H6	24.3	24.3	24.3	24.8	27.8	32.1	36.1	37.6	38.1	38.2	38.2	38.2
H7	23.0	23.0	23.0	23.7	26.8	31.0	34.8	36.3	36.8	36.9	36.9	36.9
H8	21.0	21.0	21.0	21.6	24.6	28.9	32.9	34.3	34.9	35.0	35.0	35.0
H9	21.4	21.4	21.4	22.0	25.1	29.4	33.2	34.7	35.3	35.3	35.3	35.3
H10	21.3	21.3	21.3	23.0	26.6	30.4	33.1	34.2	34.6	34.7	34.7	34.7
H11	21.8	21.8	21.8	23.6	27.4	31.1	33.6	34.6	35.0	35.0	35.0	35.0
H12	22.1	22.1	22.1	24.1	27.9	31.6	33.9	34.9	35.2	35.3	35.3	35.3
H13	21.9	21.9	21.9	23.7	27.4	31.1	33.6	34.6	35.0	35.1	35.1	35.1
H14	22.1	22.1	22.1	24.1	27.9	31.6	33.9	34.8	35.2	35.2	35.2	35.2
H15	21.7	21.7	21.7	23.5	27.3	31.0	33.5	34.5	34.9	34.9	34.9	34.9
H16	22.0	22.0	22.0	23.7	27.4	31.1	33.8	34.9	35.3	35.3	35.3	35.3
H17	21.8	21.8	21.8	23.7	27.5	31.2	33.6	34.5	34.9	35.0	35.0	35.0
H18	21.8	21.8	21.8	23.7	27.5	31.2	33.6	34.5	34.9	34.9	34.9	34.9
H19	21.9	21.9	21.9	23.8	27.5	31.2	33.7	34.7	35.1	35.1	35.1	35.1
H20	21.6	21.6	21.6	23.6	27.4	31.0	33.4	34.3	34.7	34.7	34.7	34.7
H21	21.8	21.8	21.8	23.6	27.4	31.1	33.6	34.5	34.9	35.0	35.0	35.0
H22	21.0	21.0	21.0	23.2	27.1	30.7	32.8	33.6	33.9	34.0	34.0	34.0
H23	21.2	21.2	21.2	23.6	27.5	31.1	33.0	33.7	34.0	34.1	34.1	34.1
H24	21.2	21.2	21.2	23.5	27.5	31.0	32.9	33.7	34.0	34.0	34.0	34.0
H25	21.2	21.2	21.2	23.6	27.5	31.0	32.9	33.7	34.0	34.0	34.0	34.0
H26	22.9	22.9	22.9	25.4	29.4	32.9	34.6	35.2	35.5	35.5	35.5	35.5
H27	22.6	22.6	22.6	25.1	29.1	32.6	34.3	34.9	35.2	35.2	35.2	35.2
H28	22.6	22.6	22.6	25.1	29.1	32.6	34.3	34.9	35.2	35.2	35.2	35.2
H29	22.5	22.5	22.5	25.0	29.0	32.5	34.2	34.8	35.1	35.1	35.1	35.1
H30	22.5	22.5	22.5	25.1	29.1	32.6	34.3	34.9	35.1	35.1	35.1	35.1
H31	22.5	22.5	22.5	25.1	29.1	32.6	34.2	34.8	35.0	35.0	35.0	35.0
H32	22.4	22.4	22.4	25.0	29.0	32.5	34.1	34.7	34.9	35.0	35.0	35.0
H33	22.1	22.1	22.1	24.7	28.7	32.2	33.9	34.5	34.7	34.8	34.8	34.8

H34	22.1	22.1	22.1	24.6	28.6	32.1	33.8	34.5	34.7	34.7	34.7	34.7
H35	22.0	22.0	22.0	24.5	28.5	32.0	33.7	34.4	34.6	34.6	34.6	34.6
H36	21.8	21.8	21.8	24.4	28.4	31.9	33.6	34.2	34.5	34.5	34.5	34.5
H37	21.6	21.6	21.6	24.2	28.2	31.7	33.4	34.0	34.3	34.3	34.3	34.3
H38	21.3	21.3	21.3	23.8	27.9	31.4	33.1	33.7	34.0	34.0	34.0	34.0
H39	20.9	20.9	20.9	23.4	27.4	30.9	32.6	33.3	33.5	33.6	33.6	33.6
H40	20.3	20.3	20.3	22.8	26.8	30.3	32.1	32.7	33.0	33.0	33.0	33.0
H41	20.7	20.7	20.7	23.2	27.2	30.7	32.4	33.0	33.3	33.3	33.3	33.3
H42	19.9	19.9	19.9	22.4	26.4	29.9	31.7	32.3	32.6	32.6	32.6	32.6
H43	19.7	19.7	19.7	22.1	26.1	29.7	31.4	32.1	32.4	32.4	32.4	32.4
H44	19.1	19.1	19.1	21.5	25.4	29.0	30.8	31.6	31.9	31.9	31.9	31.9
H45	19.1	19.1	19.1	21.5	25.4	29.0	30.9	31.6	31.9	32.0	32.0	32.0
H46	19.1	19.1	19.1	21.3	25.3	28.8	30.8	31.6	31.9	31.9	31.9	31.9
H47	18.9	18.9	18.9	21.2	25.1	28.7	30.7	31.5	31.8	31.8	31.8	31.8
H48	18.8	18.8	18.8	21.0	24.9	28.5	30.5	31.3	31.6	31.7	31.7	31.7
H49	18.4	18.4	18.4	20.5	24.4	28.0	30.1	30.9	31.2	31.3	31.3	31.3
H50	18.3	18.3	18.3	20.4	24.3	27.9	30.0	30.8	31.1	31.2	31.2	31.2
H51	17.7	17.7	17.7	19.9	23.8	27.4	29.5	30.3	30.6	30.6	30.6	30.6
H52	17.7	17.7	17.7	19.9	23.8	27.4	29.4	30.2	30.6	30.6	30.6	30.6
H53	20.5	20.5	20.5	22.8	26.7	30.3	32.2	33.0	33.3	33.3	33.3	33.3
H54	14.3	14.3	14.3	16.2	20.0	23.7	26.0	26.9	27.3	27.4	27.4	27.4
H55	15.4	15.4	15.4	16.9	20.5	24.3	26.9	28.1	28.6	28.6	28.6	28.6
H56	15.3	15.3	15.3	17.4	21.3	24.9	27.0	27.8	28.2	28.2	28.2	28.2
H57	14.4	14.4	14.4	16.4	20.2	23.9	26.1	27.0	27.4	27.5	27.5	27.5
H58	14.6	14.6	14.6	16.6	20.4	24.0	26.3	27.2	27.6	27.7	27.7	27.7
H59	16.2	16.2	16.2	18.3	22.2	25.8	27.9	28.8	29.2	29.2	29.2	29.2
H60	16.3	16.3	16.3	18.3	22.1	25.7	28.0	28.9	29.3	29.4	29.4	29.4
H61	14.0	14.0	14.0	15.8	19.6	23.3	25.6	26.7	27.1	27.1	27.1	27.1
H62	15.1	15.1	15.1	16.7	20.4	24.1	26.7	27.8	28.3	28.3	28.3	28.3
H63	15.4	15.4	15.4	16.8	20.3	24.2	27.1	28.3	28.8	28.9	28.9	28.9
H64	16.4	16.4	16.4	17.4	20.8	24.8	28.0	29.3	29.9	30.0	30.0	30.0
H65	16.4	16.4	16.4	17.5	20.8	24.8	28.1	29.4	30.0	30.0	30.0	30.0
H66	15.2	15.2	15.2	16.5	20.0	23.8	26.8	28.0	28.6	28.6	28.6	28.6
H67	14.9	14.9	14.9	15.9	19.2	23.2	26.5	27.9	28.5	28.5	28.5	28.5
H68	15.5	15.5	15.5	16.5	19.8	23.8	27.2	28.5	29.1	29.2	29.2	29.2
H69	15.0	15.0	15.0	16.0	19.3	23.3	26.7	28.0	28.6	28.7	28.7	28.7
H70	18.4	18.4	18.4	19.2	22.5	26.5	30.0	31.4	32.0	32.1	32.1	32.1
H71	15.2	15.2	15.2	16.0	19.3	23.3	26.8	28.2	28.8	28.9	28.9	28.9
H72	21.0	21.0	21.0	21.9	25.2	29.2	32.7	34.2	34.8	34.8	34.8	34.8
H73	21.0	21.0	21.0	21.9	25.2	29.2	32.7	34.1	34.7	34.8	34.8	34.8
H74	20.1	20.1	20.1	20.9	24.1	28.2	31.8	33.3	33.9	34.0	34.0	34.0
H75	20.6	20.6	20.6	21.6	24.9	28.9	32.3	33.7	34.3	34.3	34.3	34.3
H76	21.1	21.1	21.1	21.9	25.1	29.2	32.9	34.3	34.9	35.0	35.0	35.0
H77	21.0	21.0	21.0	21.8	25.1	29.1	32.8	34.2	34.8	34.9	34.9	34.9
H78	24.4	24.4	24.4	25.1	28.2	32.4	36.1	37.6	38.2	38.3	38.3	38.3
H79	26.4	26.4	26.4	27.0	30.2	34.3	38.0	39.5	40.1	40.2	40.2	40.2
H80	24.1	24.1	24.1	24.7	27.8	31.9	35.8	37.2	37.9	38.0	38.0	38.0
H81	24.7	24.7	24.7	25.3	28.4	32.5	36.3	37.8	38.4	38.5	38.5	38.5
H82	26.9	26.9	26.9	27.5	30.5	34.7	38.5	39.9	40.6	40.7	40.7	40.7
H83	25.9	25.9	25.9	28.2	32.1	35.7	37.6	38.3	38.6	38.6	38.6	38.6
H84	25.4	25.4	25.4	27.7	31.6	35.2	37.2	37.9	38.2	38.2	38.2	38.2
H85	23.0	23.0	23.0	25.1	29.0	32.6	34.8	35.7	36.0	36.0	36.0	36.0
H86	23.3	23.3	23.3	26.4	30.6	34.0	35.1	35.6	35.8	35.8	35.8	35.8

12.9.13 Noise levels at 57 of the 86 nearest residential properties are below 35 dB(A) level, indicating that the noise immission levels would be regarded as acceptable and the resident's amenity as receiving 'sufficient protection' without further assessment requiring to be undertaken.

12.9.14 There are 29 properties that have predicted noise levels greater than this simplified noise criteria as indicated in Table 12.25. Therefore the 'full' acoustic assessment has only been considered at these. However, as background noise measurements were carried out at additional properties, as agreed with the local authority, these properties have also been considered in the full acoustic assessment so as to provide a more comprehensive description of the cumulative acoustic impact.

Derived Acoustic Acceptance Criteria

12.9.15 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 40 dB(A) daytime lower limit has been adopted. Justification for this limit is as follows:

- Number of noise affected residential properties: 13 of the considered residential properties are predicted to experience cumulative noise levels of greater than 35 dB(A), although this increases to 28 when the Dersalloch predictions are scaled to their conditioned limits. This is a small number of properties in relation to the scale of the cumulative development which would generate

significant social, economic and environmental benefits, suggesting a limit towards the upper end of the range would be appropriate;

- Potential impact on the power output of the Proposed Development: The rated power of the cumulative developments would be 123 MW should the turbine types considered in the acoustic assessment be installed, large in comparison with other wind farm developments in Scotland, suggesting that a lower limit towards the upper end of the range would be appropriate. A lower limit towards the lower or middle of the range could limit the power output of the Proposed Development; 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, it has been assumed that properties can be downwind of all wind turbines simultaneously such that the noise levels experienced would be less at properties where this would not occur in practice. Again, this does not suggest a high impact such that a lower limit at the upper end of the range could be appropriate.

12.9.16 A 43 dB(A) night-time lower limit has been adopted for the cumulative assessment following the same logic described above. The chosen lower limits also account for the existing Dersalloch scheme being consented with lower fixed limits of 37.5 dB(A) during the day and 43 dB(A) at night.

12.9.17 The cumulative assessment criteria are summarised in Table 12.26 where L_B is the level of background noise. The daytime noise limit is the higher of 40 dB(A) or background plus 5 dB(A) and the night-time limit is the higher of 43 dB(A) or background plus 5 dB(A).

Table 12.26: Cumulative assessment criteria

Time of Day	Permissible Noise Level
Daytime	40 dB(A) for L_B less than 35 dB(A) L_B + 5 dB, for L_B greater than 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)

12.9.18 In the cumulative assessment there are some differences from the background noise survey locations inferred to be representative of each property shown in Table 12.7. In the cumulative assessment the noise survey data collected to inform the assessment of Dersalloch has been considered. This is necessary as the noise limits for Dersalloch are based on this data. The Gass Farm data collected for Dersalloch has been used in place of the data collected by the Applicant at H1-H3 and the Grimmet data collected for Dersalloch has been adopted at H4-H7 in the cumulative assessment.

12.9.19 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.

12.9.20 The derived noise limits for daytime and night-time periods, for each residential property, can be found in Table 12.27 and Table 12.28.

Cumulative Acoustic Assessment

12.9.21 A comparison of the cumulative predicted noise levels with the proposed daytime noise limits for the nearby residential properties is shown in Table 12.27. The predicted noise levels at 1 ms^1 and 2 ms^1 have been assumed as equal to 3 ms^1, though this is a conservative measure. The term ΔL is used to denote the difference between the predicted cumulative noise level and the proposed limit. A negative value indicates that the predicted noise level is within the limit. Table 12.28 shows a comparison with the proposed night-time noise limits.

12.9.22 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 of predicted noise levels below derived noise limits during daytime periods is -0.7 dB(A). The minimum margin during night-time periods is -2.2 dB(A).

12.9.23 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 12.15 & 12.16 of Technical Appendix 12.7.

12.9.24 Figure 12.2 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 12.27: 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	33.2	44.0	-10.8	33.2	44.0	-10.8	33.2	44.0	-10.8	33.9	44.0	-10.1
H2	33.3	44.0	-10.7	33.3	44.0	-10.7	33.3	44.0	-10.7	34.0	44.0	-10.0
H3	33.6	44.0	-10.4	33.6	44.0	-10.4	33.6	44.0	-10.4	34.3	44.0	-9.7
H4	24.1	42.3	-18.2	24.1	42.3	-18.2	24.1	42.3	-18.2	24.9	42.3	-17.4
H5	24.1	42.3	-18.2	24.1	42.3	-18.2	24.1	42.3	-18.2	24.7	42.3	-17.6
H6	24.3	42.3	-18.0	24.3	42.3	-18.0	24.3	42.3	-18.0	24.8	42.3	-17.5
H7	23.0	42.3	-19.3	23.0	42.3	-19.3	23.0	42.3	-19.3	23.7	42.3	-18.6
H9	21.4	40.0	-18.6	21.4	40.0	-18.6	21.4	40.0	-18.6	22.0	40.0	-18.0
H11	21.8	40.0	-18.2	21.8	40.0	-18.2	21.8	40.0	-18.2	23.6	40.0	-16.4
H12	22.1	40.0	-17.9	22.1	40.0	-17.9	22.1	40.0	-17.9	24.1	40.0	-15.9
H13	21.9	40.0	-18.1	21.9	40.0	-18.1	21.9	40.0	-18.1	23.7	40.0	-16.3
H14	22.1	40.0	-17.9	22.1	40.0	-17.9	22.1	40.0	-17.9	24.1	40.0	-15.9
H16	22.0	40.0	-18.0	22.0	40.0	-18.0	22.0	40.0	-18.0	23.7	40.0	-16.3
H19	21.9	40.0	-18.1	21.9	40.0	-18.1	21.9	40.0	-18.1	23.8	40.0	-16.2
H26	22.9	40.0	-17.1	22.9	40.0	-17.1	22.9	40.0	-17.1	25.4	40.0	-14.6
H27	22.6	40.0	-17.4	22.6	40.0	-17.4	22.6	40.0	-17.4	25.1	40.0	-14.9
H28	22.6	40.0	-17.4	22.6	40.0	-17.4	22.6	40.0	-17.4	25.1	40.0	-14.9
H29	22.5	40.0	-17.5	22.5	40.0	-17.5	22.5	40.0	-17.5	25.0	40.0	-15.0
H30	22.5	40.0	-17.5	22.5	40.0	-17.5	22.5	40.0	-17.5	25.1	40.0	-14.9
H31	22.5	40.0	-17.5	22.5	40.0	-17.5	22.5	40.0	-17.5	25.1	40.0	-14.9
H32	22.4	40.0	-17.6	22.4	40.0	-17.6	22.4	40.0	-17.6	25.0	40.0	-15.0
H62	15.1	40.0	-24.9	15.1	40.0	-24.9	15.1	40.0	-24.9	16.7	40.0	-23.3
H72	21.0	40.0	-19.0	21.0	40.0	-19.0	21.0	40.0	-19.0	21.9	40.0	-18.1
H78	24.4	40.0	-15.6	24.4	40.0	-15.6	24.4	40.0	-15.6	25.1	40.0	-14.9
H79	26.4	40.0	-13.6	26.4	40.0	-13.6	26.4	40.0	-13.6	27.0	40.0	-13.0
H80	24.1	40.0	-15.9	24.1	40.0	-15.9	24.1	40.0	-15.9	24.7	40.0	-15.3
H81	24.7	40.0	-15.3	24.7	40.0	-15.3	24.7	40.0	-15.3	25.3	40.0	-14.7
H82	26.9	40.0	-13.1	26.9	40.0	-13.1	26.9	40.0	-13.1	27.5	40.0	-12.5
H83	25.9	40.0	-14.1	25.9	40.0	-14.1	25.9	40.0	-14.1	28.2	40.0	-11.8
H84	25.4	40.0	-14.6	25.4	40.0	-14.6	25.4	40.0	-14.6	27.7	40.0	-12.3
H85	23.0	40.0	-17.0	23.0	40.0	-17.0	23.0	40.0	-17.0	25.1	40.0	-14.9
H86	23.3	40.0	-16.7	23.3	40.0	-16.7	23.3	40.0	-16.7	26.4	40.0	-13.6

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	37.1	44.6	-7.5	41.2	46.0	-4.8	44.8	47.9	-3.1	46.2	50.2	-4.0
H2	37.2	44.6	-7.4	41.4	46.0	-4.6	44.9	47.9	-3.0	46.3	50.2	-3.9
H3	37.4	44.6	-7.2	41.6	46.0	-4.4	45.2	47.9	-2.7	46.6	50.2	-3.6
H4	28.1	42.7	-14.6	32.2	43.6	-11.4	35.9	44.7	-8.8	37.3	46.1	-8.8
H5	27.8	42.7	-14.9	32.0	43.6	-11.6	35.9	44.7	-8.8	37.3	46.1	-8.8
H6	27.8	42.7	-14.9	32.1	43.6	-11.5	36.1	44.7	-8.6	37.6	46.1	-8.5
H7	26.8	42.7	-15.9	31.0	43.6	-12.6	34.8	44.7	-9.9	36.3	46.1	-9.8
H9	25.1	40.0	-14.9	29.4	40.0	-10.6	33.2	40.0	-6.8	34.7	40.0	-5.3
H11	27.4	40.0	-12.6	31.1	40.0	-8.9	33.6	40.0	-6.4	34.6	40.0	-5.4
H12	27.9	40.0	-12.1	31.6	40.0	-8.4	33.9	40.0	-6.1	34.9	40.0	-5.1
H13	27.4	40.0	-12.6	31.1	40.0	-8.9	33.6	40.0	-6.4	34.6	40.0	-5.4

H14	27.9	40.0	-12.1	31.6	40.0	-8.4	33.9	40.0	-6.1	34.8	40.0	-5.2
H16	27.4	40.0	-12.6	31.1	40.0	-8.9	33.8	40.0	-6.2	34.9	40.0	-5.1
H19	27.5	40.0	-12.5	31.2	40.0	-8.8	33.7	40.0	-6.3	34.7	40.0	-5.3
H26	29.4	40.0	-10.6	32.9	40.0	-7.1	34.6	40.0	-5.4	35.2	40.0	-4.8
H27	29.1	40.0	-10.9	32.6	40.0	-7.4	34.3	40.0	-5.7	34.9	40.0	-5.1
H28	29.1	40.0	-10.9	32.6	40.0	-7.4	34.3	40.0	-5.7	34.9	40.0	-5.1
H29	29.0	40.0	-11.0	32.5	40.0	-7.5	34.2	40.0	-5.8	34.8	40.0	-5.2
H30	29.1	40.0	-10.9	32.6	40.0	-7.4	34.3	40.0	-5.7	34.9	40.0	-5.1
H31	29.1	40.0	-10.9	32.6	40.0	-7.4	34.2	40.0	-5.8	34.8	40.0	-5.2
H32	29.0	40.0	-11.0	32.5	40.0	-7.5	34.1	40.0	-5.9	34.7	40.0	-5.3
H62	20.4	40.0	-19.6	24.1	40.0	-15.9	26.7	40.0	-13.3	27.8	41.2	-13.4
H72	25.2	40.0	-14.8	29.2	40.0	-10.8	32.7	40.0	-7.3	34.2	40.6	-6.4
H78	28.2	40.0	-11.8	32.4	40.0	-7.6	36.1	41.7	-5.6	37.6	43.7	-6.1
H79	30.2	40.0	-9.8	34.3	40.0	-5.7	38.0	40.0	-2.0	39.5	40.6	-1.1
H80	27.8	40.0	-12.2	31.9	40.0	-8.1	35.8	40.0	-4.2	37.2	40.6	-3.4
H81	28.4	40.0	-11.6	32.5	40.0	-7.5	36.3	40.0	-3.7	37.8	40.6	-2.8
H82	30.5	40.0	-9.5	34.7	40.0	-5.3	38.5	40.0	-1.5	39.9	40.6	-0.7
H83	32.1	40.0	-7.9	35.7	40.4	-4.7	37.6	41.8	-4.2	38.3	43.4	-5.1
H84	31.6	40.0	-8.4	35.2	40.4	-5.2	37.2	41.8	-4.6	37.9	43.4	-5.5
H85	29.0	40.0	-11.0	32.6	40.0	-7.4	34.8	40.0	-5.2	35.7	40.0	-4.3
H86	30.6	40.0	-9.4	34.0	40.0	-6.0	35.1	40.0	-4.9	35.6	40.0	-4.4

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	46.8	52.5	-5.7	46.9	54.6	-7.7	46.9	56.3	-9.4	46.9	57.4	-10.5
H2	46.9	52.5	-5.6	47.0	54.6	-7.6	47.0	56.3	-9.3	47.0	57.4	-10.4
H3	47.2	52.5	-5.3	47.3	54.6	-7.3	47.3	56.3	-9.0	47.3	57.4	-10.1
H4	37.9	47.3	-9.4	37.9	48.4	-10.5	37.9	49.0	-11.1	37.9	49.1	-11.2
H5	37.9	47.3	-9.4	37.9	48.4	-10.5	37.9	49.0	-11.1	37.9	49.1	-11.2
H6	38.1	47.3	-9.2	38.2	48.4	-10.2	38.2	49.0	-10.8	38.2	49.1	-10.9
H7	36.8	47.3	-10.5	36.9	48.4	-11.5	36.9	49.0	-12.1	36.9	49.1	-12.2
H9	35.3	40.0	-4.7	35.3	40.0	-4.7	35.3	40.0	-4.7	35.3	40.0	-4.7
H11	35.0	40.0	-5.0	35.0	40.0	-5.0	35.0	40.0	-5.0	35.0	40.0	-5.0
H12	35.2	40.0	-4.8	35.3	40.0	-4.7	35.3	40.0	-4.7	35.3	40.0	-4.7
H13	35.0	40.0	-5.0	35.1	40.0	-4.9	35.1	40.0	-4.9	35.1	40.0	-4.9
H14	35.2	40.0	-4.8	35.2	40.0	-4.8	35.2	40.0	-4.8	35.2	40.0	-4.8
H16	35.3	40.0	-4.7	35.3	40.0	-4.7	35.3	40.0	-4.7	35.3	40.0	-4.7
H19	35.1	40.0	-4.9	35.1	40.0	-4.9	35.1	40.0	-4.9	35.1	40.0	-4.9
H26	35.5	40.0	-4.5	35.5	40.0	-4.5	35.5	40.0	-4.5	35.5	40.0	-4.5
H27	35.2	40.0	-4.8	35.2	40.0	-4.8	35.2	40.0	-4.8	35.2	40.0	-4.8
H28	35.2	40.0	-4.8	35.2	40.0	-4.8	35.2	40.0	-4.8	35.2	40.0	-4.8
H29	35.1	40.0	-4.9	35.1	40.0	-4.9	35.1	40.0	-4.9	35.1	40.0	-4.9
H30	35.1	40.0	-4.9	35.1	40.0	-4.9	35.1	40.0	-4.9	35.1	40.0	-4.9
H31	35.0	40.0	-5.0	35.0	40.0	-5.0	35.0	40.0	-5.0	35.0	40.0	-5.0
H32	34.9	40.0	-5.1	35.0	40.0	-5.0	35.0	40.0	-5.0	35.0	40.0	-5.0
H62	28.3	43.4	-15.1	28.3	45.9	-17.6	28.3	48.4	-20.1	28.3	48.4	-20.1
H72	34.8	42.8	-8.0	34.8	45.2	-10.4	34.8	47.8	-13.0	34.8	50.8	-16.0
H78	38.2	45.5	-7.3	38.3	47.0	-8.7	38.3	48.1	-9.8	38.3	48.1	-9.8
H79	40.1	42.8	-2.7	40.2	45.2	-5.0	40.2	47.8	-7.6	40.2	50.8	-10.6
H80	37.9	42.8	-4.9	38.0	45.2	-7.2	38.0	47.8	-9.8	38.0	50.8	-12.8
H81	38.4	42.8	-4.4	38.5	45.2	-6.7	38.5	47.8	-9.3	38.5	50.8	-12.3
H82	40.6	42.8	-2.2	40.7	45.2	-4.5	40.7	47.8	-7.1	40.7	50.8	-10.1
H83	38.6	45.2	-6.6	38.6	47.3	-8.7	38.6	49.5	-10.9	38.6	51.8	-13.2
H84	38.2	45.2	-7.0	38.2	47.3	-9.1	38.2	49.5	-11.3	38.2	51.8	-13.6
H85	36.0	40.0	-4.0	36.0	40.0	-4.0	36.0	40.0	-4.0	36.0	40.0	-4.0
H86	35.8	40.0	-4.2	35.8	40.0	-4.2	35.8	40.0	-4.2	35.8	40.0	-4.2

The term L_p is used to denote the predicted noise level

The term ΔL is used to denote the difference between the predicted noise level and the recommended limit

Table 12.28: 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	33.2	44.2	-11.0	33.2	44.2	-11.0	33.2	44.2	-11.0	33.9	44.2	-10.3
H2	33.3	44.2	-10.9	33.3	44.2	-10.9	33.3	44.2	-10.9	34.0	44.2	-10.2
H3	33.6	44.2	-10.6	33.6	44.2	-10.6	33.6	44.2	-10.6	34.3	44.2	-9.9
H4	24.1	43.0	-18.9	24.1	43.0	-18.9	24.1	43.0	-18.9	24.9	43.0	-18.1
H5	24.1	43.0	-18.9	24.1	43.0	-18.9	24.1	43.0	-18.9	24.7	43.0	-18.3
H6	24.3	43.0	-18.7	24.3	43.0	-18.7	24.3	43.0	-18.7	24.8	43.0	-18.2
H7	23.0	43.0	-20.0	23.0	43.0	-20.0	23.0	43.0	-20.0	23.7	43.0	-19.3
H9	21.4	43.0	-21.6	21.4	43.0	-21.6	21.4	43.0	-21.6	22.0	43.0	-21.0
H11	21.8	43.0	-21.2	21.8	43.0	-21.2	21.8	43.0	-21.2	23.6	43.0	-19.4
H12	22.1	43.0	-20.9	22.1	43.0	-20.9	22.1	43.0	-20.9	24.1	43.0	-18.9
H13	21.9	43.0	-21.1	21.9	43.0	-21.1	21.9	43.0	-21.1	23.7	43.0	-19.3
H14	22.1	43.0	-20.9	22.1	43.0	-20.9	22.1	43.0	-20.9	24.1	43.0	-18.9
H16	22.0	43.0	-21.0	22.0	43.0	-21.0	22.0	43.0	-21.0	23.7	43.0	-19.3
H19	21.9	43.0	-21.1	21.9	43.0	-21.1	21.9	43.0	-21.1	23.8	43.0	-19.2
H26	22.9	43.0	-20.1	22.9	43.0	-20.1	22.9	43.0	-20.1	25.4	43.0	-17.6
H27	22.6	43.0	-20.4	22.6	43.0	-20.4	22.6	43.0	-20.4	25.1	43.0	-17.9
H28	22.6	43.0	-20.4	22.6	43.0	-20.4	22.6	43.0	-20.4	25.1	43.0	-17.9
H29	22.5	43.0	-20.5	22.5	43.0	-20.5	22.5	43.0	-20.5	25.0	43.0	-18.0
H30	22.5	43.0	-20.5	22.5	43.0	-20.5	22.5	43.0	-20.5	25.1	43.0	-17.9
H31	22.5	43.0	-20.5	22.5	43.0	-20.5	22.5	43.0	-20.5	25.1	43.0	-17.9
H32	22.4	43.0	-20.6	22.4	43.0	-20.6	22.4	43.0	-20.6	25.0	43.0	-18.0
H62	15.1	43.0	-27.9	15.1	43.0	-27.9	15.1	43.0	-27.9	16.7	43.0	-26.3
H72	21.0	43.0	-22.0	21.0	43.0	-22.0	21.0	43.0	-22.0	21.9	43.0	-21.1
H78	24.4	43.0	-18.6	24.4	43.0	-18.6	24.4	43.0	-18.6	25.1	43.0	-17.9
H79	26.4	43.0	-16.6	26.4	43.0	-16.6	26.4	43.0	-16.6	27.0	43.0	-16.0
H80	24.1	43.0	-18.9	24.1	43.0	-18.9	24.1	43.0	-18.9	24.7	43.0	-18.3
H81	24.7	43.0	-18.3	24.7	43.0	-18.3	24.7	43.0	-18.3	25.3	43.0	-17.7
H82	26.9	43.0	-16.1	26.9	43.0	-16.1	26.9	43.0	-16.1	27.5	43.0	-15.5
H83	25.9	43.0	-17.1	25.9	43.0	-17.1	25.9	43.0	-17.1	28.2	43.0	-14.8
H84	25.4	43.0	-17.6	25.4	43.0	-17.6	25.4	43.0	-17.6	27.7	43.0	-15.3
H85	23.0	43.0	-20.0	23.0	43.0	-20.0	23.0	43.0	-20.0	25.1	43.0	-17.9
H86	23.3	43.0	-19.7	23.3	43.0	-19.7	23.3	43.0	-19.7	26.4	43.0	-16.6

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	37.1	45.0	-7.9	41.2	46.0	-4.8	44.8	47.4	-2.6	46.2	49.1	-2.9
H2	37.2	45.0	-7.8	41.4	46.0	-4.6	44.9	47.4	-2.5	46.3	49.1	-2.8
H3	37.4	45.0	-7.6	41.6	46.0	-4.4	45.2	47.4	-2.2	46.6	49.1	-2.5
H4	28.1	43.0	-14.9	32.2	43.0	-10.8	35.9	43.0	-7.1	37.3	43.4	-6.1
H5	27.8	43.0	-15.2	32.0	43.0	-11.0	35.9	43.0	-7.1	37.3	43.4	-6.1
H6	27.8	43.0	-15.2	32.1	43.0	-10.9	36.1	43.0	-6.9	37.6	43.4	-5.8
H7	26.8	43.0	-16.2	31.0	43.0	-12.0	34.8	43.0	-8.2	36.3	43.4	-7.1
H9	25.1	43.0	-17.9	29.4	43.0	-13.6	33.2	43.0	-9.8	34.7	43.0	-8.3
H11	27.4	43.0	-15.6	31.1	43.0	-11.9	33.6	43.0	-9.4	34.6	43.0	-8.4
H12	27.9	43.0	-15.1	31.6	43.0	-11.4	33.9	43.0	-9.1	34.9	43.0	-8.1
H13	27.4	43.0	-15.6	31.1	43.0	-11.9	33.6	43.0	-9.4	34.6	43.0	-8.4

H14	27.9	43.0	-15.1	31.6	43.0	-11.4	33.9	43.0	-9.1	34.8	43.0	-8.2
H16	27.4	43.0	-15.6	31.1	43.0	-11.9	33.8	43.0	-9.2	34.9	43.0	-8.1
H19	27.5	43.0	-15.5	31.2	43.0	-11.8	33.7	43.0	-9.3	34.7	43.0	-8.3
H26	29.4	43.0	-13.6	32.9	43.0	-10.1	34.6	43.0	-8.4	35.2	43.0	-7.8
H27	29.1	43.0	-13.9	32.6	43.0	-10.4	34.3	43.0	-8.7	34.9	43.0	-8.1
H28	29.1	43.0	-13.9	32.6	43.0	-10.4	34.3	43.0	-8.7	34.9	43.0	-8.1
H29	29.0	43.0	-14.0	32.5	43.0	-10.5	34.2	43.0	-8.8	34.8	43.0	-8.2
H30	29.1	43.0	-13.9	32.6	43.0	-10.4	34.3	43.0	-8.7	34.9	43.0	-8.1
H31	29.1	43.0	-13.9	32.6	43.0	-10.4	34.2	43.0	-8.8	34.8	43.0	-8.2
H32	29.0	43.0	-14.0	32.5	43.0	-10.5	34.1	43.0	-8.9	34.7	43.0	-8.3
H62	20.4	43.0	-22.6	24.1	43.0	-18.9	26.7	43.0	-16.3	27.8	43.0	-15.2
H72	25.2	43.0	-17.8	29.2	43.0	-13.8	32.7	43.0	-10.3	34.2	43.0	-8.8
H78	28.2	43.0	-14.8	32.4	43.0	-10.6	36.1	43.0	-6.9	37.6	43.0	-5.4
H79	30.2	43.0	-12.8	34.3	43.0	-8.7	38.0	43.0	-5.0	39.5	43.0	-3.5
H80	27.8	43.0	-15.2	31.9	43.0	-11.1	35.8	43.0	-7.2	37.2	43.0	-5.8
H81	28.4	43.0	-14.6	32.5	43.0	-10.5	36.3	43.0	-6.7	37.8	43.0	-5.2
H82	30.5	43.0	-12.5	34.7	43.0	-8.3	38.5	43.0	-4.5	39.9	43.0	-3.1
H83	32.1	43.0	-10.9	35.7	43.0	-7.3	37.6	43.0	-5.4	38.3	43.0	-4.7
H84	31.6	43.0	-11.4	35.2	43.0	-7.8	37.2	43.0	-5.8	37.9	43.0	-5.1
H85	29.0	43.0	-14.0	32.6	43.0	-10.4	34.8	43.0	-8.2	35.7	43.0	-7.3
H86	30.6	43.0	-12.4	34.0	43.0	-9.0	35.1	43.0	-7.9	35.6	43.0	-7.4

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	46.8	51.2	-4.4	46.9	53.6	-6.7	46.9	56.4	-9.5	46.9	59.6	-12.7

H2	46.9	51.2	-4.3	47.0	53.6	-6.6	47.0	56.4	-9.4	47.0	59.6	-12.6
H3	47.2	51.2	-4.0	47.3	53.6	-6.3	47.3	56.4	-9.1	47.3	59.6	-12.3
H4	37.9	44.5	-6.6	37.9	45.6	-7.7	37.9	46.7	-8.8	37.9	47.7	-9.8
H5	37.9	44.5	-6.6	37.9	45.6	-7.7	37.9	46.7	-8.8	37.9	47.7	-9.8
H6	38.1	44.5	-6.4	38.2	45.6	-7.4	38.2	46.7	-8.5	38.2	47.7	-9.5
H7	36.8	44.5	-7.7	36.9	45.6	-8.7	36.9	46.7	-9.8	36.9	47.7	-10.8
H9	35.3	43.0	-7.7	35.3	43.0	-7.7	35.3	43.0	-7.7	35.3	43.0	-7.7
H11	35.0	43.0	-8.0	35.0	43.0	-8.0	35.0	43.0	-8.0	35.0	43.0	-8.0
H12	35.2	43.0	-7.8	35.3	43.0	-7.7	35.3	43.0	-7.7	35.3	43.0	-7.7
H13	35.0	43.0	-8.0	35.1	43.0	-7.9	35.1	43.0	-7.9	35.1	43.0	-7.9
H14	35.2	43.0	-7.8	35.2	43.0	-7.8	35.2	43.0	-7.8	35.2	43.0	-7.8
H16	35.3	43.0	-7.7	35.3	43.0	-7.7	35.3	43.0	-7.7	35.3	43.0	-7.7
H19	35.1	43.0	-7.9	35.1	43.0	-7.9	35.1	43.0	-7.9	35.1	43.0	-7.9
H26	35.5	43.0	-7.5	35.5	43.0	-7.5	35.5	43.0	-7.5	35.5	43.0	-7.5
H27	35.2	43.0	-7.8	35.2	43.0	-7.8	35.2	43.0	-7.8	35.2	43.0	-7.8
H28	35.2	43.0	-7.8	35.2	43.0	-7.8	35.2	43.0	-7.8	35.2	43.0	-7.8
H29	35.1	43.0	-7.9	35.1	43.0	-7.9	35.1	43.0	-7.9	35.1	43.0	-7.9
H30	35.1	43.0	-7.9	35.1	43.0	-7.9	35.1	43.0	-7.9	35.1	43.0	-7.9
H31	35.0	43.0	-8.0	35.0	43.0	-8.0	35.0	43.0	-8.0	35.0	43.0	-8.0
H32	34.9	43.0	-8.1	35.0	43.0	-8.0	35.0	43.0	-8.0	35.0	43.0	-8.0
H62	28.3	43.0	-14.7	28.3	43.0	-14.7	28.3	43.5	-15.2	28.3	43.5	-15.2
H72	34.8	43.0	-8.2	34.8	43.0	-8.2	34.8	45.8	-11.0	34.8	45.8	-11.0
H78	38.2	43.0	-4.8	38.3	45.7	-7.4	38.3	48.7	-10.4	38.3	48.7	-10.4
H79	40.1	43.0	-2.9	40.2	43.0	-2.8	40.2	45.8	-5.6	40.2	45.8	-5.6
H80	37.9	43.0	-5.1	38.0	43.0	-5.0	38.0	45.8	-7.8	38.0	45.8	-7.8
H81	38.4	43.0	-4.6	38.5	43.0	-4.5	38.5	45.8	-7.3	38.5	45.8	-7.3
H82	40.6	43.0	-2.4	40.7	43.0	-2.3	40.7	45.8	-5.1	40.7	45.8	-5.1
H83	38.6	43.0	-4.4	38.6	43.7	-5.1	38.6	45.8	-7.2	38.6	45.8	-7.2
H84	38.2	43.0	-4.8	38.2	43.7	-5.5	38.2	45.8	-7.6	38.2	45.8	-7.6
H85	36.0	43.0	-7.0	36.0	43.0	-7.0	36.0	43.0	-7.0	36.0	43.0	-7.0
H86	35.8	43.0	-7.2	35.8	43.0	-7.2	35.8	43.0	-7.2	35.8	43.0	-7.2

Cumulative Construction Noise Assessment

12.9.25 Any noise due to the construction of the other wind farms considered in the cumulative operational noise assessment would not be ongoing at the same time as the construction of the Proposed Development as Dersalloch is already built.

12.10 Summary

12.10.1 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 IoA GPG, as recommended for use by relevant planning policy.

12.10.2 To establish baseline conditions, background noise surveys were carried out at six nearby properties and the measured background noise levels used to determine appropriate noise limits, as specified by ETSU-R-97 and the IoA GPG.

12.10.3 Operational noise levels were predicted using a noise propagation model, the Proposed Development 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.

12.10.4 A construction noise assessment carried out in accordance with BS 52281:2009 "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.

12.10.5 Vibration and air overpressure due to blasting are not expected to have a significant impact on nearby residents should the mitigation measures described within be adopted.

12.10.6 A cumulative operational noise assessment was completed to determine the potential impact of the Proposed Development alongside the existing Dersalloch Wind Farm. The predicted noise levels are within noise limits derived in accordance with ETSU-R-97 at all properties at all considered wind speeds.

12.10.7 The potential impact of the Proposed Development, along with the mitigation proposed and any residual impact, is summarised in Table 12.29.

Table 12.29: 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 both alone and in the cumulative scenario No 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 Saturday (except during turbine erection and commissioning/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
Decommissioning			
Potential noise from Proposed Development decommissioning activities	General best practice measures of reducing noise, employed during the construction phase, would be adopted as precaution	A Decommissioning and Restoration Plan would be submitted for approval no later than twelve months prior to the final decommissioning of the wind farm.	Not significant

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.

13 Socio-economics

13.1 Introduction

13.1.1 This chapter of the Environmental Impact Assessment Report (EIAR) has been prepared by Natural Power Consultants Limited (Natural Power) and assesses the potential socio-economic, tourism and recreation impacts and effects that could occur as a result of the proposed Sclenteuch Wind Farm (hereafter known as the 'Proposed Development').

13.1.2 As stated in Chapter 1: Introduction, the Proposed Development is located both in East Ayrshire and South Ayrshire Council in Scotland.

13.1.3 The Proposed Development will consist of up to nine wind turbines with tip heights of up to 200 m. The Proposed Development will have a generating capacity of up to 54 megawatts (MW) and up to 45 MW of storage capacity also proposed within the battery energy storage system compound. In addition, the Proposed Development is planned to have an operational period of 50 years.

13.1.4 This chapter will outline policies considered relevant to the potential socio-economic impacts of the Proposed Development, and how the Proposed Development will contribute toward targets and objectives set out within Scottish and local strategies.

13.2 Methodology

Study Area

13.2.1 The socio-economic and tourism baseline considers the study areas of:

- East Ayrshire;
- South Ayrshire;
- Scotland; and
- the UK.

13.2.2 The quantifiable economic impacts reported in this document are inclusive, i.e. the reported impact for Scotland includes the impacts within East Ayrshire and South Ayrshire.

13.2.3 The tourism and recreation assessment is based on assets which lie within 15 km of the Proposed Development.

Assessment Methodology

13.2.4 Where other EIAR chapters follow methodology widely recognised by statutory and governing bodies, there is no such recognised methodology for socio-economic assessments. This chapter takes the approach of highlighting how the Proposed Development supports UK and Scottish strategy and policy documents relating to socio-economics and identifies what benefits the Proposed Development could provide locally should it be granted consent.

13.2.5 As part of the scoping process for the Proposed Development, a scoping report was issued to consultees for a scoping response. The assessment carried out in this chapter has taken into account the responses to the scoping report regarding socio-economics, tourism and recreation. In addition, this chapter will assess the economic baseline of the area, including the importance of the tourism sector.

13.2.6 Baseline conditions were established through desktop studies. The following sources of information were used in the completion of this chapter:

- Relevant economic development strategies and policies at UK and Scottish levels;
- Official statistics including: National Online Manpower Information System (NOMIS), Office of National Statistics (ONS), Census 2011, Scottish Government, East Ayrshire Council and South Ayrshire Council publications and VisitScotland
- Economic impact assumptions drawn from RenewableUK publications on the economic benefits of onshore wind farms.

Socio-economics

13.2.7 The methodology adopted will assess the following key stages:

- Existing economic environment (baseline) using official data on population, industrial structure, unemployment and economic activity levels, income and earnings;
- The potential economic effects during the development and construction phase of the Proposed Development including direct employment, supplier effects and income effects;
- The potential economic effects during the operational phase of the Proposed Development including direct employment, supplier effects and income effects;
- The economic affects arising from infrastructure improvements and potential community benefits and shared ownership;
- Consider and report on mitigation and management measures which could be employed to minimise any negative impacts and maximise potential positive impacts.

13.2.8 This socio-economic assessment is grounded on a RenewableUK publication[1] on economic impact modelling utilising the most recent industry research, conducted by BiGGAR Economics. The report discusses the economic impacts of onshore wind farm development and has shown, through investigation of numerous case studies across the UK, how expenditure from the different phases of wind farm development (e.g. development, construction, operation and maintenance) is passed to the local, regional and national economy. As such, this provides a model which can be utilised to illustrate the potential quantifiable economic inputs that the Proposed Development can have for East Ayrshire and South Ayrshire Councils, Scotland and the UK. This research method has been deployed on numerous other socio-economic assessments of onshore wind farms across the UK and is considered an applicable and quantifiable approach.

13.2.9 The assessment calculates the socio-economic impact from the construction of nine turbines. The employment and resultant gross value added (GVA) impacts are based on the indicative maximum generation capacity of 54 MW. The potential 45 MW within the stored battery energy storage energy compound is seen as storage and therefore has not been assessed.

Tourism and Recreation

13.2.10 The potential effects of wind farm developments on the tourism and recreation sector is well-researched, and as such key studies have been included for reference, including:

- Economic impacts of wind farms on Scottish tourism: research findings (Scottish Government, 2008)[2]
- VisitScotland wind farm consumer research (2011)[3]
- Wind farms and tourism trends in Scotland (BiGGAR Economics, 2017)[4]
- Wind farms and tourism trends in Scotland: evidence from 44 wind farms (BiGGAR Economics, 2021)[5]
- Public attitudes tracker energy infrastructure and energy sources (Department for Business, Energy and Industrial Strategy (BEIS) 2021)[6]

13.2.11 Tourist assets have been identified as detailed in Section 13.6 and the analysis focuses on whether the Proposed Development is likely to lead to change in behaviour, for example few tourists visiting the area.

13.2.12 Recreational assets, such as trails, have been identified as detailed in Section 13.6, and the potential reduction in recreational amenity has been assessed. There are a number of potential ways that the Proposed Development could affect trails, including through reduced amenity associated with landscape and visual impacts and through reduced access. Reduced access to amenity is particularly important in the context of areas that have limited access to recreational amenities, such as walking.

Assessment of Potential Effect Significance

13.2.13 The initial consideration of the sensitivity of an area's economy, or a tourism asset to an effect is assessed based on the criteria outlined in Table 13.1.

Table 13.1 – Socio-economics, tourism and recreation sensitivity criteria

	Description
Very high	The asset has little or no capacity to absorb change without fundamentally altering its present character and/or is of very high tourism, recreational or socio-economic value, or of national importance. For example, it is a destination in its own right (for attractions), with a substantial proportion of visitors on a national level.
High	The asset has low capacity to absorb change without fundamentally altering its present character and/or is of high tourism, recreational or socio-economic value, or of importance to Scotland.
Medium	The asset has moderate capacity to absorb change without substantially altering its present character, has some tourism, recreational or socio- economic value and/or is of regional importance (e.g. Scotland). For example, it is a popular destination among current visitors (for attractions), with a significant contribution to the regional economy.
Low	The asset is tolerant to change without detriment to its character, has low tourism, recreational and/or socio-economic value, or is of local importance. For example, it is an incidental destination for current visitors (for attractions).

[1] RenewableUK. (2015) *Onshore Wind: Direct and Wider Economic Benefits.* [Online] Available from - https://www.renewableuk.com/news/295907/Onshore-Wind-Direct-and-Wider-Economic-Benefits-Members-only.htm. [Accessed: 13/04/2022]
[2] Scottish Government (2008) *Economic impacts of wind farms on Scottish tourism: report. [Online]* Available from - Economic impacts of wind farms on Scottish tourism: report - gov.scot (www.gov.scot) [Accessed: 13/04/2022]
[3] VisitScotland (2011) *Wind Farm Consumer Research.* [Online] Available from - Windfarm Consumer Research final_docx (parliament.scot) [Accessed 13/04/2022]
[4] BiGGAR Economics (2017) *Wind Farms & Tourism Trends in Scotland.* [Online] Available from - Microsoft Word - Wind Farms and Tourism Trends in Scotland Oct17.docx (biggareconomics.co.uk) [Accessed: 13/04/2022]
[5] BiGGAR Economics (2021) *Wind Farms & Tourism Trends in Scotland: Evidence from 44 Wind Farms.* [Online] Available from - Microsoft Word - BiGGAR Economics Wind Farms and Tourism 2021.docx [Accessed: 13/04/2022]
[6] Business, Energy and Industrial Strategy Committee (2021) *BEIS Public Attitudes Tracker: Energy Infrastructure and Energy Sources.* [Online] Available from - BEIS PAT Autumn 2021 Energy Infrastructure and Energy Sources (publishing.service.gov.uk) [Accessed: 13/04/2022]

Negligible	The asset is resistant to change and/or is of little tourism, recreational or socio-economic value. For example, an incidental destination with low numbers of current visitors (for attractions).

13.2.14 The magnitude of the potential effect will be assessed based on criteria presented in Table 13.2.

Table 13.2 – Socio-economics, recreation and tourism magnitude criteria

	Description
High	Major loss/improvement to key elements/features of the baselines conditions such that post development character/composition of baseline condition will be fundamentally changed. For example, a major long-term alteration of socio-economic conditions, a major reduction/improvement of recreational assets, or a substantial change to tourism spend
Medium	Loss/improvement to one or more key elements/features of the baseline conditions such that post development character/composition of the baseline condition will be noticeably changed. For example, a moderate alteration of socio-economic conditions, a moderate reduction/improvement in the recreational asset, or a moderate change to tourism spend
Low	Changes arising from the alteration will be detectable but not material; the underlying composition of the baseline condition will be similar to the pre-development situation. For example, a small alteration of the socio-economic conditions, a small reduction/improvement in the recreational asset, or a small change in tourism spend
Negligible	Very little change from baseline conditions. Change is barely distinguishable, approximating to a “no change” situation

13.2.15 The sensitivity of the asset and the magnitude of the predicted effects will be used as a guide, in addition to judgement to predict the significance of the likely effects. Moderate and major effects are assessed as significant in EIA terms. The significance criteria is outlined in Table 13.3.

Table 13.3 – Significance matrix

	Sensitivity				
Magnitude	Very high	High	Medium	Low	Very Low
High	Major	Major	Moderate	Moderate	Minor
Medium	Major	Moderate	Moderate	Minor	Negligible
Low	Moderate	Moderate	Minor	Negligible	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

13.3 Consultation

13.3.1 The assessment carried out in this chapter has taken into account the responses to the scoping report regarding the socio-economics, tourism and recreation.

13.3.2 The responses to the scoping opinion and where they have been addressed in the report are set out in Table 13.4 below.

Table 13.4 – Consultation responses

Consultee	Issue	Response and how considered in the chapter
East Ayrshire Council	Lighting impacts on the Dark Sky Park will need to be assessed, particularly given the close proximity to the boundaries of this designation, and welcome any detailed consideration of aviation lighting impacts on this designation alongside consideration of Dark Sky Park Lighting Supplementary Guidance. The EIA Report should consider any strategies for long-term public access to the site for recreational uses during its operational lifetime, including any options for connections to be made with surrounding land and uses, to maximise the public access benefits. Management of public access to the site during the construction period should also be detailed.	Detail of aviation lighting impact is addressed in Chapter 5: Landscape and Visual Impact Assessment (LVIA). Details of Access Management Plan is addressed in Chapter 11: Traffic and Transport.
South Ayrshire Council	We note that no conclusion is reached in paragraph 5.3.10 of the Scoping Report as to whether, or how, potential effects on the Galloway Dark Sky Park will be assessed in the LVIA. Confirmation on the proposed approach is required from the Applicant.	Details addressed in Chapter 5: LVIA
Scot Ways	The right of way SKC11 as recorded in the National Catalogue of Rights of Way	Details addressed in Chapter 5: LVIA, Chapter 6: Cultural Heritage

crosses or is close to the application site. The Heritage Path Old Road through Straiton crosses or is close to the application site. The Scottish Hill Track route 82 Barr to Straiton and Patna [HT385] which crosses or is close to the application site.	and Chapter 13: Socioeconomics on the impact of Proposed Development on the Core Paths and access routes through Proposed Development Area and surrounding area.

13.4 Legislation, Policy and Guidance

13.4.1 All relevant national legislation, planning policies, guidelines, development plans and other material considerations are addressed in Chapter 4: Approach to EIA/Climate Change, Legislative and Policy Context. A summary of those matters related to socio-economics is included below.

13.4.2 This assessment includes a review of existing economic development policies, referencing tourism strategies where applicable, at the UK, Scottish and local level, together with reference to the evidence base.

UK Planning Policy and Advice

Energy White Paper – Powering our Net Zero Future[7]

13.4.3 The UK Government published the above paper in December 2020 (HM Government, 2020) which sets out the approach to be taken to tackling the challenge of climate change. Recognising the world-leading UK net-zero target, the Foreword states that this will require decisive global action and significant investment to open up opportunities for economic growth and job creation.

13.4.4 It states that 'The UK should harness more of the economic benefit from the accelerated deployment of renewable technologies. This will help position the whole of the UK to reap economic benefits'.

Scottish Planning Policy and Advice

Climate Change Plan (2018)[8]

13.4.5 The vision of the Climate Change Plan (Scottish Government, 2018) (CCP) sets out that 'By 2032, Scotland's electricity system will supply a growing share of Scotland's energy needs and by 2030, 50% of all Scotland's energy needs will come from renewables'.

13.4.6 The Strategy states in Chapter 1 that the Scottish Government 'will also continue to pursue policies and goals within our own gift to secure this route to market, and to ensure that as wide a range of onshore and offshore technologies as possible are able to develop in the right places – securing as much economic and industrial benefit for Scotland as possible'.

13.4.7 In addition, it details that 'investment to enhance the competitiveness and productivity of Scotland's low carbon electricity generation and network sector will contribute to the Scottish Government's wider objectives of sustainable economic growth.'

Update to the Climate Change Plan 2018-2032: Securing a Green Recovery on a Path to Net Zero[9]

13.4.8 In December 2020, the 'Update to the Climate Change Plan 2018 – 2032: Securing a Green Recovery on the Path to Net Zero' (CCP Update) (Scottish Government, 2020) was published. Building on the policy outcomes identified in the 2018 CCP, the CCP Update sets the Scottish Government's legislative commitment to reducing emissions by 75% by 2030 (compared with 1990) and to net-zero by 2045 in the context of a post-COVID green recovery.

13.4.9 The CCP highlights key commitments which include, amongst others, to increase the number of good, green jobs and to enable people to access these jobs through training and reskilling. In addition, it recognises that the green recovery and transition to net zero presents considerable economic opportunities for Scotland by capitalising on its strengths including in energy.

Scottish Energy Strategy (2017)[10]

13.4.10 In December 2017, the Scottish Energy Strategy (SES) (Scottish Government, 2017) was published by the Scottish Government alongside the then Draft CCP and the Onshore Wind Policy Statement.

13.4.11 A key goal within the SES is that Scotland will become a world leader in renewable and low carbon technologies and services. The SES sets out a target for Scotland to achieve almost complete decarbonisation of energy and sets a 2030 '*all energy*'

[7] Secretary of State for Business, Energy and Industrial Strategy (2020) *The Energy White Paper: Powering our Net Zero Future.* [Online] Available from - Energy White Paper (publishing.service.gov.uk) [Accessed: 21/04/2022]
[8]Scottish Government (2018) *Climate Change Plan: third report on proposal and policies 2018 – 2032.* [Online] Available from - Supporting documents - Climate Change Plan: third report on proposals and policies 2018-2032 (RPP3) - gov.scot (www.gov.scot) [Accessed: 21/04/2022]
[9]Scottish Government (2020) *Securing a green recovery on a path to new zero: climate change plan 2018 – 2032 – update.* [Online] Available from Supporting documents - Securing a green recovery on a path to net zero: climate change plan 2018–2032 - update - gov.scot (www.gov.scot) [Accessed: 21/04/2022]
[10] Scottish Government (2017) *Scottish Energy Strategy: The future of energy in Scotland.* [Online] Available from -Scottish Energy Strategy: The future of energy in Scotland (www.gov.scot) [Accessed: 21/04/2022]

target for the equivalent of 50% of Scotland's heat, transport and electricity consumption to be supplied from renewable sources.

13.4.12 Onshore wind is also recognised as a key opportunity. The SES sets out that 'Onshore wind is now amongst the lowest cost forms of power generation of any kind, and is a vital component of the huge industrial opportunity that renewables create for Scotland. The sector supports an estimated 7,500 jobs in Scotland, and generated more than £3 billion in turnover in 2015'.

Scotland's Energy Strategy Position Statement (2021)[11]

13.4.13 On 16th March 2021 the Scottish Government published its position statement in relation to the SES. The Energy Strategy Position Statement provides an overview of the key priorities for the short to medium-term in ensuring a green economic recovery, whilst remaining aligned to the net zero ambitions.

13.4.14 The Strategy sets out a Green Economic Recovery and states 'creating green jobs are at the heart of the Scottish Government's plans for a fair, resilient and green economic recovery.'

13.4.15 In addition, Section 8 'Support for Industries and Sectors across the Energy Landscape' states 'the continued growth of Scotland's renewable energy industry is fundamental to enabling us to achieve our ambition of creating sustainable jobs as we transition to net zero.'

Onshore Wind – Policy Statement Refresh 2021: Consultative Draft (2021)[12]

13.4.16 The above document was published in October 2021 and the period of consultation ran until the end of January 2022. The report seeks views on a range of issues, including the Scottish Government's ambition to secure an additional 8-12 GW of installed onshore wind capacity by 2030; how to tackle the barriers to deployment of more onshore wind; and how to secure maximum economic benefit from these developments.

The National Planning Framework for Scotland 3[13]

13.4.17 The third National Planning Framework 3 for Scotland (NPF3) (Scottish Government, 2014), published in June 2014, represents a spatial expression of the Scottish Government's aspirations for sustainable economic growth in Scotland over the next 20-30 years. It sets out at the national level, the Scottish Government's strategy for the country's development, in terms of how we are to develop our environment and includes development proposals identified as schemes of national importance.

13.4.18 Several visions for Scotland are set out in NPF3 including being, amongst others:

- A low carbon place - facilitate the transition to a low carbon economy, particularly by supporting diversification of the energy sector. The special strategy as a whole aims to reduce greenhouse gas emissions and facilitate adaption to climate change.

The Draft National Planning Framework 4[14]

13.4.19 In November 2021 the Scottish Government published its Draft Scotland 2045: Our Fourth National Planning Framework (Draft NPF4). Only limited weight can be given to the polices in Draft NPF4 at this stage, given it is a consultation document only. When adopted NPF4 will replace both NPF3 and Scottish Planning Policy and will form part of the statutory Development Plan.

13.4.20 Part 3 'Sustainable Places' details Scotland's future net zero, nature positive places will be more resilient to the impacts of climate change and support the recovery and restoration of our natural environment. In addition, this will help Scotland's places to thrive within the planet's sustainable limits and maximise the new economic and wellbeing opportunities from a just transition to a net zero, nature-positive economy.

13.4.21 It implies a collective need for supporting a just transition by creating new jobs in emerging technologies and significant economic opportunities for lower carbon industry.

Scottish Planning Policy[15]

13.4.22 Scottish Planning Policy (SPP) was published in June 2014 (Scottish Government, 2014) and is a statement of Scottish Government policy on land use planning. SPP emphasises the importance of tackling climate change and, in particular, the need to reduce greenhouse gas emissions.

13.4.23 SPP policies and decisions are guided by Principal Policies including:

[11]Scottish Government *Scotland's Energy Strategy Position Statement.* [Online] Available from - Scotland's Energy Strategy Position Statement (www.gov.scot) [Accessed: 21/04/2022]
[12] Scottish Government (2021) *Onshore wind – policy statement refresh 2021: consultative draft.* [Online] Available from - Onshore wind - policy statement refresh 2021: consultative draft - gov.scot (www.gov.scot) [Accessed: 21/04/2022]
[13]Scottish Government (2014) *National Planning Framework 3.* [Online] Available from Supporting documents - National Planning Framework 3 - gov.scot (www.gov.scot) [Accessed: 21/04/2022]
[14]Scottish Government (2021) *Scotland 2045 – fourth National Planning Framework – Draft: consultation.* [Online] Available from - Scotland 2045: Our Fourth National Planning Framework (www.gov.scot) [Accessed: 21/04/2022]
[15] Scottish Government (2020) *Scottish Planning Policy.* [Online] Available from - Supporting documents - Scottish Planning Policy - gov.scot (www.gov.scot) [Accessed: 21/04/2022]

- Responding to economic issues, challenges and opportunities, as outlined in local economic strategies;
- Protecting, enhancing and promoting access to natural heritage, including green infrastructure, landscape and the wider environment.

The Scottish Government's 'Programme for Scotland 2021-2022 'A Fairer, Greener Scotland'[16]

13.4.24 On 7th September 2021, the Scottish Government published its 'Programme for Scotland 2021-2022 'A Fairer, Greener Scotland.' The Programme was introduced amidst the ongoing process to lead the country out of the COVID-19 pandemic and much of the focus of the Programme is on the response to the challenges presented by this. The Introduction from the First Minister within the Programme states that, '*In the year of COP26 – being hosted in our great city of Glasgow – we will rise to the other global challenge we face, taking the necessary action to stem climate change. We will do so in a way which ensures we grasp the opportunities to put a net-zero Scotland at the heart of our economic prosperity.'*

13.4.25 The Programme set out several actions including, amongst others:

- Securing a net zero nation through building a net zero economy that is fair for all, create opportunities for new, good and green jobs and introducing Just Transition plans for all sectors and regions.
- Creating an economy that works for all of Scotland's people and places through investing an addition £500 million to support the new, good and green jobs of the future, including upskilling and reskilling people to access these.

13.4.26 The Programme goes on to state that the Scottish Government is committed to securing between 8 and 12 GW of installed onshore wind by 2030, recognising the vital role that this technology has to play in delivery the net zero commitment. The Programme also confirms that Scotland is leading the way in new forms of clean energy and states that in 2020 almost 100% of gross electricity consumption came from renewable sources. The Scottish Government's aim is that by 2030 50% of Scotland's overall energy consumption will come from renewable sources, which will pave the way for decarbonising the country's energy system almost completely by 2050. The Programme recognises that '*Development of renewable energy presents an immense opportunity for Scotland to lead by example – showing how a clean energy future is possible at home, and as a net exporter of renewable energy, attracting further investment and ensuring our progress to net zero is environmentally and economically beneficial'* (page 64).

13.4.27 As well as focussing on the delivery of net zero in relation to tackling climate change, the Programme also recognises the importance of renewable energy to the economic recovery post-COVID. '*A just transition to net zero requires a robust, diversified economy where businesses can make investments with confidence – domestically and globally – and will ensure Scotland is a world-leader, showcasing our strengths including in green and renewable technologies. That isn't just a moral obligation in meeting our ambitious targets to end Scotland's contribution to climate change, it is an economic opportunity to be grasped: benefiting businesses by leveraging public and private sector finance to create new markets and business opportunities, and benefiting people by protecting existing jobs, and creating new skills, training and employment opportunities*' (Page 78).

Scotland's National Strategy for Economic Transformation [17]

13.4.28 The Strategy sets out the priorities for Scotland's economy as well as the actions needed to maximise the opportunities of the next decade to achieve the vision of a wellbeing economy.

13.4.29 The vision for Scotland by 2032 includes, amongst others, being recognised as an 'international benchmark for how an economy can transform itself, de-carbonise and rebuild natural capital whilst creating more well-paid and secure jobs and developing new markets based on renewable sources of energy and low carbon technology.'

13.4.30 Key industries and new market opportunities include:

- Renewable energy, with Scotland enjoying a quarter of Europe's wind potential and home to globally leading businesses in tidal energy as part of a wider energy industry with strengths in the company base, financial capital, infrastructure, knowledge and knowhow;
- The circular economy, where resources are kept in high-value use, creating new market, innovation and job opportunities that will be key to achieving our targets for net zero and nature.

[16]Scottish Government (2021) *A Fairer, Greener Scotland: Programme for Government 2021 – 22.* [Online] Available from - A Fairer, Greener Scotland: Programme for Government 2021-22 (www.gov.scot) [Accessed: 21/04/2022]

[17] Scottish Government (2022) *Scotland's National Strategy for Economic Transformation.* [Online] Available from - 3. New Market Opportunities - Scotland's National Strategy for Economic Transformation - gov.scot (www.gov.scot) [Accessed: 21/04/2022]

East Ayrshire Local Planning Policy and Advice

East Ayrshire Local Development Plan 2 Draft[18]

13.4.31 East Ayrshire Council has considered and agreed the proposed Local Development Plan in line with officer recommendations in March 2022 with formal public consultation to be undertaken in due course.

13.4.32 In the Main Issues Report, key areas of change facing East Ayrshire are set out along with options for future development. Renewable energy and energy efficiency measures will be a key focus of the Council's efforts in taking a more sustainable approach to development activity in East Ayrshire.

13.4.33 Another key aim is to drive economic growth and inward investment in a sustainable manner and ensure there is access to employment opportunities.

East Ayrshire Economic Development Strategy 2014/2025[19]

13.4.34 The Strategy sets out the Economic Development Vision and Priorities with associated key actions for East Ayrshire for the period 2014 – 2025.

13.4.35 It details renewables as a priority growth sector and emphasises the support for these sectors to secure growth, productivity and innovation.

13.4.36 In addition, sustainability is one of the operating principles for the delivery of economic development. It states that all agencies shall endeavour to use locally sourced products and labour, build to high environmental standards, encourage green transport plans, improve industrial and domestic energy efficiency and promote renewable energy/re-use and recycling.

East Ayrshire Tourism Action Plan 2017/2020[20]

13.4.37 The East Ayrshire Tourism Strategy and Action Plan highlights the importance of sustainable tourism development and calls for growth in sustainable tourism. One of its key objectives is to develop sustainable tourism agenda and support businesses to tackle issues relation to energy efficiency.

South Ayrshire Local Planning Policy and Advice

South Ayrshire Local Development Plan[21]

13.4.38 The South Ayrshire Local Development Plan was adopted on 23rd September 2014. It sets out strategic spatial priorities and policies for South Ayrshire and will secure land for specified uses to provide certainty for development.

13.4.39 In the Plan, it details that South Ayrshire will support proposals for generating and using renewable energy in stand-alone locations, and as part of new and existing developments'. In addition, it details that 'local benefits arising from wind farms can be important to the economic future of rural communities'.

South Ayrshire Sustainable Development and Climate Change Strategy 2019 - 2024[22]

13.4.40 This strategy sets out how South Ayrshire council aims to further sustainable development and tackle climate change over the next five years.

13.4.41 One of the strategic outcomes includes Outcome 3.2 – 'Council plans and strategies support communities to live more sustainably, reduce carbon emissions and adapt to a changing climate through designing new developments and regeneration schemes in a way to be energy efficient, resilient to impacts of climate change, maximise use of renewables, and support active travel.'

13.4.42 In addition, a key outcome to the strategic objective to 'make the most of the local economy' is the growth in green jobs through transition to low carbon economy.

South Ayrshire Strategic Economic Plan Vision 2030[23]

13.4.43 This plan sets out the challenges faced by today's economy and introduces three key principles of design – great places, strong businesses, and good growth – that run through the plan to ensure that the strategy will deliver inclusive as well as environmental growth and increasing productivity.

13.4.44 Its key objective is to invest in natural capital and environmental growth. In addition, the plan cements South Ayrshire's commitment to sustainable development.

[18]East Ayrshire Council (2022) *Information about the local development plan 2.* [Online] Available from - Information about local development plan 2 · East Ayrshire Council (east-ayrshire.gov.uk) 21/04/2022]

[19]East Ayrshire Council (2014) *East Ayrshire Economic Development Strategy 2014/2025.* [Online] Available from - Economic Development Strategy 2014-2025 (east-ayrshire.gov.uk) [Accessed: 30/04/2022]

[20]East Ayrshire Council (2017) *East Ayrshire Tourism Action Plan – 2017/2020.* [Online] Available from - East Ayrshire Tourism Action Plan (east-ayrshire.gov.uk) [Accessed: 30/04/2022]

[21] South Ayrshire Council (2014) *East Ayrshire Local Development Plan.* [Online] Available from - https://archive.south-ayrshire.gov.uk/documents/LocalDevPlan_Final.pdf [Accessed: 30/04/2022]

[22]South Ayrshire Council (2019) *South Ayrshire Council Sustainable Development and Climate Change Strategy 2019 -2024.* [Online] Available from - Sustainable Development and Climate Change Strategy - Appendix 1 (south-ayrshire.gov.uk) [Accessed: 30/04/2022]

[23] South Ayrshire Council *Strategic Economic Plan Vision 2030* [Online] Available from - sac_strategic_economic_plan_-_pdf_for_publishing.pdf (south-ayrshire.gov.uk) [Accessed: 30/04/2022]

Ayrshire Local Planning Policy and Advice

Ayrshire Joint Structure Plan (2007)[24]

13.4.45 The Ayrshire Joint Structure Plan establishes a framework that brings together the aspirations of communities with those of business and industry, and the area's many supporting agencies and organisations to provide a strategic land use context to the year 2025.

13.4.46 Five key objectives were identified within the plan, two of which were:

- To support measures that encourage economic development underpinned by a sustainable population; and
- To safeguard and enhance the quality of the environment.

13.4.47 In addition, the plan seeks to facilitate the development of renewable energy and energy saving within communities and act as an economic and sustainable driver of local economies for the future.

Ayrshire and Arran Tourism Strategy 2012/17[25]

13.4.48 The strategy highlights the importance of tourism to the economy of Ayrshire and Arran, generating around £348 million of revenue per year, and the potential to grow this further through a co-ordinated regional and sustainable approach.

Local Action Plans and Strategies

13.4.49 Various action plans have been produced for the local area and the wider hinterland of the Proposed Development. These include:

- Patna Community Action Plan 2015 – 2020;
- Dalmellington Community Parish Action Plan 2012 - 2017;
- Drongan, Rankinston & Stair Community Action Plan 2014 – 2019;
- East Ayrshire Community Planning Delivering Community Regeneration Action Plan 2011 – 2015; and
- Dalrymple, Hollybush and Skeldon Community Action Plan 2019 – 2024
- Cumnock Action Plan 2016 – 2021

13.4.50 These documents identify specific improvements, goals and objectives, such as creating a community woodland area in Dalmellington and enhancing Cumnock's outdoor activities and open spaces by rejuvenating Woodroad Park and improving Broomfield. While some of these goals have been implemented others remain aspirational.

13.5 Socio-economic baseline

13.5.1 This subsection summarises the baseline characteristics of the local area and compares them against a Scottish and national context in terms of population, industrial structure, critical strategic employers, unemployment and economic activity levels, income and earnings, and the relative economic importance of tourism. These are presented to demonstrate what impact the Proposed Development may have on the local area.

13.5.2 In order to provide a comparison, the following geographical areas were considered:

- Local: defined as East Ayrshire and South Ayrshire
- Regional area: Scotland
- Great Britain: the national area, defined as England, Wales and Scotland. In some cases, due to data availability the UK (England, Wales, Scotland and Northern Ireland) was used.

Population

13.5.3 The local area of South Ayrshire has experienced a marginal population decline of 0.7 % between the period of 2001 – 2020 in comparison to the local authority of East Ayrshire which experienced an overall increase in population over the same period. However, populations have declined by 0.9 % from 2012 – 2020. Scotland and Great Britain, as a whole, experienced an increase in population from 2001 – 2020.

13.5.4 Table 13.5 outlines the local and regional area and Great Britain overall population change in the years of 2001, 2012 and 2020.

Table 13.5 – Population

	East Ayrshire	South Ayrshire	Scotland	Great Britain
Population (2001)	120,300	112,200	5,064,200	57,424,200
Population (2012)	122,700	112,900	5,313,600	61,881,400
Population (2020)	121,600	112,100	5,466,000	65,185,700
% change				
2001 – 2012	2 %	0.6 %	4.7 %	7.7 %
2012 - 2020	-0.9 %	-0.7 %	2.8 %	5.3 %

Source – NOMIS Official Labour Market Statistics

[24] South Ayrshire Council, North Ayrshire Council and East Ayrshire Council *Ayrshire Joint Structure Plan – Growing a Sustainable Ayrshire.* [Online] Available from - Layout 1 (www.gov.scot) [Accessed: 30/04/2022]

[25] Ayrshire and Arran (2012) *2012/2017 Tourism Strategy* [Online] Available from - Ayrshire and Arran Tourism Strategy (east-ayrshire.gov.uk) [Accessed: 30/04/2022]

Age Structure

13.5.5 East and South Ayrshire working age populations have declined during the period of 2001 to 2020 along with an increase in retirement age populations, which is likely to put additional pressure on services in the local area. South Ayrshire, in particular, has a retirement age population 7 % above average in contrast to Scotland in 2020.

13.5.6 Table 13.6 shows the overall age structure for the local, regional and national levels between the period of 2001-2020.

Table 13.6 – Age structure

	East Ayrshire	%	South Ayrshire	%	Scotland	%	Great Britain	%
2001								
Children (0-15)	23,907	20 %	20,255	18 %	970,374	19 %	11,465,609	20 %
Working Age (16-64)	77,000	64 %	70,400	63 %	3,286,645	65 %	36,809,800	64 %
Retirement Age (65+)	19,380	16 %	21,524	19 %	807,181	16 %	9,148,769	16 %
2012								
Children (0-15)	21,559	18 %	18,261	16 %	914,626	17 %	11,601,404	19 %
Working Age (16-64)	78,900	64 %	69,400	62 %	3,473,233	65 %	39,711,900	64 %
Retirement Age (65+)	22,241	18 %	25,259	22 %	925,741	17 %	10,568,092	17 %
2020								
Children (0-15)	20,869	17 %	17,418	16 %	916,783	17 %	11,648,653	18 %
Working Age (16-64)	75,500	62 %	65,800	59 %	3,493,137	64 %	40,665,300	62 %
Retirement Age (65+)	23,707	20 %	28,955	26 %	1,056,080	19 %	12,871,771	20 %

Note – Percentages may not add up to 100% due to rounding.
Source – NOMIS and National Records of Scotland

13.5.7 Working age population are projected to decrease[26] for East Ayrshire and South Ayrshire to 67,906 and 57,242 in 2043 respectively. In contrast, retirement age populations are projected to increase to 28,244 and 33,368 for East Ayrshire and South Ayrshire respectively in 2043.

Industrial Structure

13.5.8 Comparable occupation figures at the local, Scottish and Great Britain levels are presented in Table 13.7.

Table 13.7 – Industrial structure, 2021

	East Ayrshire (%)	South Ayrshire (%)	Scotland (%)	Great Britain (%)
Standard Occupational Classification (SOC) 2010 Major Group 1-3	39.2	48.9	48.2	49.7
1 Managers, Directors and Senior Officials	7.4	7.5	8.7	10.5
2 Professional Occupations	19.1	25.2	23.8	23.7
3 Associate Professional & Technical	12.5	15.6	15.5	15.3
SOC 2010 Major Group 4-5	22.3	18.6	18.9	19.0
4 Administrative & Secretarial	11.4	7.7	9.9	10.2
5 Skilled Trades Occupations	10.8	10.6	9.0	8.8
SOC 2010 Major Group 6-7	21.5	13.5	17.7	16.2
6 Caring, Leisure and Other Service Occupations	8.0	7.4	9.3	9.2
7 Sales and Customer Service Occs	13.4	5.9	8.4	6.9
SOC 2010 Major Group 8-9	17.0	19.1	15.2	15.1
8 Process Plant & Machine Operatives	4.9	7.4	5.2	5.5
9 Elementary Occupations	11.9	11.5	9.9	9.6

Source – ONS Annual Population Survey

13.5.9 East Ayrshire has lower proportions of highly skilled populations, Standard Occupational Classification (SOC) major Group 1-3 (39.2 %), in contrast to Scotland (48.2%) and Great Britain (49.7 %). In addition, East Ayrshire has higher proportions of SOC major group 4-5, 6-7 and 8-9.

[26]National Records of Scotland *Population Projections for Scottish Areas (2018-Based)* [Online] Available from Subnational population projections of Scotland - National Records of Scotland (shinyapps.io) [Accessed: 30/04/2022]

13.5.10 South Ayrshire exhibits slightly above average proportions of highly skilled populations (48.9 %) in contrast to the regional average (48.2 %). However, it has highest proportion of the lowest skilled group (SOC 2010 Major Group 8-9) at 19.1% in contrast to East Ayrshire's slightly lower proportion (17 %) along with Scottish (15.2 %) and Great British (15.1 %) levels.

13.5.11 Table 13.8 summarises the industry of employment across each spatial level.

Table 13.8 summarises the industry of employment across each spatial level, 2021

Employment by Industry	East Ayrshire (%)	South Ayrshire (%)	Scotland (%)	Great Britain (%)
Mining and Quarrying	0.4	0.3	1.2	0.2
Manufacturing	6.4	10.2	7.2	7.9
Electricity, Gas, Steam and Air Conditioning Supply	0.4	0.1	0.9	0.5
Water Supply, Sewerage, Waste Management and Remediation Activities	0.9	0.5	0.7	0.7
Construction	5.1	4	5.1	4.8
Wholesale and Retail Trade, Repair of Motorcycles	15.4	18.2	13.9	14.9
Transportation and Storage	4.5	5.7	4.5	5.1
Accommodation and Food Service Activities	6.4	9.1	7.2	7.2
Information and Communication	1.3	1.1	3.7	4.5
Financial and Insurance Activities	1.0	1.1	3.3	3.5
Real Estate Activities	0.9	1.4	1.5	1.8
Professional Scientific and Technical Activities	4.5	5.1	7.1	8.7
Professional Scientific and Technical Activities	4.5	5.1	7.1	8.7
Administrative and Support Service Activities	7.7	3.4	8.0	8.8
Public Administration and Defence, Compulsory Social Security	7.7	5.1	6.5	4.6
Education	6.4	8.0	8.4	9.0
Human Health and Social Work Activities	25.6	20.5	16.6	13.6
Arts, Entertainment and Recreation	2.3	2.3	2.3	2.2
Other Service Activities	1.3	2.3	1.7	1.9

Source – ONS Business Register and Employment Survey: open access

13.5.12 A review of the industry of employment suggests the local area of East Ayrshire and South Ayrshire has a significantly higher proportion of manufacturing, wholesale and retail trade and human health and social work in comparison to Scotland and Great Britain. In addition, there is a lower incidence of professional scientific and technical activities, information, communication and administrative and support service activities.

13.5.13 In terms of educational attainment levels, Table 13.9 shows South Ayrshire having a higher proportion of residents with lower qualifications- NVQ2 and Above, and NVQ1 and above - in contrast to the regional and national levels. East Ayrshire has lower proportions (41.8 %) of residents with higher qualifications in contrast to Scottish levels (50.1%). However, both South and Easy Ayrshire show lower proportions of residents with no qualifications in comparison to regional and national levels.

Table 13.9 – Qualifications

Qualification[27]	East Ayrshire (%)	South Ayrshire (%)	Scotland (%)	Great Britain (%)
NVQ4 and Above	41.8	50.3	50.1	43.5
NVQ3 and Above	57.2	66.9	64.9	61.5
NVQ2 and Above	78.2	83.2	79.6	78.2
NVQ1 and Above	86.2	90.6	86.5	87.6
Other Qualifications	8.1	4.1	5.8	5.9
No Qualifications	5.8	5.3	7.7	6.6

Source – ONS Annual Population Survey

Note – The variables show the total number of people who are qualified at a particular level and above, so data in the table are not additive.

[27] No Qualifications = No formal qualifications held.

Other Qualifications = includes foreign qualifications and some professional qualifications.

NVQ 1 Equivalent = fewer than 5 GCSEs at grades A-C, foundation GNVQ, NVQ 1, intermediate 1 national qualification (Scotland) or equivalent.

NVQ 2 Equivalent = 5 or more GCSEs at grades A-C, intermediate GNVQ, NVQ 2, intermediate 2 national qualification (Scotland) or equivalent.

NVQ 3 Equivalent = 2 or more A levels, advanced GNVQ, NVQ 3, 2 or more higher or advanced higher national qualifications (Scotland) or equivalent.

NVQ 4 Equivalent And Above = HND, Degree and Higher Degree level qualifications or equivalent.

Critical Strategic Local Employers

13.5.14 Data from 'Ayrshire Socio-Economic Profile and Analysis[28]' from 2015 showed hospitals to be the largest employer in Ayrshire (as of 2015) providing 6,800 jobs in 2013 most concentrated in East Ayrshire. The second largest employers include supermarkets with around 6,400 jobs provided and spread evenly through East Ayrshire, North Ayrshire and South Ayrshire. In addition, tourism and hospitality present considerable job opportunities accounting for almost 12,000 jobs when combined.

13.5.15 Due to the presence of Prestwick Airport in South Ayrshire, providing 1,700 jobs all of which are concentrated in South Ayrshire. Furthermore, the Council and the Health Board are both major employers in East Ayrshire along with Asda, Morrisons, Tesco and Land Engineering being the largest private sector employers in the region[29].

Unemployment

13.5.16 Unemployment rate is an effective measure of economic performance and can allow for spatial comparisons to be made. Table 13.10 shows unemployment rates for 2021. The data shows that unemployment rate in the local area is higher than the Scottish level.

Table 13.10 – Unemployment rates (2021)

East Ayrshire (%)	South Ayrshire (%)	Scotland (%)	Great Britain (%)
4	4.1	3.9	4.4

Source – ONS annual population survey

13.5.17 Employment levels in Scotland was severely impacted by the financial recession with unemployment rates nearly doubling between 2008 and 2011 (4.9 % and 8.2 %). In addition, East Ayrshire unemployment rates increased significantly from 6 % in 2008 to 9.7 % in 2009. It has steadily fallen to reach an all-time low for both East Ayrshire and South Ayrshire in 2019 before increasing again around the time of the COVID pandemic in 2020. The rates have begun to decrease again until 2021. Over the period of 2004 – 2021, East Ayrshire has had a predominantly higher unemployment rate compared to South Ayrshire, Scotland and Great Britain until recently, in 2021, where it has dropped lower than South Ayrshire and Great Britain. Figure 13.1 illustrates the changes in unemployment rates across the local, Scottish and Great British levels between 2004 -2021.

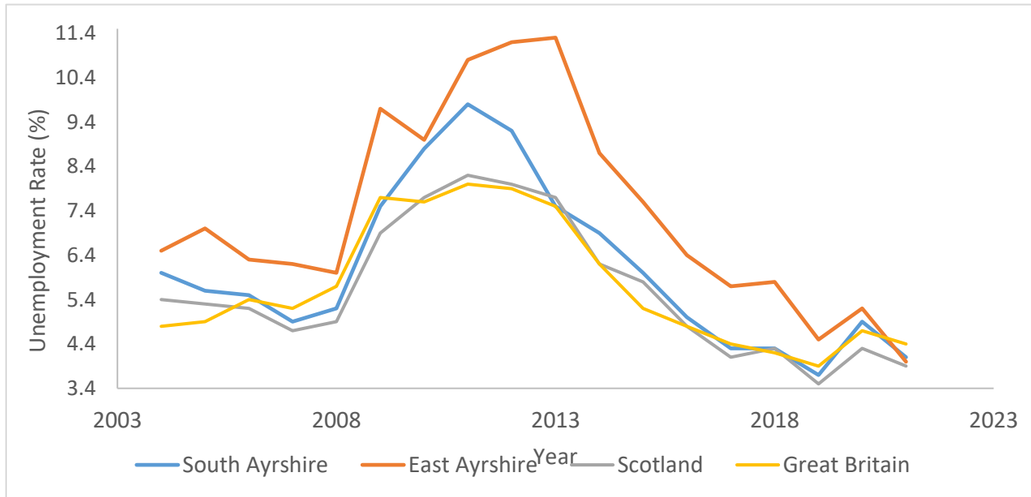


Figure 13.1 - Unemployment rate, 2004 - 2021

Source – ONS Annual Population Survey

13.5.18 The higher levels of unemployment exhibited in South Ayrshire may indicate relatively low levels of economic opportunity. Rural areas typically exhibit an above average proportion of self-employed individuals. This is demonstrated in South Ayrshire (Table 13.11) where self-employed levels are higher (9.3 %) than the regional average (7.5 %). Overall, South Ayrshire's economically active population (73 %) is lower than East Ayrshire (78.1 %), Scottish (76.2 %) and Great British levels (78.4 %). In addition, the proportion of retired people in South Ayrshire is particularly high (29.7 %) compared to the regional (23.8 %) and national (13.8 %) average. Overall, the local labour market appears to be marginally less dynamic than the wider region, local authority and the national average.

Table 13.11 – Labour market profile

Jan 2021 - Dec 2021	East Ayrshire (%)	South Ayrshire (%)	Scotland (%)	Great Britain (%)
Economically Active (16-64)	78.1	73	76.2	78.4
In Employment	75.2	68.5	73.1	74.8
Employee	66.2	58.6	65.4	65.3

[28] SQW (2015) *Ayrshire Socio-Economic Profile and Analysis – Final Report.* [Online] Available from - Ayrshire Socio-Economic Profile and Analysis (south-ayrshire.gov.uk) [Accessed: 30/04/2022]

[29] East Ayrshire Council (2014) *Economic Development Strategy 2014/2025* [Online] Available from - Economic Development Strategy 2014-2025 (east-ayrshire.gov.uk) [Accessed: 05/05/2022]

Self Employed	8.4	9.3	7.5	9.3
Unemployed	4.0	4.1	3.9	4.4
Economically Inactive (16-64)	21.9	27	23.8	21.6
Retired	13.5	29.7	15.3	13.8
Student	19.6	17.2	25.9	28.1
Looking after family	23.5	12	16.3	19.2
Permanently sick/disabled	27.5	29.2	29.4	24.6
Other economically inactive	12.7	#	10.4	11.9

Sample size too small

Source – ONS Annual Population Survey

Economic Activity Levels

13.5.19 The economic activity rate is a useful measure of the labour market opportunities available in the area[30]. South Ayrshire, in particular, has lower levels of economic activity relative to East Ayrshire which is closer to the national average.

Table 13.12 – Economic activity rate

Jan 2021 - Dec 2021	East Ayrshire (%)	South Ayrshire (%)	Scotland (%)	Great Britain (%)
Economically Active (16-64)	78.1	73	76.2	78.4
Economically Inactive (16-64)	21.9	27	23.8	21.6

Source – ONS Annual Population Survey

13.5.20 As shown in Figure 13.2, per capita output in 2019 (measured by Gross Value Added per head of population at current basic prices), for East Ayrshire and North Ayrshire mainland is £16,122 (54 % of UK levels) and South Ayrshire is £22,043 (74 % of UK level). Due to data availability, East Ayrshire and North Ayrshire GVA per head of population was used.

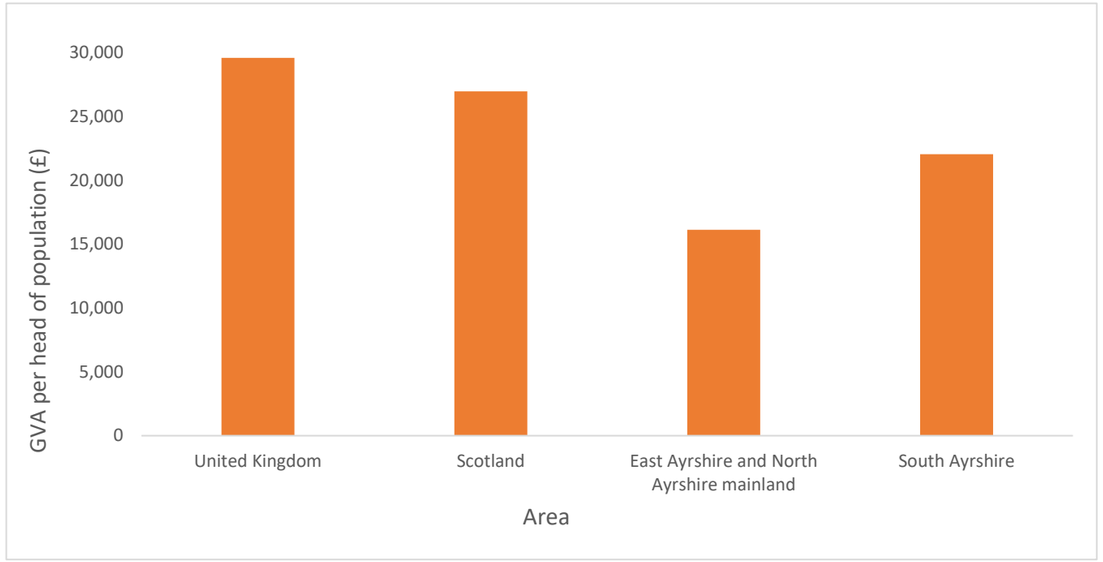


Figure 13.2 – GVA per head of population (at current basic prices), 2019

Source – Regional Accounts 2019 (ONS)[31]

13.5.21 In addition, the Gross Disposable Household Income (GDHI)[32] per head in 2019 for East Ayrshire and South Ayrshire was £17,306 and £19,428 respectively. In contrast to Scottish levels (£19,649) and national levels (£21,433), both local areas are lower particularly East Ayrshire. East Ayrshire has the second lowest GDHI in the Glasgow and Strathclyde region and third lowest overall across all of Scotland.

Tourism Employment

13.5.22 The level of tourism related employment in East Ayrshire and South Ayrshire has both increased from 2009-2017 (Table 13.13). In relation to individual jobs, South Ayrshire has more than double the proportion of East Ayrshire tourism employment in 2017 and a higher percentage change in comparison to Scottish levels across 2009-2017.

[30] The economic activity rate measures the percentage of the population, both in employment and unemployed that represents the labour supply regardless of their labour status. The figure represents the degree of success of the area in engaging people in the productive activity.

[31] Office for National Statistics (2022) *Regional gross value added (balanced) per head and income components.* [Online] Available from - Regional gross value added (balanced) per head and income components - Office for National Statistics (ons.gov.uk) [Accessed: 05/05/2022]

[32]Office for National Statistics (2021) *Regional gross disposable household income, UK: 1997 to 2019.* [Online] Available from - Regional gross disposable household income, UK - Office for National Statistics (ons.gov.uk) [Accessed: 05/05/2022]

Table 13.13 – Tourism employment, 2009 – 2017

	Tourism jobs 2017	% change 2009 - 2012	% change 2012 - 2017	% change 2009 - 2017
East Ayrshire	2,500	-9 %	19 %	9 %
South Ayrshire	6,000	2 %	9 %	11 %
Scotland	206,000	-5 %	13 %	8 %
Great Britain[33]	3,240,000	2 %	18 %	21 %

Source – VisitScotland using Scottish Government Growth Sector Statistics (October 2018)[34]

Predicted spending on accommodation and local businesses

13.5.23 Another impact of wind farms is the spending of workers when they visit wind farms and stay away from home. This will benefit accommodation, food and drink providers. This occurs throughout all stages of the wind farm cycle.

13.5.24 RenewableUK[35] produced a report 'Onshore Wind: Direct & Wider Economics Impacts' which detailed case study research on three projects using numbers of workers visiting an area, time spent in the area and levels of spending. This produced an estimation of the magnitude of economic impact to the local area. Based on this information, it was estimated that for every MW constructed, £7,500 is spent in the local area on accommodation and on food and drink. In relation to the Proposed Development, this would result in £405,000 (54 MW) being spent in the local area.

13.5.25 An analysis of the nearest accommodation services was carried out to determine an example total of indirect expenditure from accommodation used by construction workers. Using VisitScotland, accommodation services (self – catering cottages) within 3.5 km from the Proposed Development Area were identified and peak season rates per night were used. This produced a maximum average spend per night of £145.

Socio-economic Baseline Summary

13.5.26 Populations in both South and East Ayrshire have declined from 2012 – 2020 along with working age populations and an increase in retirement age populations across the same period.

13.5.27 Working age and retirement populations are predicted to decrease and increase respectively in 2043.

13.5.28 Lower proportions of professional occupations, technical activities and information and higher proportions of manufacturing, wholesale and retail trade and human health in the local area.

13.5.29 Lower proportions of Higher qualifications in East Ayrshire. Higher proportions of lower qualifications such as NVQ1 and NVQ2 and above in South Ayrshire.

13.5.30 Unemployment rates are slightly higher than the Scottish average with South Ayrshire having the highest.

13.5.31 Self-employed rates are higher in South Ayrshire along with retired populations and a lower economically active proportion of populations.

13.5.32 East Ayrshire GDHI is the third lowest overall across all of Scotland.

13.5.33 Tourism employment is important for East and South Ayrshire with an increase occurring from 2009 - 2017. The percentage change between 2009 – 2017 was higher for both South Ayrshire and East Ayrshire in comparison to the regional average. South Ayrshire has a larger proportion of tourism employment.

13.5.34 Predicted spending costs in the surrounding area of wind farm developments have the potential to generate £7,500 for every MW constructed. This results in £405,000 (54 MW) for the construction of the Proposed Development based on case study research.

13.6 Tourism Baseline

Tourism Volume and Value

13.6.1 This section provides a tourism profile of South Ayrshire and East Ayrshire relative to Scotland in terms of visitor and tourist trends, tourism volume and value, visitor patterns, visitor accommodation occupancy rates and expenditure patterns, the most up-to-date sources of information have been used. Where necessary, figures and statistics for Ayrshire & Arran area have been used in place of East Ayrshire and South Ayrshire due to data availability.

[33] Welsh Government (2021) *Employee jobs in tourism-related industries by area and year.* [Online] Available from - Employee jobs in tourism-related industries by area and year (gov.wales) [Accessed: 05/05/2022]
[34] VisitScotland (2018) *Tourism employment in Scotland.* [Online] Available from - insights-topic-paper---tourism-employment-2018-table-6-updated-jan-2019.pdf (visitscotland.org) [Accessed: 05/05/2022]
[35] RenewableUK (2012) *Onshore Wind: Direct & Wider Economic Impacts.* [Online] Available from - Microsoft Word - SB - Report Onshore Wind Direct & Wider Economic Impacts 26apr12 Amends & comments - SB (publishing.service.gov.uk) [Accessed: 05/05/2022]

Profile of Tourism

13.6.2 The VisitScotland Ayrshire & Arran Factsheet 2019[36] provides an overall summary of tourism in Ayrshire. Between 2017 and 2019, visitors contributed £50.2 million and £121.5 million in East Ayrshire and South Ayrshire respectively. Nearly 50 % of income generated by Ayrshire and Arran (£258.5 million) is generated in South Ayrshire.

13.6.3 The VisitScotland Ayrshire and The Isle of Arran Scotland Visitor Survey 2015 & 2016[37] highlighted strengths, weaknesses and hidden opportunities. Visitors were most attracted to the scenery and landscape and were satisfied with ease of getting around. The weaknesses included the availability of free Wi-Fi at accommodation and value for money of eating out.

13.6.4 The report noted the following key trends in Ayrshire & Arran:

- Overnight tourism expenditure has decreased by 10 % from 2016-2018 which resulted from decreases in both domestic and international spend
- Slight increase in domestic visits and bed nights in 2017-2019 – driven by Scottish residents – were sufficient to offset a 7 % drop in international travellers.
- Domestic day tourism trips have declined by 2 %
- Day spend increased by 7 % thus producing net growth in tourism expenditure.
- Sightseeing was the most popular activity by visitors with scenery and landscape being the top factor attracting two-thirds of visitors.

13.6.5 The Proposed Development lies around 1 km to the south of the village of Patna. Patna is located alongside the River Doon which is popular with anglers. It is a small town with 2,081[38] residents. The local attraction within the immediate vicinity of the Proposed Development is Doon Valley Railway located on the eastern side of the Proposed Development boundary. The Railway is operated by Ayrshire Railway Preservation Group and was formed in 1974 to keep steam alive in Ayrshire.

Top Visitor Attractions

13.6.6 The top free and paid visitor attraction within 15 km of the Proposed Development is Maclaurin Galleries and the Robert Burns Birthplace Museum. Other attractions identified in the Ayrshire and Arran Factsheet 2019, which are also in the 15 km study area, include Rozelle House. Overall, VisitScotland suggests that the majority of popular attractions are not located in close proximity to the Proposed Development (Table 13.14).

13.6.7 Visitor numbers to Dean Castle Country Park (top free of charge site) are significantly higher in comparison to Culzean Castle and Country Park (top paid site) with the remaining free sites being significantly lower than the paid sites (Table 13.14). In addition, Dean Castle Country Park and Culzean Castle and Country Park are both located 16 km from the Proposed Development.

Table 13.14 – Top free and paid visitor attractions in Ayrshire and Arran

Top Sites (free of charge)	2019 Rank	2019 Visitors	Approx. distance from Proposed Development
Dean Castle Country Park	1	1,365,246	16 km W
Maclaurin Galleries	2	40,066	12 km NW
Goatfell	3	24,308	52 km NW
Rozelle House	4	13,676	12 km NW
Burns Monument Centre	5	6,833	29 km N
Top Sites (Paid)			
Culzean Castle and Country Park	1	333,965	16 km W
Robert Burns Birthplace Museum	2	261,283	11.5 km NW
Scottish Maritime Museum	3	73,310	31 km NNW
Brodick Castle and Country Park	4	68,423	48 km NW
Dundonald Castle	5	24,718	26 km N

Source – Ayrshire and Arran Factsheet (2019)[39]

13.6.8 In addition, sites not included in the top visitor attraction category but located close by (within 15 km) to the Proposed Development Area include:

- Scottish Dark Sky Observatory (although currently burnt down)
- Galloway Forest Park
- Doon Valley Railway (Scottish Industry Railway Centre)
- Crossraguel Abbey

Top Visitor Activities

13.6.9 Top visitor activities to do in Ayrshire and Arran include going to a meal in a restaurant (1.9 million) and going for a drink in a pub (1.4 million). A lower number

[36]VisitScotland (2021) *Ayrshire and Arran Factsheet 2019.* [Online] Available from - Ayrshire and Arran Factsheet 2019 (visitscotland.org) [Accessed: 05/05/2022]
[37]VisitScotland *Scotland Visitor Survey 2015 & 2016.* [Online] Available from - Layout 1 (visitscotland.org) [Accessed: 05/05/2022]
[38] East Ayrshire Council *Community Plan 2015 – 2030 – Populations.* [Online] Available from - Locality Populations (eastayrshirecommunityplan.org) [Accessed: 05/05/2022]
[39] VisitScotland (2021) *Ayrshire and Arran Factsheet 2019.* [Online] Available from - Ayrshire and Arran Factsheet 2019 (visitscotland.org) [Accessed: 05/05/2022]

of visitors were taking part in outdoor activities including long walks (0.6 million) or centre-based walking (0.7 million).

13.6.10 The highest social activity was visiting family for leisure with 1.3 million annual day trips and visiting family and friends equalled a total of 2 million day trips every year.

13.6.11 Table 13.15 show the top visitor activities between 2016 – 2018 in Ayrshire and Arran.

Table 13.15 – Top visitor activities, 2016 – 2018

Activity	2016 – 2018 Ayrshire and Arran Rank	Ayrshire and Arran Annual Average Day Trips (millions)
Went for a meal in a restaurant, café, hotel, pub, etc	1	1.9
Went for a drink in a pub, club, hotel, etc	2	1.4
Visited a beach	3	1.3
Visited family for leisure	4	1.3
Short walk – up to 2 miles/1 hour	5	1.3
Sightseeing on foot	6	0.8
Centre based walking	7	0.7
Visited friends for leisure	8	0.7
Went for a snack in a fast food outlet, takeaway etc	9	0.6
Long walk, hike or ramble (minimum of 2 miles/1 hour)	10	0.6

Source – Ayrshire and Arran Factsheet (2019)

Tourism Offers and Characteristics

13.6.12 Ayrshire and Arran have a fantastic range of assets which establish the foundations of an already strong tourism sector. The most significant of their offers includes Cultural & Heritage and Activities & Natural Environment.

13.6.13 Table 13.16 shows Ayrshire and Arran tourism offers.

Table 13.16 – Ayrshire and Arran tourism offers

Offers	Characteristics	Potential Yield
Cultural & Heritage, including Burns Activities & Natural Environment	High potential for development of new or enhanced offerings	Very strong
Golf Sailing Arran	Already strong, core, offers with great scope for further exploitation Distinctive 'Scotland in miniature' island destination with strong market appeal	Very strong
Food & Drink Islands	Complementary offers that can add greatly to visitor experiences and increase spend/stays	Strong
Weddings & Civils Partnerships Business Tourism	Niche offers which, although smaller in scale, are strong offers with scope for further development.	Moderate
Events & Festivals	Cross-cutting all the offers, with potential to provide a programme of strategic events and festivals, which showcase our offers and attract visitors	Complements all of the offers

Source – Ayrshire and Arran Tourism Strategy 2012/17[40]

Recreational Paths and Trails

13.6.14 Due to the higher susceptibility of receptors using promoted long-distance footpaths and cycle routes, recreational routes were identified in EIAR Chapter 5: Landscape and Visual Impact Assessment within a radius of 15 km from the Proposed Development.

13.6.15 There are numerous core paths within the surrounding area, including a network of core paths and footpaths within 10 km of the Proposed Development. These paths pass through the western part of the Proposed Development. There are also a number of Scottish Great Trails, including the Ayrshire Coastal Path, located approximately 14 km to the west of the Proposed Development at its closest point, the River Ayr Way, located approximately 14 km to the north of the Proposed Development and the Southern Upland Way, located approximately 25 km to the south east at its closest point.

13.6.16 In addition, National Cycle Network (NCN) routes are located within the surrounding area including Route NCN 7 located within 10 km to the west of the Proposed Development at its closest point as it runs from North England to Inverness-shire.

13.6.17 Table 13.17 details the recreational routes identified and considered within the assessment of the Proposed Development:

[40]Ayrshire and Arran *2012/2017 Tourism Strategy.* [Online] Available from - Ayrshire and Arran Tourism Strategy (east-ayrshire.gov.uk) [Accessed: 05/05/2022]

Table 13.17 – Recreational routes

Recreational Routes within 15 km of Proposed	Description
A713	Part of Galloway Tourist Route and follows part of the north-eastern boundary of the Proposed Development. Extensive theoretical visibility within 5 km of the Proposed Development. Considered in the assessment.
Patna to Straiton Core Path	Theoretical visibility from most of this route between Patna and Straiton, passing the Proposed Development. Considered in the assessment.
Core Paths within the Doon Valley	Theoretical visibility from routes on the east of the Proposed Development of the Doon Valley above Patna and Waterside, within 5 km of the Proposed Development. Considered in the assessment.
Core Paths around Straiton	Theoretical visibility from routes south and west of Straiton, within 5 km of the Proposed Development. Considered in the assessment.
National Cycle Network Route 7	Approximately 6.3 km west of the Proposed Development at its closest point. Extensive theoretical visibility within 15 km of the Proposed Development. Considered in the assessment.
Ayrshire Coastal Path	Approximately 14 km north-west of the Proposed Development at its closest point. Limited theoretical visibility along a small stretch through Ayr. Not considered in the assessment.
River Ayr Way	Approximately 14 km north of the Proposed Development at its closest point. Intermittent theoretical visibility. Not considered in the assessment.
Hill routes in the Southern Uplands	Theoretical visibility from several summits within 25 km, likely to be access by walkers. Considered in the assessment.

Source – EIAR Chapter 5 – LVIA

UK Trips and Expenditure

13.6.18 The number of domestic tourist trips from Scotland and rest of Great Britain to Ayrshire and Arran has only risen by 1 % over the period of 2016 to 2019 (Table 13.18). Total domestic overnight tourism expenditure decreased by -10 % over the same period. It is clear that Ayrshire and Arran is more dependent on its Scottish domestic visitors as they make up more than half of the visitors (405,000) visiting every year.

Table 13.18 – UK tourists to Ayrshire by country of residence 2016 – 2019

	Visitors (annual average)			Domestic Tourism Expenditure (%)		
	Ayrshire and Arran (000s) (2017-2019)	Scotland (2019) (000s)	Ayrshire and Arran % change 2016-18/2017-19	Ayrshire and Arran (%)	Scotland (%)	Ayrshire and Arran % change 2016-18/2017-19
Scotland	405	7,692	1%	53%	44	-5 %
Rest of Great Britain	256	6,119	0%	47%	56	-16 %
Total (m)	0.66	13.81	1%	£139	£3,200	-10 %

Note – Rest of Great Britain includes England and Wales
Source – VisitScotland Ayrshire and Arran Factsheet (2019)[41] and Key Facts on Tourism in Scotland (2019)[42]

Overseas Trips and Expenditure

13.6.19 The top five overseas markets between 2017-2019 for Ayrshire and Arran was USA, Germany, Canada, Australia and France[43], however overall, Europe accounts for the majority of overseas visitors (37,000) ahead of North America (27,000) (Table 13.19). In addition, the number of visitors has decreased in North America (-13 %) and Europe (-8 %) between 2016-2019 with a rise seen in visits from the rest of world (13 %).

13.6.20 Overseas tourism expenditure has decreased by 9 % between 2016 and 2019 with the highest reduction from North America (-12 %).

Table 13.19 – Overseas trips and expenditure by country of residence (Ayrshire and Arran) 2016 – 2019

	Visits			Expenditure		
	Ayrshire and Arran 2017-2019 Average (000s)	Ayrshire and Arran % Change 2016-18/2017-19	Scotland 2019 (000s)	Ayrshire and Arran Average 2017-2019 (£m)	Ayrshire and Arran % change 2016-18/2017-19	Scotland 2019 (£m)
Europe	37	-8 %	1122	16	-6 %	623
North America	27	-13 %	125	18	-12 %	92
Rest of World	18	13 %	2213	15	-10 %	1823
Total (in m)	0.08	-7 %	3.46	£50	-9 %	£2538

Source – VisitScotland Ayrshire and Arran Factsheet (2019)

[41]VisitScotland (2021) *Ayrshire and Arran Factsheet 2019.* [Online] Available from - Ayrshire and Arran Factsheet 2019 (visitscotland.org) [Accessed: 10/05/2022]
[42]VisitScotland (2020) *Key Facts on Tourism in Scotland 2019.* [Online] Available from - Key Facts on Tourism in Scotland 2019 (visitscotland.org) [Accessed: 10/05/2022]
[43]VisitScotland (2020) *Key Facts on Tourism in Scotland 2019.* [Online] Available from - Key Facts on Tourism in Scotland 2019 (visitscotland.org) [Accessed: 10/05/2022]

Total Trips

13.6.21 Ayrshire and Arran tourism profile is predominantly influenced by British travellers making up 89 % of all trips in 2017-2019. Domestic visitors also accounted for three quarters of all overnight spend in Ayrshire and Arran over the same period.

Day Trips

13.6.22 The analysis above relates to visitors who are staying one or more nights in an area. It does not take account of the number and value of day trip visitors. It is stated in Ayrshire and Arran 2012/17 Tourism Strategy[44] publication that the vast majority of visitors are from domestic markets, with 62 % of people coming as day visitors, 33 % domestic tourists, and 5 % overseas tourists. However, both day visitors and domestic tourists tend to have a low spend compared to international tourists.

Purpose of Trip

13.6.23 Table 13.20 details the purpose of both overseas and Great British trips to Ayrshire and Arran. Most domestic and overseas tourists visit Ayrshire and Arran for a holiday. In terms of UK trips, Ayrshire and Arran have a proportionally greater number of holiday visitors than the Scottish average.

13.6.24 Compared to the Scottish average, a notable percentage of overseas tourists are visiting friends or relatives. There are relatively few business trips, either domestic or overseas in Ayrshire and Arran.

Table 13.20 – Purpose of travel 2017 – 2019

	Overseas (%)		GB Trips (%)	
	Ayrshire and Arran Average (2017-2019)	Scotland 2019	Ayrshire and Arran Average (2017-2019)	Scotland 2019
Holiday	58	61	66	56
VFR	34	25	26	29
Business	7	11	6	13
Other	1	3	2	2

Note – VFR = Visiting friends or relatives
Source – VisitScotland Ayrshire and Arran Factsheet (2019) and Key Facts on Tourism in Scotland (2019)

Accommodation

13.6.25 Using VisitScotland[45], an accommodation search for both East Ayrshire and South Ayrshire detailed 225 accommodation providers with the majority (185) being in the region of South Ayrshire. A total of 65 providers were located within 15 km of the Proposed Development (Table 13.21).

Table 13.21 – Accommodation providers within 15 km of the Proposed Development

Accommodation	Type	Location	Number of Bedrooms	Approx. Distance from Proposed Development
Barwheys	Self – Catering	Maybole	8	6.4 km NW
Crawfordston Cottage	Self – Catering	Maybole	1	5.8 km NW
Culzean Castle Camping and Caravanning Club Site	Touring Park	Maybole	-	14.8 km W
The Ranch Holiday Park	Touring Park	Maybole	-	10.8 km W
Ayrshire Loft & Cottages (8) At Cloncaird Castle	Self - Catering	Kirkmichael	1- 3	3.3 km W
Riverview Country Apartment	Self- Catering	Waterside by Patna	3	0.1 km E
Blairquhan Cottages (8)	Self Catering	Straiton	2-4	3.4 km W
Blairquhan Castle	Hotel	Straiton	15	3.4 km W
Glenlinn Cottage	Self - Catering	Straiton	3	4 km SW
No. 36	Self – Catering	Straiton	3	2.1 km SW
Holly Tree Cottage	Self Catering	Straiton	2	2.1 km SW
The Walled Garden Caravan Park	Caravan and Camping Park	Crosshill	-	9.1 km SW
Sundrum Castle Holiday Park	Holiday Park	Sundrum, by Ayr	-	11.9 km N
Enterkine House Hotel and Woodland Lodge	Hotel	Annbank	6	14.9 km N
Swan Bothy and Cob Cottage	Self – Catering	Ayr	2-3	9 km N
Afton Villa	B&B	Ayr	3	14.9 km NNW
Ayr Craigie Gardens Caravan and Motorhome Club site	Touring Park	Ayr	-	14 km NNW

[44]Ayrshire and Arran *2012/2017 Tourism Strategy.* [Online] Available from - Ayrshire and Arran Tourism Strategy (east-ayrshire.gov.uk) [Accessed: 10/05/2022]

[45]VisitScotland *Accommodation provider search.* [Online] Available from - Search results | VisitScotland[Accessed: 10/05/2022]

Western House Hotel	Hotel	Ayr	49	14.3 km NNW
Coorie Nook	Self – Catering	Ayr	3	13 km NNW
A'Turas-Mara Guest House	Guest House	Ayr	3	13.7 km NNW
Garden Apartment	Self- Catering	Ayr	2	14.8 km NNW
Daviot House	B&B	Ayr	6	14.9 km NNW
Ayr Holiday Apartments (3)	Self-Catering	Ayr	1-2	14.7 km NNW
10A Barns Street	Self - Catering	Ayr	4	14.5 km NNW
Citadel Apartments	Self- Catering	Ayr	3	14.5 km NNW
The Townhouse Apartments	Self – Catering	Ayr	3	14.5 km NNW
Mercure Ayr Hotel	Hotel	Ayr	118	14.6 km NNW
Fox Hollow	Self – Catering	Ayr	3	14.5 km NNW
No. 7 Barns Terrace	Self – Catering	Ayr	4	14.5 km NNW
Duke of Wellington Apartment	Self – Catering	Ayr	2	14.5 km NNW
Barns Services Accommodation	B&B	Ayr	3	14.5 km NNW
Miller House	Guesthouse	Ayr	2	14.5 km NNW
Fairfield House Hotel	Hotel	Ayr	44	14.5 km NNW
5A Park Circus Apartments (2)	Self – Catering	Ayr	3-4	14.3 km NNW
Harbour Heaven	Serviced Apartments	Ayr	2	14.3 km NNW
Hotel Kylestrome	Hotel	Ayr	13	14.3 km NNW
Lochinver Guest House	Guest House	Ayr	7	14.3 km NNW
Savoy Park Hotel	Hotel	Ayr	15	14.2 km NNW
Grange View	B&B	Ayr	3	13.9km NNW
Woodcroft Cottage	Self – Catering	Ayr	2	13.9 km NNW
Blackburn Villa	B&B	Ayr	4	14 km NNW
Dairy and Stable Cottage	Self – Catering	Ayr	1-2	13.7 km NNW
Church Cottage	Self – Catering	Ayr	2	13.6 km NNW
Newfield Mews	Self – Catering	Ayr	2	13.9 km NNW
Gartferry Apartments	Self – Catering	Ayr	2	13.8 km NNW
Chestnuts Hotel	Hotel	Ayr	14	13.8 km NNW
Coorie Nook	Self – Catering	Ayr	3	13.1 km NNW
Sherwood Bed and Breakfast	B&B	Ayr	2	12.8 km NW
Abbots Way	Self – Catering	Ayr	3	13 km NW
Bright and Beautiful	Self – Catering	Ayr	3	13 km NW
Doonbank Cottage Bothy	Self – Catering	Ayr	1	12 km NW
Brig O'Doon House Hotel	Hotel	Ayr	5	11.4 km NW
Ayrs and Graces	B&B	Ayr	3	10.6 km NW
Craig Tara Holiday Park	Holiday Park	Ayr	-	13.9 km NW
Craig Tara Deluxe Caravan Holidays	Caravan Holiday Home	Ayr	-	13.2 km NW
Heads of Ayr Holiday Park	Holiday Park	Ayr	-	13.6 km NW
Carrick Hills Cosy Croft	Self – Catering	Ayr	2	13.2 km NW
Turnberry 4 Self Catering Cottage	Self – Catering	Dailly	4	14.4 km SW
Savita Cottage	Self – Catering	Dailly	3	14.4 km SW
Brunston Castle	Self – Catering	Dailly	2	14.4 km SW
Loch Doon Caravan and Camping Park	Touring Park	Dalmellington	-	7.2 km SE
Craigengillan Stables	Glamping	Dalmellington	-	5.5 km SE
Stables Holiday Cottage	Self – Catering	New Cumnock	2	10.6 km E
Ben Nith	Self – Catering	New Cumnock	2	14.2 km E
The Old School Dalleagles B&B	B&B	New Cumnock	5	14.6 km E

13.6.26 It is clear, that in the immediate vicinity of the Proposed Development, the majority of accommodation providers are Self – Catering Cottages or Apartments. In addition, a large number of accommodation providers (43) are located in Ayr where there is a wider range of accommodation types including Self- Catering, Hotel, B&Bs/Guesthouse, Serviced Apartments and Holiday Parks. It is also interesting to note the scale of bed spaces is limited which suggests the local area may be seen as more of a day visit destination than an overnight visit location.

13.6.27 Table 13.22 shows the accommodation providers by location and type.

Table 13.22 – Accommodation providers by location and type

	Hotels	Guest House/B&Bs	Self - Catered	Camping and Caravan Sites	Total
Maybole			2	2	4
Kirkmichael			1		1
Waterside by Patna			1		1
Straiton	1		3	1	5
Crosshill				1	1
Sundrum				1	1
Annbank	1				1
Ayr	7	10	22	4	43
Dailly			3		3

Dalmellington				2	2
New Cumnock		1	2		3
Total	9	11	35	10	65

13.6.28 Furthermore, Self-Catered accommodation is most common (35) in contrast to the smaller number of hotels in the surrounding area (9). This confirms that East and South Ayrshire is a place for family holidays, activity holidays and short breaks.

13.6.29 In Ayrshire and Arran, most domestic tourists chose to stay in a hotel or self – catering accommodation (Table 13.23). However, the average annual occupancy for hotels in Ayrshire (28%) is lower than the national average (41 %) whereas occupancy rates for camping (10 %) in the area are higher than the national average (6 %).

Table 13.23 – Accommodation used in 2015 and 2016

	UK Trips	
	Ayrshire and Arran	Scotland
Hotel	28	41
Self-catering	22	22
B&B / Guest House /Restaurant with Rooms	17	20
Friends/Family	16	19
Touring caravan / motorhome	10	-
Camping	10	6

Source – VisitScotland Scotland Visitor Survey (2015 & 2016) – Ayrshire and Arran [46]

Occupancy

13.6.30 As would be expected, occupancy rates are highest during the main holiday season, with occupancy rates for hotels tending to be higher in springtime rather than the autumn months (Table 13.24).

13.6.31 Average annual occupancy for hotels, self – catering accommodation and hostels were slightly higher than the national average, while occupancy rates for guesthouses were lower.

Table 3.24 – Occupancy in Ayrshire and Arran, 2019

	Hotel (%)	Guest House (%)	Self Catering (%)	Hostel (%)
Winter	56	2	40	37
Spring	78	27	44	36
Summer	83	55	61	62
Autumn	75	25	62	41.5
Average for region	73	34	51	47
Annual average for all of Scotland	71	50	48	41

Source – VisitScotland Ayrshire and Arran Factsheet (2019)

Cultural Heritage Tourism

13.6.32 In terms of cultural heritage tourism, the Cultural Heritage Assessment (see Chapter 6 of this EIAR) identified one Conservation Area, three Scheduled Monuments, one Category A Listed Building, three Category B Listed Buildings and two Category C Listed Buildings within the Inner Study Area (ISA) which included the Proposed Development Area and an area of 500 m surrounding it. The Outer Study Area (OSA) includes from the Proposed Development Area boundary to a radius of 10 km for heritage assets of national importance and 5 km for heritage assets of regional importance. Within the OSA, there were no inventoried Battlefields, Properties in Care or World Heritage Sites identified and six Conservation Areas, four inventorised Gardens and Designed Landscapes, twelve Scheduled Monuments and eight Category A listed Buildings. Within 5 km, there were twelve Category B listed Buildings identified.

13.6.33 The majority of the heritage assets identified are not classed as tourism attractions and the sites that have been identified, have been assessed as being mainly of regional/local importance.

13.6.34 In addition, of the heritage assets identified, the assessed operational effects ranged between none and minor significance in EIA terms. Further details are discussed in Chapter 6 of this EIAR.

Tourism Baseline Summary

13.6.35 Across Ayrshire and Arran, the tourism sector is heavily reliant on the domestic market in terms of visitor numbers and expenditure with 89 % of all trips undertaken by British travellers in 2017-2019. However, total domestic overnight expenditure experienced a 10 % drop, which resulted from a decrease in both domestic and international spend.

13.6.36 Overall number of visitors between 2017 and 2019 made nearly 750,000 overnight trips per year to Ayrshire and Arran. In addition, the very slight increase in domestic visits – driven by Scottish residents – was sufficient to offset a 7 % drop in international travellers.

[46]VisitScotland *Scotland Visitor Survey 2015 & 2016.* [Online] Available from - Layout 1 (visitscotland.org) [Accessed: 10/05/2022]

13.6.37 The highest proportion of visitors to Ayrshire and Arran stayed in hotels with self – catering accommodation used by just over a fifth of visitors. In addition, visitors to Ayrshire and Arran were more likely to camp in contrast to the Scottish annual average.

13.6.38 There is in total 65 accommodation providers within 15 km radius from the Proposed Development with the majority being situated in and around Ayr. The majority of accommodation providers were self – catered accommodation (35) in contrast to the smaller number of hotels in the surrounding area (9).

13.6.39 The cultural heritage assets identified have been assessed as having none to minor significant impacts as a result of the Proposed Development therefore cultural heritage tourism is highly unlikely to experience a significant impact from the Proposed Development.

13.7 Assessment of Potential Effects

Development and Construction

13.7.1 This section assesses the potential economic effects from the Proposed Development, during the development and construction including direct employment, supplier effects and income effects (in terms of GVA impact).

13.7.2 The Proposed Development will also present job opportunities at a local, Scottish and UK level throughout the life cycle of the project; specific numbers are presented below.

13.7.3 In the development phase, along with other Scottish consultants listed in Table 1.3 of Chapter, Natural Power has been appointed as the lead EIA consultants. The EIA has been managed from its headquarters approximately 16.1 km from the Proposed Development in St John's Town of Dalry.

13.7.4 Should the Proposed Development be granted consent, employment opportunities will be available during the planning condition discharge stage and continue through to the construction phase, with opportunities for local contractors. Further positive supply chain impacts on local, Scottish and UK levels are also expected.

13.7.5 Should the Proposed Development be granted consent it is expected that there will be employment opportunities for managing the satisfaction of planning conditions requirements with Local Planning Authorities (LPA) and commissioning of relevant preconstruction surveys.

13.7.6 The following method for sourcing the direct economic effects during the development and construction phase is grounded on RenewableUK research[47], carried out by BiGGAR Economics, to discover the economic impacts of onshore wind.

13.7.7 Based on the research, the total cost of development per MW installed ranged from £11,000 to over £700,000. The weight average cost was £150,216 per MW installed. For the basis of this assessment, it has been assumed the RenewableUK estimate is appropriate, as it was based on a larger sample of existing projects which equates to a total development expenditure ('devex') for the Proposed Development (54 MW) of £8,111,664 (£8.1 million).

13.7.8 The RenewableUK research estimated the average construction cost per MW to be around £1,318,875 (£1.32 million), however, this rate varies between ±15 % depending on the precise nature of each development. Similarly, to cost of the development estimate, it has been assumed the RenewableUK estimate of £1.32 million per MW is appropriate which equates to a total construction expenditure ('capex') in the region of £71,219,250 (£71.2 million) for the 54 MW development.

13.7.9 The RenewableUK research has previously given indication for how these total expenditures would be apportioned geographically, finding that on average the majority, 98 %, of devex spend is in the UK, including 13 % spent in the local area and 59 % spent at a regional level (i.e. Scottish). On average, 47 % of capex was spent in the UK, 36 % at the regional (i.e. Scottish) level and 12 % at the local level. These figures can be extrapolated for the Proposed Development using the total devex (£8.1. million) and capex (£71.2 million) estimates for the Proposed Development.

13.7.10 Table 13.25 summarises the development and construction costs across each area.

Table 13.25 – Development and construction costs

Spatial Area	% of Total Development Spend	£ Equivalent per annum (Development)	% of Total Construction Spend	£ Equivalent per annum (Construction)
Local	13 %	£1,054,516	12 %	£8,546,310
Scotland**	59 %	£4,785,882	36 %	£25,638,930
UK*	98 %	£7,949,431	47 %	£33,473,048

Note – Excludes non-UK devex (2%) and non-UK capex (53%). *the figures for UK include the Scottish values. **the figures for Scotland include the local values.

[47] RenewableUK (2012) *Onshore Wind: Direct & Wider Economic Impacts.* [Online] Available from - Microsoft Word - SB - Report Onshore Wind Direct & Wider Economic Impacts 26apr12 Amends & comments - SB (publishing.service.gov.uk) [Accessed 20/05/2022]

13.7.11 The contract data from RenewableUK's case study research assessment has been combined with turnover per employee data and ratio of GVA to turnover for relevant industries (Table 13.26). These tables also show the breakdown of development and construction costs into each of the main components of the work, based on the case study data.

Table 13.26 – GVA and employment ratios (Development Phase)

Indicator	Turnover per Employee (£)	GVA / Turnover
Project Development	£120,965	0.569
Legal and Financial	£87,041	0.777
Environmental Impact Assessment	£101,102	0.653
Development Total	£103,036	0.666

Source – RenewableUK/BiGGAR Economics Table 2. Data taken from ONS Annual Business Survey 2013,2014

13.7.12 Table 13.27 shows that the turbine contracts for manufacture, assembly and transport account for the majority of the value of the construction contracts, accounting for 64.4 %. The balance of plant contracts account for 28.6 % and the grid connections account for 7.1 %. Therefore, the weighted average for construction shows there is one employee per £137,942 in turnover and a GVA/Turnover rate of 0.432.

Table 13.27 – GVA and employment ratios (Construction Phase)

Indicator	Turnover per Employee (£)	GVA / Turnover
Balance of Plant Contract	150,194	0.458
Turbine Contract	129,672	0.422
Grid Connections Contract	163,802	0.419
Total Construction	137,942	0.432

Source – RenewableUK/BiGGAR Economics Table 6: Data taken from ONS Annual Business Survey 2013, 2014

13.7.13 Applying the assumptions set out in Tables 13.26 and 13.27 above, GVA and Employment Ratios provides an estimate on the level of employment at the local, Scottish and UK level.

13.7.14 At the development phase, the level of employment at the Scottish level for the Proposed Development (54 MW) is estimated to be around 46.45 jobs, contributing £3.2 million in GVA (see Table 13.28). At the construction phase, the Proposed Development could sustain 185.87 jobs, contributing £11.1 million in GVA (see Table 13.29).

13.7.15 At the local level, the development phase of the Proposed Development could sustain up to 10.23 jobs and contribute £702,307 in GVA (see Table 13.28). In the construction phase, the Proposed Development could sustain up to 61.96 jobs and contribute £3.7 million in GVA (see Table 13.29).

Table 13.28 – Economic impact of the Proposed Development (Development Phase)

Spatial Area	Jobs	GVA (£)	Turnover (£)
Local	10.23	£702,307	£1,054,516
Scotland	46.45	£3,187,397	£4,785,882
UK	77.15	£5,294,321	£7,949,431

Table 13.29 – Economic impact of the Proposed Development (Construction Phase)

Spatial Area	Jobs	GVA (£)	Turnover (£)
Local	61.96	£3,692,006	£8,546,310
Scotland	185.87	£11,076,018	£25,638,930
UK	242.66	£14,460,357	£33,473,048

13.7.16 Although construction impacts are usually one-off in nature, they will be lasting up to 24 months and therefore will have a meaningful benefit to the local economy. The forecasted scale of employment and GVA impact during the construction phase can be seen as having a positive effect on both the local and Scottish economies. It is also expected that during the construction phase there will be positive impacts on the local hospitality sector with construction site workers residing in accommodation locally to the Proposed Development, using local shopping and catering facilities etc.

13.7.17 The supply chain, or indirect impacts are also likely to benefit from the Proposed Development as construction activity typically has strong beneficial cascading effects with other sectors such as, building, manufacturing etc and therefore lead to job creation elsewhere in the local economy.

13.7.18 The temporary employment supported by the construction and development of the Proposed Development may be a noticeable change in the East Ayrshire and South Ayrshire economy, but not in any of the other study areas. Therefore, the magnitude of this impact was assessed as **low** in East Ayrshire and South Ayrshire and **negligible** everywhere else.

13.7.19 On this basis, the effect of spending on construction and development contracts was assessed as **minor** (beneficial) for East and South Ayrshire and **negligible** (beneficial) for the other areas.

Operations and Maintenance

13.7.20 This section analyses the potential economic effects during the operational and maintenance phase of the wind farm including direct employment, supplier effects and income effects (in terms of GVA impact). These effects will differ in their scale, duration and geographic coverage.

13.7.21 In the event of decommissioning, or replacement of the wind turbines, it is anticipated that the likelihood of socio-economic effects is similar to, or less than, that expected during construction. Decommissioning would be undertaken in line with best practice processes and methods at that time and will be managed through an agreed Construction Environmental Management Plan.

13.7.22 The method presented for sourcing the direct economic effects during the operational phase is grounded on the same RenewableUK research as described above.

13.7.23 According to the research, the annual cost of operations and maintenance per MW installed ranges from £23,000 to £130,000 per annum. The operations and maintenance costs are affected by the size of development, land contracts and whether turbines are still under warranty.

13.7.24 Applying values calculated from RenewableUK research, the estimated weighted average operational expenditure ('opex') for onshore wind is £59,867 per MW installed per annum. Therefore, using this estimate, the total opex for the Proposed Development (54 MW) is approximately £3,232,818 (£3.2 million).

13.7.25 The RenewableUK research has previously given indication for how this total cost would be apportioned geographically. The vast majority, 87 %, of the operation and maintenance spend is within the UK, including 42 % spent in the local area and 58 % spent at a Scottish level.

13.7.26 Table 13.30 summarises the operation and maintenance costs across each spatial level based on the total opex, £3.2 million, calculated for the Proposed Development.

Table 13.30 – Operational and maintenance costs per annum

Spatial Area	% of Spend	£ Equivalent per annum
Local	42 %	£1,357,784
Scotland	58 %	£1,875,034
UK	87 %	£2,812,552

Note – Excludes non-UK operation related expenditure (13%)

13.7.27 The contract data from the case study assessment (i.e. turnover data) has been combined with turnover per employee data and ratio of GVA to turnover for relevant industries (Table 13.31). This table also shows the breakdown of operation and maintenance costs into each of the main components of work, based on the case study data.

Table 13.31 – GVA and employment ratios

	Turnover per employee (£)	GVA / Turnover	% of Spend
Turbine Maintenance	£154,923	0.364	31 %
Site Maintenance	£109,844	0.440	6 %
Operational Management	£122,500	0.584	11 %
Land Agreements	£49,744	0.360	14 %
Habitat Management costs	£83,600	0.337	0 %
Non-domestic rates (business rates)	n/a	0.500	6 %
Community Benefit	£47,967	0.342	7 %
Other (Average)	£86,741	0.418	24 %
Operational and Maintenance Total	£121,935	0.430	100 %

Source – RenewableUK/BiGGAR Economics Table 9. Data taken from ONS Annual Business Inquiry 2010

13.7.28 Applying the assumptions from RenewableUK, set out in Table 13.31 above, provides an estimate on the level of employment at the operational phase for local, Scottish and UK levels.

13.7.29 This gives the level of employment at the Scottish level for the operational phase of the Proposed Development as approximately 15.38 jobs, contributing £806,265 in GVA. At the local level, the operational phase of the Proposed Development is expected to sustain approximately 11.14 jobs, contributing £583,847 in GVA (Table 13.32).

Table 13.32 – Economic impact of the Proposed Development (Operational and Maintenance)

Spatial Area	% of Spend	£ Equivalent per annum
Local	42 %	£1,357,784
Scotland	58 %	£1,875,034
UK	87 %	£2,812,552

13.7.30 The forecasted scale of employment and GVA impact during the operational phase can be seen as having a positive effect on both the local and Scottish economies.

13.7.31 The magnitude of potential operational effects was assessed as **low** with respect to the economies of East Ayrshire and South Ayrshire and Scotland as a whole.

13.7.32 In this way, the effect of expenditure on operations and maintenance contracts was assessed as **negligible** (beneficial) with respect to East and South Ayrshire economies and **negligible** (beneficial) with reference to the Scottish economy as a whole.

Tourism and Recreation

Literature Review

13.7.33 A growing body of research regarding the opinions of tourists towards wind farms exists. Extracts from the key findings and the potential impact of the Proposed Development are summarised below. Overall, this research tends to support the premise that wind farm development has not resulted in a serious negative economic impact on tourism and could even have wider positive impacts.

Economic impacts of wind farms on Scottish tourism: research findings (Scottish Government, 2008)

13.7.34 Research from Scottish Government[48] has suggested that wind farms have a minor impact on visitor activity with evidence detailing 93-99 % of tourists that has seen a wind farm in the local area suggested that the experience would not have any effect on their decision to return to that area, or to Scotland as a whole. Furthermore, 48 % of visitors were positive regarding the statement 'I like to see wind farms' with a further 24 % neutral, resulting in a minority of 28 % of tourists preferring landscapes without wind farms.

VisitScotland Wind Farm Consumer Research (2011)[49]

13.7.35 Key findings from this research found 83 % of Scotland respondents (80 % of UK) stated their decision to holiday in the UK would not be affected by the presence of a wind farm. A further 80 % of Scotland respondents (81 % of UK) either disagreed, or neither agreed nor disagreed, that wind farms spoil the look of the Scottish countryside.

13.7.36 Overall, the research suggests that, at the current time, the overwhelming majority of consumers do not feel wind farms spoil the look of the countryside.

Wind Farms and Tourism Trends in Scotland (BiGGAR Economics,2017)

13.7.37 In 2017, BiGGAR Eocnomics undertook an analysis examining the relationship between wind farm developments and tourism. The study looked at wind farms constructed between 2009 and 2015 and tourism at the national, regional and local level during the same period.

13.7.38 Analysis found that during this time period, the number of wind farms increased across Scotland, and in almost all local authority areas, while employment in sustainable tourism also grew substantially. The analysis also found no correlation between tourism employment and the number of turbines at the national or local authority area.

13.7.39 In addition, no link was found between the development of a wind farm and tourism related employment. In 21 out of the 28 areas considered, employment in sustainable tourism grew. In 22 out of the areas, employment either grew faster or decreased less than the rate for the relevant local authority area as a whole.

13.7.40 Overall, the conclusion of this study found no relationship between the development of onshore wind farms and tourism employment at the level of Scottish economy, at the local authority level or in the areas immediately surrounding the wind farm development.

Wind Farms & Tourism Trends in Scotland: Evidence from 44 Wind Farms (BiGGAR Economics, 2021)

13.7.41 The most recent research on the economic impact of wind farms on tourism was published by BiGGAR Economics in 2021[50]. The study was carried out to find empirical evidence of a relationship between the development of onshore wind farms and the tourism sector in Scotland.

13.7.42 The analysis of trends at the local authority area found no relationship between the growth in the number of wind turbines and the level of tourism employment. In addition, the analysis considered the possibility of more local effects, through examining tourism-related employment in the immediate vicinity of 16 wind farms. This analysis found that in the majority of cases, tourism-related employment in the vicinity of wind farms had outperformed the trend for Scotland as a whole and for the local authority area in which the wind farm was based.

[48] Scottish Government (2008) *Economic impacts of wind farms on Scottish tourism: research findings.* [Online] Available from - Economic impacts of wind farms on Scottish tourism: research findings - gov.scot (www.gov.scot) [Accessed 24/05/22]
[49] VisitScotland (2011) *Wind Farm Consumer Research.* [Online] Available from - RES-CD-TOU-006.pdf (ascogfarm.com) [Accessed 24/05/22]
[50] BiGGAR Economics. (2021) *Wind Farms & Tourism Trends in Scotland: Evidence from 44 Wind Farms.* [Online] Available from - https://biggareconomics.co.uk/wp-content/uploads/2021/11/BiGGAR-Economics-Wind-Farms-and-Tourism-2021.pdf. [Accessed: 13/04/2022]

13.7.43 Overall, from the analysis of 44 wind farm case studies in Scotland, the research has provided a substantial evidence base to determine that there was no relationship between wind farm development and trends in tourism employment at the level of the Scottish economy, across local authority areas nor in the locality of wind farm sites.

Public Attitudes Tracker: Energy Infrastructure and Energy Sources (Department for Business, Energy & Industrial Strategy (BEIS), 2021)

13.7.44 A national tracker survey[51] outlined that support for renewable energy has been consistently high, with 87 % expressing support for the use of renewables, whilst opposition to renewables was very low at 1 %. And more specifically, the national tracker found that 90 % support onshore wind, with only 4 % opposing it.

Local Attractions

13.7.45 The top free visitor attraction within 15km is Maclaurin Galleries. Maclaurin Galleries is set within the grounds of Rozelle Park (another top tourist attraction), and contains a wide range of works from local, national and internationally acclaimed artists (high sensitivity). Macluarin Galleries is not located within immediate proximity to the Proposed Development (12 km NW) and therefore is considered highly unlikely that the Proposed Development will lead to a change in visitor behaviour (negligible magnitude). Therefore, the effect has been assessed as **negligible.**

13.7.46 Robert Burns Birthplace Museum is the top paid visitor attraction within 15 km of the Proposed Development (high sensitivity). It offers tourists the experience to visit the humble cottage where Robert Burns was born and spent the first years of his life. There is also a café located at the site. The attraction is not located within immediate proximity to the Proposed Development (11.5 km NW) and therefore is considered highly unlikely that the Proposed Development will lead to a change in visitor behaviour (negligible magnitude). Therefore, the effect has been assessed as **negligible**.

13.7.47 The Doon Valley Railway is situated in Waterside by Patna. It is run by volunteers who preserve the unique history of industrial steam and diesel locomotives and where the relics are restored. There is also a café on site. It is understood that this attraction does not have a substantial number of visitors and as such it is likely to be of mainly local importance (low sensitivity). It is also unlikely that the key features (such as local heritage) will be adversely affected and therefore the magnitude has been assessed as low. Therefore, the effect has been assessed as **negligible**.

13.7.48 The Scottish Dark Sky Observatory occupies a hilltop site on the Galloway Forest Dark Sky Park border located 5.8 km SE from the Proposed Development. It is equipped with two large telescopes and runs a full program of stargazing events throughout the year. As the tourist attraction does not list in the top 10 (rated by VisitScotland) for Ayrshire and Arran, it implies it does not attract a wide range of visitors however it is an important local attraction (low sensitivity). Currently, it is in a state of disrepair after being completely destroyed by a fire outbreak in Summer 2021 and therefore will not be receiving any visitors for the foreseeable future therefore the magnitude has been assessed as low. The effect has therefore been assessed as **negligible**.

13.7.49 Galloway Forest Park, located in Dumfries and Galloway is the largest Forest Park in Britain, with over 300 square miles of outstanding natural beauty. This is one of Scotland's national parks and is considered to be of high sensitivity. Given its substantial size, covering much of Dumfries and Galloway and the lack of visitor centres within 15 km of the Proposed Development, it is considered highly unlikely that the Proposed Development will lead to a change in visitor behaviour (negligible magnitude). Therefore, the effect has been assessed as **negligible.**

13.7.50 Loch Doon Castle (8.7 km SE of Proposed Development) is situated near Dalmellington along the shores of Loch Doon. The castle was built in the late 1200s and after being taken down, stone by stone was re-erected on its present spot in 1935. Currently, there is no visitor access to the site as high-level masonry inspections are taking place. It is understood that this attraction does not have a substantial number of visitors and as such it is likely to be of mainly local importance (low sensitivity). It is also unlikely that the key features (such as local heritage) will be adversely affected and therefore the magnitude has been assessed as low. Therefore, the effect has been assessed as **negligible**.

13.7.51 Crossraguel Abbey (11.6 km west of Proposed Development) was founded in the early 1200s. It is understood that this attraction does not have a substantial number of visitors and as such it is likely to be of mainly local importance (low sensitivity). Furthermore, the Abbey is currently undergoing high level masonry inspections and therefore there is no visitor access to the site. It is also unlikely that the key features (such as local heritage) will be adversely affected and therefore the

[51] Department for Business, Energy & Industrial Strategy. (2021) *BEIS Public Attitudes Tracker: Energy Infrastructure and Energy Sources, Autumn 2021, UK* [Online] Available from – BEIS PAT Autumn 2021 Energy Infrastructure and Energy Sources (publishing.service.gov.uk) [Accessed 24/05/22]

magnitude has been assessed as low. Therefore, the effect has been assessed as **negligible**.

Accommodation

13.7.52 The VisitScotland search concluded three accommodation providers within the local area of the Proposed Development (1 - 3 km). The closest accommodation provider being Riverview Country Apartment (self-catering) situated 0.1 km East of the Proposed Development and a further two self – catering providers in Straiton (2.1 km south west) which suggests mainly local economic importance (low sensitivity). The rural location, quality of views and proximity to attractions such as walking routes, the Dark Sky Observatory and Doon Valley Railway are considered key features. Therefore, the magnitude has been assessed as medium. Therefore, the effect has been assessed as **minor.**

13.7.53 Similarly, 3.3 km to the west of the Proposed Development, near Kirkmichael, one self- catered accommodation provider is located, Ayrshire Loft & Cottages at Cloncaird Castle, which is assessed as mainly local/regional importance (medium sensitivity). This accommodation provider contains eight individual cottages within the grounds of the castle. The castle is privately owned and not open to the public as a visitor attraction. The quality of service, rural location, walking/cycling routes, and proximity to Galloway Forest Park are considered key features. Therefore, the magnitude has been assessed as low. Therefore, the effect has been assessed as **minor**.

13.7.54 There are an additional three accommodation providers situated in Straiton. Blairquhan Castle hotel and associated self-catering cottages 3.4 km west and another self-catering cottage 4km south west of the Proposed Development, which are assessed as local/regional importance (medium sensitivity). The quality of service, rural location and proximity to attractions such as walking/cycling routes, Doon Valley Railway and the Dark Sky Observatory are key features. Therefore, the magnitude has been assessed as low. Therefore, the effect has been assessed as **minor**.

13.7.55 There are two accommodation providers in Dalmellington, 5.5 km – 7.2 km south east of the Proposed Development, Loch Doon Caravan and Camping Park and Craigengillan Stables (glamping) and are likely to be of mainly local economic importance (low sensitivity). The rural location, views and walking/cycling trails, the Dark Sky Observatory and Galloway Forest Park are considered key features. Therefore, the magnitude has been assessed as medium. The effect has therefore been assessed as **minor**.

13.7.56 There are three accommodation providers north west/west in Maybole, between 5.8 - 14.8 km from the Proposed Development. The closest accommodation providers are two self – catering cottages and two touring parks situated furthest away. The two self-catering accommodation providers and touring parks are likely to be of mainly local economic importance (low sensitivity). The rural location, walking/cycling trails and proximity to Robert Burns Birthplace Museum are considered key features. It is not expected that these will be significantly affected, therefore, the magnitude has been assessed as low. The effect has been assessed as **negligible**. In addition, the touring parks are at a substantial distance from the Proposed Development that impacts are unlikely (negligible magnitude). Therefore, the effect has been assessed as **negligible.**

13.7.57 A large number of accommodation providers are situated in and around Ayr between 9 – 14.9 km north to north west from the Proposed Development with the majority situated beyond 10 km. A variety of providers including self- catered, B&B, Touring/Holiday Park, Hotel, Guest House and Serviced Apartments however, the majority of the providers are self – catered accommodation. These are assessed as having local/regional importance (medium sensitivity) however due to the substantial distance from the Proposed Development, impacts are unlikely (negligible magnitude). Therefore, the effect has been assessed as **negligible.**

13.7.58 There is a Walled Garden Caravan Park located in Crosshill, 9.1 km south west of the Proposed Development, likely to be of mainly local economic importance (low sensitivity). The key features include the rural location, walk/cycling trails and Crossraguel Abbey. There is a substantial distance between the accommodation provider and the Proposed Development therefore impacts are unlikely (negligible magnitude). Therefore, the effect has been assessed as **negligible**.

13.7.59 Two self-catering and a B&B are situated in New Cumnock, between 10.6 – 14.6 km east of the Proposed Development, likely to be of mainly local importance (low sensitivity). In addition, due to the substantial distance from the Proposed Development, impacts are unlikely to be experienced (negligible magnitude). Therefore, the effect has been assessed as **negligible**.

13.7.60 Sundrum Castle Holiday Park is situated in Sundrum, by Ayr 11.9 km north of the Proposed Development, likely to be of mainly local importance (low sensitivity). Due to the substantial distance from the Proposed Development, impacts are unlikely to be experienced (negligible magnitude). Therefore, the effect has been assessed as **negligible.**

13.7.61 Three self-catered accommodations are located in Dailly, 14.4 km south west of the Proposed Development, likely to be of mainly local importance (low sensitivity). Due to the substantial distance from the Proposed Development, impacts are unlikely to be experienced (negligible magnitude). Therefore, the effect has been assessed as **negligible**.

13.7.62 Enterkine House Hotel and Woodland Lodge, Annebank is situated 14.9 km north of the Proposed Development which is likely to be of local importance (low sensitivity). Due to the substantial distance from the Proposed Development, impacts are unlikely to be experienced (negligible magnitude). Therefore, the effect has been assessed as **negligible**.

Recreational Paths and Trails

Construction

13.7.63 Recreational paths and trails have been identified within 15 km of the Proposed Development and the potential reduction in recreational amenity has been assessed. There are a number of potential ways that the Proposed Development could affect trails, including through reduced amenity associated with landscape and visual impacts and through reduced access. Reduced access to amenity is particularly important in the context of areas that have limited access to recreational amenities, such as walking. It is important to highlight that any construction noise will be temporary in nature as either the visitor will be moving through the landscape away from the Proposed Development, or the construction noise will be short-lived.

13.7.64 Core path 7 Patna to Straiton is the closest receptor likely to be impacted by construction noise. The core path is 5 miles long (8 km) and is classified as a moderate/hard trail. The path runs south west from Patna mainly on forestry roads and unmade paths via Sclenteuch Moor to the border with South Ayrshire and is considered to be of high sensitivity. The path passes through the Proposed Development Area for approximately 1 km on the western side and is approximately 520 m from the nearest turbine. Disruption is expected during the construction phase, though it is likely that the path will still be accessible. On this basis, the magnitude has been assessed as medium. Therefore, the effect has been assessed as **moderate and temporary**.

Operation

13.7.65 Core path 7 Patna to Straiton passes through the Proposed Development Area and is considered to be of high sensitivity. The magnitude of impact is likely to be medium and the effect **moderate** for locations where turbines are clearly visible along the pathand **minor** for other locations along the path.

13.7.66 Multiple core paths around Straiton approximately 2.2 km south west of Proposed Development at their closest point and are considered to be of high sensitivity. Therefore, the magnitude has been assessed as medium. The effect has been assessed as **moderate** for locations where the turbines are clearly visible along the path and **minor** for other locations.

13.7.67 Core paths within the Doon Valley are considered to be of high sensitivity. Therefore, the magnitude has been assessed as medium. The effect has been assessed as **moderate** for locations where the turbines are clearly visible along the path and **minor** for other locations.

13.7.68 The A713 runs along the eastern side of the Proposed Development Area boundary at its closest point through Waterside. It forms part of the Galloway Tourist Route which is 92 miles in length starting from Gretna to Ayr. It is has been assessed to be of medium sensitivity. Due to its close proximity to the Proposed Development, the magnitude has been assessed as medium and therefore the effect has been assessed as **moderate**.

13.7.69 National Cycle Route 7 passes approximately 6.3 km to the west of the Proposed Development at its closest point. The sections of Route 7 amount to 547.2 miles long and a section passes from Carlisle to Glasgow via the Ayrshire coast. It is assessed as high sensitivity within the LVIA however due to the substantial distance from the Proposed Development, the magnitude has been assessed as low. Therefore, the effect has been assessed as **minor**.

13.7.70 Hill routes in the Southern Uplands pass to the south and east of the Proposed Development. Given the number of visitors, it is considered regionally important (high sensitivity). The Proposed Development will be visible at certain sections of the route, in particular on hill routes. However, the presence of the Proposed Development is considered unlikely to deter those walking the whole length of the walk, though a small number of people walking individual sections may choose to walk in a different area. It is unlikely to lead to a reduction in recreational access (low magnitude). Therefore, the effect would be **minor**.

Tourism and Recreation Impact Summary

13.7.71 There are not expected to be any significant effects on tourism or recreation assets in the surrounding area. For both accommodation and local attraction assessments, the effect was assessed to be either minor or negligible.

13.7.72 Several of the core paths around Straiton, Doon Valley and A713 (Galloway Tourist Route) have been assessed as having a moderate effect however this effect will only be experienced in short sections along the routes. The assessment does not consider

that these effects from the Proposed Development are sufficiently adverse enough to deter a significant number of visitors away from these particular assets and as such, the Proposed Development is not likely to have any detrimental significant impacts on visitor numbers or the visitor economy.

13.7.73 Any potential negative impacts on tourism are likely going to be far outweighed by the wider positive benefits for the local area and Scotland as a whole in terms of employment opportunities, enhanced access and investment into the area.

13.8 Do – nothing Scenario

13.8.1 In the absence of the Proposed Development, it is likely that the land would continue under the same land use. Felling of forestry would occur on Proposed Development at some stage and trees may or may not be replanted.

13.8.2 The potential economic benefits generated during the development, construction, operation and maintenance will not be delivered resulting in the loss of a total of 83 jobs and approximately £5 million GVA at a local level and 247 jobs and £15.1 million GVA in Scotland as a whole.

13.8.3 In addition, the enhanced access from the creation of trails and paths will be lost potentially impacting on the local activities within the surrounding area including walking, wildlife interests, sports and country pursuits.

13.8.4 In addition, the loss of enhanced access will reduce footfall within the local area from the loss routes and paths available to visitors and tourists. This could impact the tourism economy in which these council areas heavily rely on.

13.9 Mitigation and Potential Benefits

Environmental benefits provided by the Proposed Development

13.9.1 The Proposed Development has the generating capacity of up to 54 MW of renewable electricity, subject to final wind turbine procurement. Based on 6 MW wind turbines, the Proposed Development would produce sufficient electrical energy to satisfy the average annual requirements of approximately 6,796 homes[52].

Mitigation and potential community benefits

13.9.2 This section considers the mitigation and potential community benefits which could be employed to minimise any negative impacts and maximise potential positive impacts.

13.9.3 The assessment reveals no determinantal significant residual socio-economic impacts from the Proposed Development. Instead, the analysis shows that there will be significant employment related benefits associated with the Proposed Development.

13.9.4 In terms of tourism, as highlighted in the BiGGAR Report, wind farm development has not resulted in a serious negative economic impact on tourism, with even wider positive impacts being seen.

13.9.5 In addition to the existing connection between Straiton and Patna and existing forestry track (SKC11), the Applicant is offering to create a walking and nature trail called Keirs Glen Trail. This would include the creation of a circular walking trail, with car parking, biodiversity enhancements and information boards. This would create new routes for visitors, tourists and the local community to use for outdoor pursuits, exercise and wildlife interests.

13.9.6 Furthermore, the Applicant is engaging with local councils and communities for information on priority aims and projects in their area to provide a tailored local benefit package as part of the proposal.

13.9.7 The community fund is expected to be to be in line with the Scottish Government Good Practice Principles on Community Benefit.

13.10 Residual Effects

13.10.1 As a result of these enhancement and mitigation measures, the residual effect on the recreational trails will be negligible.

13.10.2 The disruption to the access for paths within the Proposed Development Area will be minimised through the Path Management Plan. This will reduce the magnitude of the effect to Low and therefore the significance of the effect to Minor.

13.10.3 The effect during the operational phase of the wind farm will also be negligible. The improved access will allow more people to access outdoor recreation and encourage new types of walkers to the area. The scale of this increased amenity is not known; however, it is assumed that this will be equivalent to any potentially decreased

[52] Based on the annual average homes consumption figures from BEIS – National Energy Efficiency Data-Framework (NEED) 2021; figures may vary depending on final number of turbines and model chosen.

amenity from current walkers due to the addition of the windfarm to the character of the paths. The magnitude of the effect has therefore been assessed as negligible. As a result, the significance of the effect has also been assessed as negligible.

13.11 Summary and Conclusions

Socio-economic

13.11.1 In terms of development and construction impact, of the £81.4 million wind farm development and construction value, there is potential for £9.6 million to benefit the local economy and £30.4 million to benefit the Scottish economy. Applying industry assumption provides an estimate on the level of development and construction employment at the Scottish level for the wind farm development as 232 jobs contributing £14.3 million in GVA. At the local level, the development and construction phase of the proposed development could sustain up to 72 jobs and contribute £4.4 million in GVA.

13.11.2 The operation and maintenance phase is also expected to generate economic impacts. Applying the data from the RenewableUK research to the Proposed Development (54 MW) provides an estimate of the turnover in the UK associated with the Proposed Development during the operations and maintenance stage, £2.8 million. Of this, £1.4 million could benefit the local economy and £1.9 million could be injected into the Scottish economy on an annual basis. Applying the industry assumptions gives the level of operational employment at the Scottish level for the Proposed Development as 15, contributing £806k GVA per annum. At the local level, the operation and maintenance phase of the Proposed Development is expected to sustain 11 jobs, contributing £584k in GVA per annum.

13.11.3 These direct economic benefits should be set against the challenging socio-economic conditions in East Ayrshire and South Ayrshire from underlying structural weaknesses. Per capita output in 2019, (measured by Gross Value Added per head of population at basic current prices) for East Ayrshire and North Ayrshire mainland[53], is 54% of the UK level and for South Ayrshire, 74% of the UK level. The local area of East Ayrshire and South Ayrshire also has higher levels of unemployment in comparison to the Scottish average. In addition, the Gross Disposable Income per head was lower than the Scottish levels for East Ayrshire, in particular, having the second lowest in the Glasgow and Strathclyde region and third lowest overall across Scotland as a whole.

13.11.4 Within the context of Environmental Impact Assessment legislation, none of the economic impacts considered is significant.

13.11.5 In addition to the states economic opportunities from the development, construction and operation phases, there is also a variety of wider economic impacts which are excluded from the construction, development and operational economic assessment. The wider impacts which should also be noted as having positive effects on the regional and national economies include:

- Supporting policy objectives: the Proposed Development can play an important role in supporting regional and national policy objectives. It will create more green jobs which are at the heart of the Scottish Government's plans for a fair, resilient and green economic recovery as stated in Scotland's Energy Strategy Position Statement. In addition, the Proposed Development will contribute to the continued growth of Scotland's renewable energy industry which is fundamental to enabling the transition to net zero. For the local policy strategies, East Ayrshire set out key focus areas in its local development plan to include renewable energy and energy efficiency measures in efforts to take a more sustainable approach to development activity in East Ayrshire. Furthermore, South Ayrshire's local development plan states that local benefits arising from wind farms can be important to the economic future of rural communities;
- Local supply chain opportunities: the research carried out by RenewableUK which estimated that the expenditure of workers who visit the local area benefit the accommodation and food service sector to the value of around £7,500 per MW constructed. The wider 'knock-on' effects can in turn support the supply chain of other activities such as the spending habits of retail operations and accommodation providers;
- Income effects: the economic analysis has focused on the GVA impact of generated employment as this is the 'real' impact on the economy. However, it is worth noting that new employment will generate additional wages and salaries, much of which will be spent in the UK; and
- Community benefits: The community benefit fund is expected to be in line with the Scottish Government Good Practice Principles on Community Benefit. In addition, the Applicant has offered to create a walking and nature trail increasing the routes for visitors and tourists to use for outdoor pursuits and to provide a tailored local benefit package as part of the proposal.

[53] Due to data availability, East Ayrshire and North Ayrshire mainland statistics were used.

Tourism and Recreation

13.11.6 In terms of tourism effects, the literature review indicates that wind farms have a minor impact on visitor activity. Recent studies from 2017 on wind farms and tourism trends (BiGGAR Economics) determined that whilst the number of wind farms increased across almost all local authority areas, employment in sustainable tourism also grew substantially. The study found no correlation between tourism employment and the number of turbines at the national or local authority area.

13.11.7 More recent research published in 2021 on the economic impact of wind farms on tourism (BiGGAR Economics) analysed trends at the local authority area and found no relationship between the growth in the number of turbines and the level of tourism employment. In addition, the analysis found that tourism related employment in the vicinity of wind farms had outperformed the trend for Scotland as a whole and for the local authority area in which the wind farm was based.

13.11.8 A national tracker survey published in 2021 also outlined that support for renewable energy had been consistently high with 87% expressing support for the use of renewables with the opposition being very low at 1%.

13.11.9 The tourism baseline indicates that although East Ayrshire and South Ayrshire are popular tourism destinations, the local area does not contain a high number of bed spaces, which suggests it is more of a day visit location and more reliant on passing trade.

13.11.10 The assessment has considered the impact on baseline conditions of tourism and recreational assets arising from the Proposed Development. The findings from this assessment conclude that the likelihood for potential negative impacts of the Proposed Development on tourism and recreational assets is considered to be low.

13.11.11 Several of the core paths around Straiton, Doon Valley and A713 (Galloway Tourist Route) have been assessed as having a moderate effect however this effect will only be experienced in short sections along the routes. The assessment does not consider that these effects from the Proposed Development are sufficiently adverse enough to deter a significant number of visitors away from these particular assets and as such, the Proposed Development is not likely to have any detrimental significant impacts on visitor numbers or the visitor economy.

13.11.12 Any potential negative impacts on tourism are likely going to be far outweighed by the wider positive benefits for the local area and Scotland as a whole in terms of employment opportunities, enhanced access and investment into the area.

14 Climate Impact Assessment

14.1 Introduction

14.1.1 This Chapter of the Environmental Impact Assessment Report (EIA Report) evaluates the effects of the Proposed Development on climate change and carbon balance.

14.1.2 This chapter of the EIAR is supported by the following appendix provided in Volume 3 Technical Appendices:

- 14.1: Carbon Balance Assessment Input Data.

14.1.3 This chapter includes the following elements:

- Legislation, Policy and Guidance;
- Scoping Responses and Consultations;
- Climate Change Impacts;
- Effects of Future Climate Change; and
- Carbon Balance Assessment.

14.2 Legislation, Policy and Guidance

14.2.1 Scotland has legislated to achieve net-zero carbon emissions. In October 2019, The Climate Change (Emissions Reduction Targets) (Scotland) Bill received Royal Assent. The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 builds on a number of energy policy documents that recognise the Scottish Governments commitment to tackling climate change and promoting the growth of renewable energy.

14.2.2 Carbon balance assessments are undertaken to support the requirements within the EIA Regulations within Scotland which transpose the EIA Directive into law stating broadly that the following should be included within environmental statements/environmental impact assessment reports;

"…A description of the likely significant effects of the project on the environment resulting from, inter

alia …

The impact of the project on climate (for example the nature and magnitude of greenhouse gas) emissions) and the vulnerability of the project to climate change…"

14.2.3 In the UK, Scotland is at the forefront in terms of providing a guidance framework through which the impact of development upon peatlands can be minimised. The carbon balance assessment reveals the likely nature and magnitude of greenhouse gas (GHG) emissions resulting from proposed wind developments through employing the Scottish Government's Carbon Calculator Tool [1], which is currently the best method to date to undertake this kind of assessment and is endorsed by SEPA and the Scottish Government.

14.2.4 The carbon balance assessment has been undertaken in accordance with guidance[2] 'Calculating Carbon Losses & Savings from Wind Farms on Scottish Peatlands – Technical Note 2.10.0[3]. As well as Technical Note 2.10.0, this report has been produced giving consideration to the following guidance documents:

- D.R. Nayak *et al*. Calculating Carbon Budgets of Wind Farms in Scottish Peatlands (May 2010);
- Calculating carbon savings from wind farms on Scottish peat lands - A New Approach by Nayak *et al.*, 2010;
- Smith *et al*. Carbon Implications of Windfarms Located On Peatlands – Update Of The Scottish Government Carbon Calculator Tool (2011);
- Scottish Natural Heritage (SNH) (now NatureScot): Carbon rich soil, deep peat and priority peatland habitats map (2016);
- NatureScot (2020) Advising on carbon-rich soils, deep peat and priority peatland habitat in development management[4].
- CCW Guidance Note: Assessing the impact of windfarm developments on peatlands in Wales (Jan 2010);
- Natural England Commissioned Report: Investigating the impacts of windfarm development on peatlands in England (Jan 2010);
- Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste. Scottish Renewables (2014);and
- Scottish Government, SNH and SEPA - Peatland Survey - Guidance on Developments on Peatland – 2017.

14.2.5 In addition, advice from the authors of the carbon calculator tool sought for previous assessments has been employed, and the completion of the carbon balance

[1] Available online from: https://informatics.sepa.org.uk/CarbonCalculator/index.jsp (last accessed 13/05/2022)

[2] Available online from: http://www.gov.scot/Topics/Business-Industry/Energy/Energy-sources/19185/17852-1/CSavings/CCguidance2-10-0 (accessed 19/04/2022)

[3] Available online from: https://www.gov.scot/publications/calculating-carbon-savings-wind-farms-scottish-peat-lands-new-approach/pages/13/ (accessed 19/04/2022)

[4] Available online from: https://www.nature.scot/doc/advising-carbon-rich-soils-deep-peat-and-priority-peatland-habitat-development-management (last accessed 19/04/2022)

assessments for the Proposed Development has required input from hydrology, peat, ecology and site investigation specialists.

14.2.6 Other information sources are referenced as footnotes throughout the chapter.

14.3 Scoping Responses and Consultations

14.3.1 Consultation for this EIA Report topic was undertaken with the organisations shown in Table 14.1.

Table 14.1: Summary of consultation

Consultee	Issues raised and recommendations	Scoping response addressed
East Ayrshire Council	The full report generated from the Scottish Government's Carbon calculation, accounting for carbon emissions and losses through disturbance and loss of peatland and savings over the lifetime of the development, should be submitted as part of the EIA Report.	Chapter addresses this
SEPA	Scottish Planning Policy states (Paragraph 205) that "Where peat and other carbon rich soils are present, applicants must assess the likely effects of development on carbon dioxide (CO_2) emissions. Where peatland is drained or otherwise disturbed, there is liable to be a release of CO_2 to the atmosphere. Developments must aim to minimise this release." Dependent upon the volumes of peat likely to be encountered and the scale of the development, applicants must consider whether a full Peat Management Plan is required or whether the information would be best submitted as part of the schedule of mitigation. Please note we do not validate carbon balance assessments except where requested to by Scottish Government in exceptional circumstances. Our advice on the minimisation of peat disturbance and peatland restoration may need to be taken into account when you consider such assessments.	See Technical Appendix 9.4 Peat Management Plan

14.4 Climate Change impacts

14.4.1 The most relevant climate change impacts are considered through the assessment of the likely magnitude of GHG emissions resulting from proposed wind developments in comparison to the baseline scenario with no development (where no emissions are produced as no construction takes place).

14.4.2 Current best practice and advice from consultees (Table 14.1) includes undertaking carbon balance assessments to assess effects with reference to the magnitude of carbon emissions released from peat by the construction of proposed wind developments on upland peat and the period of time it takes to payback those carbon emissions.

14.4.3 The carbon balance assessment employs the Scottish Government's Carbon Calculator Tool[5] and quantifies the CO_2 emissions savings over the life of the Proposed Development against the release of CO_2 from other energy generation methods as a result of implementing the project. It also reports on the time it takes to pay back any carbon debt and the potential effects of the Proposed Development on climate change in terms of carbon savings produced.

14.5 Effects of Future Climate Change

14.5.1 The potential for environmental receptors to be impacted by the Proposed Development is assessed in Chapters 5-15 of this EIAR. Of these, ornithological, ecological and hydrological receptors are the most sensitive to climate change and are discussed further in Table 14.2.

Table 14.2: Climate change effects on environmental receptors

EIAR Report Baseline	Receptor	Climate Change Effect	Effect on Receptor
Chapter 7	Ecology – Habitats, Protected Species	Temperature – up to + 2ºC Shift to wetter winters and dryer summers. Negligible change in wind speeds	While changes in temperature could affect the composition and growth rates of plant communities and invertebrates, and hence protected species and habitats, the uncertainties are high and it is not clear that the effect of the Proposed Development on those receptors would alter substantially as a result.
Chapter 8	Ornithology	Temperature – up to + 2 ºC Shift to wetter winters and dryer summers. Negligible change in	A rise in temperature has the potential to impact on habitats which in turn may affect the behaviour of bird interests. Uncertainties are high and the type and significance of effects identified from the

[5] Available online from: https://www.gov.scot/publications/carbon-calculator-for-wind-farms-on-scottish-peatlands-factsheet/ (last accessed 13/05/2022)

EIAR Report Baseline	Receptor	Climate Change Effect	Effect on Receptor
		wind speeds.	Proposed Development are not anticipated to alter as a result.
Chapter 9	Geology, Hydrology and Hydrogeology	Shift to wetter winters and dryer summers.	Limited change to future baseline and to the identified effects of the Proposed Development.

14.5.2 Given the relatively limited magnitude of change in climate parameters predicted over the operation of the Proposed Development, negligible changes to the baseline for environmental receptors are anticipated during this period. This is incorporated into the assessments undertaken in other chapters of this EIAR.

14.5.3 In terms of the potential effects of climate change on the Proposed Development to ensure adequate resilience of the project to climate change, it is considered that many of the key climate trends[6] such as increased temperature, changes in rainfall and sea level rise will not affect the Proposed Development due to its location and high elevation. And during severe windstorms, turbines engage installed braking mechanisms to shut turbines down.

14.6 Carbon Balance Assessment

14.6.1 This report has been prepared by Natural Power Consultants Ltd. and describes the carbon balance assessment undertaken for Sclenteuch Wind Farm (hereafter known as the Proposed Development) which consists of nine turbines and ancillary infrastructure. This report presents the carbon balance findings for the Proposed Development and has been produced to assist consultees and Scottish Ministers with their review of the Proposed Development's impact on peat and to assess the impact in terms of CO_2 emissions against the total potential carbon savings attributed to the Proposed Development.

14.6.2 This report should be read in conjunction with the Geology, Hydrology and Hydrogeology (Chapter 9), Ecology (Chapter 7), and Proposed Development (Chapter 2) chapters and relevant appendices of the Environmental Impact Assessment Report (EIAR) which describe the Proposed Development in more detail and provide important information on the peat resource within the Proposed Development Area.

Scope

14.6.3 The carbon balance assessment has been undertaken in accordance with guidance[7]

- 'Calculating Carbon Losses & Savings from Wind Farms on Scottish Peatlands – Technical Note 2.10.0[8]. As well as Technical Note 2.10.0, this report has been produced giving consideration to the following guidance documents:
- D.R. Nayak *et al*. Calculating Carbon Budgets of Wind Farms in Scottish Peatlands (May 2010);
- Calculating carbon savings from wind farms on Scottish peat lands - A New Approach by Nayak *et al.*, 2010;
- Smith *et al*. Carbon Implications of Windfarms Located On Peatlands – Update Of The Scottish Government Carbon Calculator Tool (2011);
- Scottish Natural Heritage (SNH) (now NatureScot): Carbon rich soil, deep peat and priority peatland habitats map (2016);
- CCW Guidance Note: Assessing the impact of windfarm developments on peatlands in Wales (Jan 2010);
- Natural England Commissioned Report: Investigating the impacts of windfarm development on peatlands in England (Jan 2010);
- Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste. Scottish Renewables (2014);
- Lindsay, R. Peatlands and Carbon: a critical synthesis to inform policy development in peatland conservation and restoration in the context of climate change (2010); and
- Scottish Government, SNH and SEPA - Peatland Survey - Guidance on Developments on Peatland – 2017.

14.6.4 In addition, advice from the authors of the carbon calculator tool sought for previous assessments has been used again here, and the completion of the carbon balance assessments for the Proposed Development required input from hydrology, peat, ecology and site investigation specialists.

14.6.5 Version V1.6.1 of the carbon calculator is currently the latest version of the online tool available (as of 27 June 2022). The inputs from the online carbon calculator tool run are presented in Annex A of this report (Reference: D35Z-F66Z-WHI2 v6). As the online tool does not allow any amendments to functionality and cannot be changed, the carbon balance assessment was undertaken subject to the specifications that the tool dictates. The tool does not currently allow users to

[6] Available online from: https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/index (last accessed 13/05/2022)

[7] Available online from: http://www.gov.scot/Topics/Business-Industry/Energy/Energy-sources/19185/17852-1/CSavings/CCguidance2-10-0 (accessed 13/05/2022)

[8] Available online from: https://www.gov.scot/publications/calculating-carbon-savings-wind-farms-scottish-peat-lands-new-approach/pages/13/ (accessed 13/05/2022)

describe the sources of the input data or the detailed information that is inserted to conduct the analysis. Therefore, Table 14.3 below presents this source information for the assessment. The data and infrastructure dimensions used have been based on the best data available at the time and, in cases where infrastructure design or construction methods were not yet clear, the worse-case values were used to ensure that the assessment presented a worse-case scenario in any areas of uncertainty. This carbon balance assessment is based on the data and infrastructure dimensions that reflect the final design of the Proposed Development, as far as is possible, as provided by the Applicant. Some of the infrastructure dimensions may vary slightly to those presented in Chapter 2: Proposed Development as dimensions also include working and disturbance areas.

14.6.6 It is important to highlight that the assessment used a robust and comprehensive peat depth dataset that was collected throughout all stages of the design work and which provides a fair representation of peat depths across the site as well as the final layout, as described in Chapter 9: Hydrology, Geology and Hydrogeology.

Table 14.3: Record of Data Sources

Input	Source of Information
Turbine capacity and lifespan	RES: Nine turbines each with a rated output of up to 6 MW. Looking for consent for fixed life-span of up to 50 years.
Capacity factor	Based on client current forecasts of capacity factors for current candidate turbines as well as an average capacity factors from published data from https://www.gov.uk/government/statistics/energy-trends-section-6-renewables (accessed on 04/05/2022). It is important to note that the capacity factors used here will not typically reflect the final capacity factor of the Proposed Development and are much lower than energy yield assessments for this Proposed Development and candidate turbines indicate; the capacity factor would be anticipated to be greater, as modern turbines are more efficient and taller than many of the older turbines on operational wind farms where the BEIS data is derived from.
Fraction of output to backup	The extra capacity that would be needed for back-up power generation is currently estimated at 5% of the rated capacity of wind plant as UK wind power regularly contributes more than 20% to the National grid.
Type of peatland	**Ecology Dept., Natural Power Consultants Ltd.** In the tool, the choice of peatland habitats is limited to acid bog or fen. In this case, acid bog was selected as no other relevant option is available. The ecological surveys (Chapter 7: Ecology) identified that the Proposed Development Area is located within coniferous woodland plantation, with a large proportion of the land outwith forested areas being marshy grassland. As described in Chapter 9: Hydrology, Geology and Hydrogeology, the generalised soil type according to the National Soil Map of Scotland[9] (shown in Figure 9.2 found in Volume 3a) within the Proposed Development Area is predominantly peat gleys. Within the Proposed Development Area, the Scotland's Carbon and Peatland Map (2016)[10] shows that the majority of the site is of Class 5 mineral soil classification, with smaller pockets of Class 1 (nationally important) intermixed with other larger pockets of a mix of Class 3 soils (Figure 9.2).
Average air temp. at site	Site specific temperature based on 29 years (1981-2010) data collected from the closest **Met Office** weather station to the Proposed Development. The Saughall Climate Station is positioned approximately 34 km north-east of the Proposed Development. The expected value is the average annual temperature over the data collection period. The minimum value is the minimum average annual temperature and maximum value is the maximum average annual temperature. https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcuurcfer (accessed 05/05/2022).
Average depth of peat on site	**SLR Consultants Ltd.** Informed by historical peat probe data and further peat probe data collection in September 2021 (872 peat probes). The total number of probes is illustrated in the interpolated peat depth map in Figure 9.4 (found in Volume 2a). As advised by the authors of the original Excel tool, the arithmetic mean was calculated from this data to represent the 'expected' value, and the minimum and maximum values provided represent the lower and upper bound values of the 95% confidence intervals of the sample data collected.
C content of dry peat	**SLR Consultants Ltd.** Based on values provided within the tool guidance. No peat cores were collected. Accordingly, these results present a worst-case scenario as the tool will assume these peat characteristics across the whole site.
Extent of drainage	**SLR Consultants Ltd.** Based on site observation, literature review and previous experience on similar sites.
Average water table depth	**SLR Consultants Ltd.** Based on water table depth observations across the site during site visits., literature review and previous experience on similar sites.
Dry soil bulk density	**SLR Consultants Ltd.** Based on values provided within the tool guidance. Accordingly, these results present a worst-case scenario as the tool will assume these peat characteristics across the whole site.
Time for regeneration of bog plants	**Ecology Dept., Natural Power Consultants Ltd.** This has been estimated to be 7 years (5 years minimum and 10 years maximum). The time period for successful regeneration of bog plant species is dependent on numerous factors including relevant seed source, successional rate, the level of herbivore disturbance and the successful stabilisation of the water table in a restoration area. The values provided are based on the professional experience of project ecologists and the quality of the existing vegetation. Potential opportunities for habitat management and peat restoration have been investigated and are reported in Chapter 7: Ecology of the EIAR. To present a worst-

[9] National Soil Map of Scotland, available online: http://map.environment.gov.scot/Soil_maps/?layer=1 (accessed 08/06/2022)

[10] Available online from: https://map.environment.gov.scot/Soil_maps/?layer=10 (accessed 08/06/2022)

Input	Source of Information
	case scenario for this assessment however, it is assumed that no peat restoration will take place.
Carbon accumulation due to C fixation by bog plants	Values have been inserted from the online tool notes that quote published primary literature and NatureScot guidance values.
Coal-fired emission factor	Fixed value of the carbon calculator tool.
Grid mix emission factor	Fixed value of the carbon calculator tool.
Fossil fuel mix emission factor	Fixed value of the carbon calculator tool.
No. of borrow pits and dimensions	**RES:** Two borrow pits are proposed for stone for use in construction of turbine foundations, hardstandings, compounds and access tracks, as required. There is limited peaty soils/peat overlying the selected borrow pits but dimensions have been included to represent a worst-case scenario.
Average depths of peat removed from infrastructure	**SLR Consultants Ltd.** Informed by historical, September and December 2021 survey data. Nearly 2000 probes were collected within the Proposed Development Area. These values are derived from interrogation of the peat depth data collected underlying each type of infrastructure including a 100 m micrositing allowance for turbines. As advised by the authors of the original Excel tool, the arithmetic mean was calculated from this data to represent the 'expected' value, and the minimum and maximum values provided represent the lower and upper bound values of the 95% confidence intervals of the sample data collected.
No. of foundations/ hardstands and dimensions	**RES:** The foundations will be made from reinforced concrete, delivered to the Proposed Development. Expected dimension of the actual foundations is 28 m x 28 m as a worst case, which includes an 8 m working area. Dimensions for hardstands consider the permanent crane hardstand area and a 2 m working area.
Volume of concrete	**RES:** Based to accommodate for turbine foundations (550 m^3 each) and concrete for ancillary foundations found in the substation and battery storage compounds.
Total length of access track	This assessment used 5,776 m of proposed new access track, 674 m of floating access track and 3,564 m of upgraded access tracks = 10,014 m in total length of access tracks.
Length of floating tracks	674 m of floating tracks are to be considered. Areas where floating access tracks are to be utilised are along sections where peat is in excess of 1 m for 100 m, at least.
Excavated access track length	This value includes 9,340 m of proposed excavated access track (new and upgraded access tracks).
Excavated access track width	See Paragraph 14.6.28 which shows the calculation for weighted access track with which takes into account new access tracks and upgrading of existing access tracks.
Average depth of peat for excavated access tracks	Informed by historical and September data and December 2021 detailed peat probe data collected. . As advised by the authors of the original Excel tool, the arithmetic mean was calculated from this data to represent the 'expected' value, and the minimum and maximum values provided represent the lower and upper bound values of the 95% confidence intervals of the sample data collected.

Input	Source of Information
	See also Paragraph 14.6.28 which shows the calculation for weighted access track peat depth which takes into account new access tracks and upgrading of existing access tracks.
Length of rock filled access tracks	All new and upgraded access tracks are assumed to be excavated, if not floating.
Additional peat excavated	**RES:** An expected volume of 3,652m^3 of additional peat will be excavated. This input accounts for the substation compound, battery energy storage system compound and temporary enabling work and construction compounds areas. Not all infrastructure is located on deep peat however, as pockets of peat exist on site, all infrastructure has been included in the tool to represent a worst-case scenario. Temporary construction compounds will also provide areas for potential storage and additional lay down areas. Calculations are shown in Table 14.4 of this document.
Area of improvement of felled plantation land	**DGA Forestry** Chapter 10 Forestry reports that a total of 113.5 ha will be felled for the Proposed Development. However, replanting will occur for 56.4 ha so expected permanently felled area is 57.1 ha.
Area of degraded bog to be improved	**Ecology Dept., Natural Power Consultants Ltd.** Potential opportunities for habitat management and peat restoration have been investigated and are reported in in Chapter 7 Ecology of the EIAR. To present a worse-case scenario for this assessment, it is assumed that no peat restoration/improvement of degraded bog will take place.
Area of borrow pits to be restored	**RES** Borrow pit will be reinstated. The final reinstatement of the borrow pit would be agreed with the local authority in consultation with NatureScot prior to reinstatement works commencing. However, as the borrow pit is not located on peat habitats, inputs for peat restoration have not been included to represent the worst-case scenario.
Water table depth around foundations and hardstands before and after restoration	**SLR Consultants Ltd.** The 'before restoration' water table depth is based on the scenario whereby drainage is not removed but left in situ. It assumes that the drainage left in place would cause some draw down on the existing water table. The 'after restoration' water depths are based on backfilling of the drainage which would bring the water table depth up to, and likely higher, than previous levels before construction.
Time to completion of backfilling, removal of any surface drains, and full restoration of the hydrology (years)	**SLR Consultants Ltd.** Values of 3, 2 and 5 years used. Based on professional judgement.
Will the hydrology of the site be restored on decommissioning?	**SLR Consultants Ltd.** Yes. During the construction and commissioning of the Proposed Development, drainage ditches will be blocked and therefore the water table will increase. Upon the decommissioning of the Proposed Development, best practice principles will be adopted.

Input	Source of Information
Will the habitat of the site be restored on decommissioning?	**Ecology Department. Natural Power Consultants Ltd.** No. At the moment it is assumed that upon decommissioning, restoration of habitats will not be undertaken. There are no plans to control grazing or to reintroduce species using nurse crops or fertilisation, therefore a worst-case scenario of "no restoration" has been inputted into the carbon calculator tool.

14.6.7 The following paragraphs report on the results of the carbon calculator calculations that are present within the online tool. For clarification of the calculations, the reader will need to view the online submission (Reference: D35Z-F66Z-WHI2 v6).

Wind Farm CO_2 Emission Savings

14.6.8 The amount of CO_2 emissions produced during energy production varies with the type of fuel used; therefore, the potential CO_2 savings from the Proposed Development depends on the type of fuel it replaces. The wind farm CO_2 emission savings over other types of generation (i.e. coal-fired, grid-mix, fossil fuel-mix) is calculated by multiplying the energy output of the Proposed Development by the emissions factor of the other type of generation.

14.6.9 Based on an averaged 6 MW turbine model scenario, the expected potential annual energy output of the Proposed Development is 147,399 MWh/yr (7,369,963 MWh over 50 years), with minimum and maximum potential outputs at 102,120 MWh/yr and 203,975 MWh/yr. Note: For a conservative analysis, the potential energy generation from Battery Energy Storage System (BESS) of 45 MW has not been included in assessment. However, infrastructure associated with BESS has been considered.

14.6.10 Based on the expected annual energy output of the Proposed Development (147,399 MWh/yr), the potential expected emissions saved over coal-fired electricity generation is 135,607 tonnes of CO_2 per year (tCO_2/yr); and over grid-mix generation is 37,378 tCO_2/yr and over fossil fuel-mix generation is 66,330 tCO_2/yr.

Emissions due to Turbine Life

14.6.11 Energy is consumed and associated CO_2 emissions are released during manufacture of turbine components, site construction (including access tracks and turbine foundations etc.), and during decommissioning of a development.

14.6.12 The carbon calculator includes a module for assessing the carbon emissions due to turbine life. Nayak et al. (2010) explain that the turbine life calculation within the carbon calculator is based on generic data as it does not accommodate a site-specific full life-cycle analysis. Therefore, the turbine life emissions for the Proposed Development are estimated utilising an equation for ≥1 MW turbines that has been derived from data from numerous European sites, and which shows a significant relationship across the European sites examined.

14.6.13 The carbon calculator reveals an expected emissions figure of 47,953 tonnes of CO_2 (tCO_2) equivalent (equiv.) emitted due to the manufacture, construction and decommissioning of the turbines. Based on the calculated emissions savings for fossil fuel-mix generation, the payback time for turbine life is expected to take approximately 9 months.

Capacity Required due to Back Up

14.6.14 In order to maintain security of energy supply, a second-by-second balance between generation and demand must be maintained by the grid operators. It has been noted that the inherent variable nature of wind energy may affect this balance and therefore, a certain proportion of power is required to stabilise the supply to the customer. The electricity system however, is designed and operated in such a way as to cope with large and small fluctuations in supply and demand. No power station is totally reliable, and demand, although predictable to a degree, is also uncertain. Therefore, the system operator establishes reserves that provide a capability to achieve balance, given the statistics of variations expected over different timescales. The variability of wind generation is but one component of the generation and demand variations that are considered when setting reserve levels.

14.6.15 It should also be noted that an individual wind turbine will generally generate electricity for 70-85% of the time, and its electricity output can vary between zero and full output in accordance with the wind speed. However, the combined output of the UK's entire wind power portfolio shows less variability, given the differences in wind speeds over the country as a whole. Whilst the amount of UK wind generation varies, it rarely, if ever, goes completely to zero, nor to full output at the same time throughout the UK.

14.6.16 The extra capacity that would be needed for back-up power generation is currently estimated to be approximately 5% of the rated capacity of the wind plant as UK wind power contributes more than 20% to the National Grid. The carbon calculator assumes that all back-up power generation will be via fossil fuels or grid-mix which does not account for any back-up energy generation from renewable sources directly or from renewable energy that has been stored in batteries. As such, the emissions figure required from back-up power generation for the Proposed Development is considered to be conservative as the calculator assumes a very worst case scenario.

14.6.17 The carbon calculator assumes that backup is provided by a fossil fuel mix of energy generation and reveals an expected emissions figure of 53,217 tCO_2 equiv. due to the back-up. Based on the calculated emissions savings for fossil fuel-mix

generation, the payback time for back-up is expected to take approximately 8 months.

Loss of Carbon Fixing Potential

14.6.18 Construction of the Proposed Development will involve the installation of infrastructure such as turbine foundations, access tracks and hardstands etc. Where vegetation and/or peat is removed or covered, the vegetation will no longer be able to photosynthesise and therefore, its ability to fix carbon will be lost. In addition, changes to drainage can have an effect on the vegetation of peatlands. Accordingly, the carbon calculator assumes that the carbon-fixing potential is lost from both the area occupied by infrastructure as well as working areas used to install the infrastructure and areas affected by drainage. In order to demonstrate a worst-case scenario of the Proposed Development's impact on carbon fixing potential through drainage, the extent of drainage around infrastructure is given as 5 m expected and 3 m and 10 m as minimum and maximum values respectively.

14.6.19 The carbon calculator also assumes that the footprint of the Proposed Development has 100% coverage of bog plants that are still accumulating carbon for those areas where vegetation is either removed during construction or compromised due to disturbance or drainage. This assumption is considered to be very much a worst-case scenario as 100% bog habitat cover is not an accurate representation of the site's total habitat characteristics.

14.6.20 Habitat loss calculations for the Proposed Development's infrastructure have been calculated and are discussed in Chapter 7 (Table 7.10) of the EIAR. The Phase 1 habitat survey (Figure 7.5 in Volume 2a) reveals that the Proposed Development Area is largely comprised of coniferous and mixed plantation, natural broadleaved woodland and marshy grassland. Other habitats include smaller areas of wet and dry modified bog, blanket bog and wet heath.

14.6.21 Of the above habitats, peat habitat types (i.e. blanket bog, modified bog, wet heath and some potential within marshy grassland) represent approximately 97 hectares (ha) of the *c.*888 ha of habitat types recorded across the area surveyed. However, only a small area of these peat habitats will be directly impacted by preparation and construction activities; with permanent loss confined to only *c.*1.4 ha in total in the worst-case scenario. In accordance with the carbon calculator's methodology however, the emissions from loss of CO_2 fixing potential is based on the footprint area of the Proposed Development, plus the expected area affected by drainage which is based on the 10 m expected extent of drainage and assumes 100% bog/mire habitat cover of the footprint and drainage area. As such, Sheet 4 of the online tool assumes that approximately 28 hectares of bog plants will be lost compared to the *c.*1.4 ha habitats identified through site specific survey work.

14.6.22 Therefore, it is considered that the carbon calculator's assumption that 100% of the land lost through construction or drainage of the Proposed Development is covered in bog plants or peatland vegetation is considered to be highly precautionary in this instance as many other types of habitat exist.

14.6.23 The carbon calculator reveals that the expected total emissions attributable to the loss of carbon accumulation by bog plants is equivalent to 1,470 tCO_2 equiv. over the operational period of the Proposed Development. Based on the calculated emissions savings for fossil fuel-mix generation, the payback time for loss of carbon fixing potential is expected to be less than 1 month. However, as previously described above, it is important to recognise that 100% bog/mire habitat cover is not an accurate description of the site's characteristics.

Loss of Carbon Dioxide from Removed Peat (Direct Loss)

14.6.24 The 2017 Peatland Survey Guidance states that peat is defined as the partially decomposed remains of plants and soil organisms which have accumulated at the surface of the soil profile. Peat accumulates where the rate of input of organic material from the surface exceeds the rate of decomposition and 'turn-over' of this new material. A peat layer does not include a mineral fraction (hence being differentiated from topsoil).

14.6.25 Peat deposits are made up on an organic soil which contains more than 60% of organic matter and exceeds 50 cm in thickness. The peat depth data at the Proposed Development are taken from over 1,977 peat depth measurements collected across the Proposed Development. As advised by the authors of the tool, the arithmetic mean was calculated from this data to represent the 'expected' value, and the minimum and maximum values provided represent the lower and upper bound values of the 95% confidence intervals of the sample data collected. Peat depths of less than 0.5 m are categorised as peat soils with peat deposits being >0.5 m in depth (JNCC, 2011[11]; Scottish Government *et al.*, 2017[12]).

14.6.26 Peat survey methodology was conducted in accordance with the guidance documentation 'Guidance on Developments on Peatland – Peatland Surveys 2017[13] The interpolated peat depths are illustrated in Figure 9.4 in Volume 2a of the EIAR.

[11] JNCC Report 445 (2011), Towards an assessment of the state of UK Peatlands.
[12] Scottish Government, NatureScot, SEPA (2017) Guidance on Developments on Peatland – Peatland Survey.

[13] Scottish Government, NaturScot, SEPA (2017) Peatland Survey. Guidance on Developments on Peatland, Available online from: Guidance+on+developments+on+peatland+-+peatland+survey+-+2017.pdf (www.gov.scot) (last accessed 06/07/2022)

The peat depth results show that the highest proportion of recorded peat depths were ≤0.5 m (62.4%) with 37.6% >0.5 m. Infrastructure elements have largely been placed on areas where mean soil depths are noted to be less than 1 m (Technical Appendix 9.2, Table 2.2).

14.6.27 Default values of carbon content of dry peat (% by weight) and dry soil bulk density (g cm^{-3}) were employed to present a worst case scenario.

14.6.28 The carbon calculator does not accommodate inputs for upgrading tracks and only allows inputs for new excavated tracks. However, under advice provided by the authors of the calculator, instead of simply reporting the length and width of new tracks (excavated tracks), the widening/upgrading of existing access tracks has been accounted for in this assessment by calculating the weighted average width of tracks along the total length of new and upgraded tracks. The same approach has been applied for calculating the weighted peat depths for access tracks.

- For example, the calculations for expected weighted track widths were as follows:

  [5,776 m (expected length of new track) x 12 m (expected width)] + [3,564 m (expected length of upgraded track) x 8 m (expected width of upgrade)] = 97,824 m2
  Then; 97,824 m2 / 9,340 (total expected length of tracks) = 10.47 m expected weighted average width.

  The calculations for expected weighted peat depths were as follows:

  [5,776 m (expected length of new track) x 0.52 m (expected average peat depth)] + [3,564 m (expected length of upgraded track) x 0.31 m (expected average depth for upgraded tracks) = 4,108 m2
  Then; 4,108 m2 / 9,340 (expected total length of tracks) = 0.44 m expected weighted average peat depth.

14.6.29 The excavated volumes calculated and reported within the assessment accommodate realistic working areas with the assumption built into the model that all peat/habitat in working areas or excavation areas is lost. Within this assessment, in order to represent a worst-case scenario the following working areas and assumptions have been incorporated into the analysis:

- An expected value for excavated access tracks width of 12 m is based on 5 m width (as described in Chapter 2: Project Description), 3 m drainage/cable trench on one side, then 2 m spacing allowance and 2 m allowance for cut/fill area/batters. In some areas, spacing may be narrower or wider therefore, the minimum and maximum values of 10 m and 13 m have been provided respectively.
- An expected value for upgrades to existing tracks of 4 m is based on an increase by 1 m plus cable trench 1 m, drainage 2 m on one side + 2 m spacing and 2 m allowance for cut/fill area/batters in the expected scenario (8 m), and then spacing may be narrower or wider, the minimum (6 m) and maximum (9 m) values have been provided.
- Working or cut/fill areas, excavation areas and batters have been included around turbine foundations and hardstands and the detailed construction data has been used. In most cases, the turbine foundation footprint and working areas will overlap with the tracks and hardstands/working areas/laydown areas. As such, all dimensions included within this assessment for turbine foundations should be considered worst-case as there is a considerable element of double counting.
- Expected dimensions for hardstands consider the permanent crane hardstand area including work area. The minimum and maximum values allow tolerance for smaller and larger permanent hardstands and work areas.
- The working areas presented within this carbon balance assessment represent those areas where peat and/or peat vegetation may be removed or damaged/disturbed. As such, the peat volumes reported in the carbon balance assessment are considered to be highly precautionary and considered to be unrealistically worst-case. In fact, latest guidance[14] states that peat depth measurements of less than 0.5 m are not categorised as peat (rather peat soils), and deep peat deposits are considered being >0.5 m in depth.

14.6.30 Some of these assumptions above will differ from those used to calculate peat extraction volumes within the Peat Management Plan (PMP) presented in Technical Appendix 9.2. The working areas presented within this carbon balance assessment represent those areas where peat and/or peat vegetation may be removed or damaged/disturbed whereas the PMP investigates only those areas where peat is extracted and stored, then available for re-use. As such, the peat volumes reported in the carbon balance assessment are considered to be precautionary and considered to be highly worst case.

14.6.31 The carbon calculator also requires information relating to other ancillary infrastructure not explicitly accounted for above, namely the substation, met mast and construction compounds. Table 14.4 utilises the expected dimensions of the

[14] Scottish Government, NaturScot, SEPA (2017) Peatland Survey. Guidance on Developments on Peatland, Available online from: Guidance+on+developments+on+peatland+-+peatland+survey+-+2017.pdf (www.gov.scot) (last accessed 06/07/2022)

additional infrastructure and peat depths used to calculate the total area and total volume of excavations.

Table 14.4: Additional peat excavated calculations

Additional Peat Excavated			
	Expected	Minimum	Maximum
Substation Compound (m^2)	3416	3186	3776
Substation Compound Average Peat Depth (m)	0.36	0.27	0.44
Temporary Enabling Works Compound (m^2)	484	400	576
Temporary Enabling Works Compound Average Peat Depth (m)	0.13	0.08	0.17
Temporary Construction Compound Battery (m^2)	7222	6820	7840
Temporary Construction Compound Battery Average Peat Depth (m)	0.32	0.16	0.48
Alternate Temp. Enabling Works Compound (m^2)	484	400	576
Alternate Temp. Enabling Works Compound Average Peat Depth (m)	0.1	0.1	0.1
Total Area of Peat Removed (m^2)	11606	10806	12768
Total Volume of Peat Removed (m^3)	3652.12	2023.42	5580.16

14.6.32 The CO_2 release associated with the volume of peat excavated assumes a worst-case scenario that 100% of the peat is lost. Sheet 5, Table 5a of the carbon calculator calculates the total expected area of land lost due to the Proposed Development construction as 15.69 ha (does not include drained peat areas) and expected volume of 'peat' removed over the footprint of the Proposed Development is expected to be 67,915 m^3. However, as previously described within paragraphs 14.6.21 and 14.6.23, only a small area of this 15.69 ha will be directly impacted by preparation and construction activities; with permanent loss confined to only *c.*1.4 ha in total in the worst-case scenario. Therefore, it is considered that the carbon calculator's assumption that 67,915 m^3 of peat will be lost through construction of the Proposed Development is considered to be highly precautionary as many other types of habitats and soils exist within the Proposed Development construction area, not only peat.

14.6.33 Total volumes and areas have been stated within the results of the tool, and these values are not rounded which conveys a false accuracy and it should be borne in mind that these values are only highly indicative as not all of the volume and areas reported as removed will be peat habitat.

14.6.34 The total expected amount of CO_2 loss, attributable to peat removal only, (i.e. CO_2 emissions from peat that is excavated for the Proposed Development only, no impacts from drainage of peat) is 24,244 tCO_2 equiv. Based on the calculated emissions savings for fossil fuel-mix generation, the payback time for peat removal only is expected to be less than 5 months. However, as previously described above, it is important to recognise that 100% bog/mire habitat cover is not an accurate description of the site's characteristics.

Loss of Carbon Dioxide from Drained Areas (Indirect Loss)

14.6.35 Carbon is also lost from peat habitats through drainage that occurs in the peat around the Proposed Development. The carbon calculator and associated guidance refers to this CO_2 loss as an "indirect loss". The extent of the site affected by drainage assumes an expected, minimum and maximum extent of drainage around each drainage feature e.g. turbine foundation, access tracks etc. It is important to bear in mind that the extent of drainage is dependent on existing drainage conditions on site and also topography. The carbon calculator, however, assumes no existing drainage on site and flat terrain which is not representative of the actual site characteristics. Therefore, results using this parameter should only be considered as indicative at best.

14.6.36 Hydrological and site investigation specialists visually noted and recorded water table depths during surveys which informed the site design evolution. Extent of drainage is a reasonable estimation based on knowledge of the site (topography etc.), experience at similar sites and expert judgement. As such, a recommended average extent around the drainage feature of 5 m was considered as an appropriate expected average for the calculation. Values of 3 m and 10 m were inserted as inputs to represent best- and worst-case scenarios respectively (also see Table 14.3).

14.6.37 Sheet 5, Table 5 of the carbon calculator calculates the total expected CO_2 loss from drained peat as 0 tCO_2 equiv. This is likely because the site possesses little peat, low water table depths and little extents of drainage as water percolates down elevations on site rather than being stored in the soil. Accordingly, in Table 5d, the tool assumes that the emissions from drained and undrained peat have the same proportion over the emissions period and therefore the net emissions due to drainage from infrastructure installation is 0 tCO_2 equiv.

Loss of Carbon Dioxide from DOC and POC loss

14.6.38 Additional CO_2 emissions from organic matter can occur as carbon dioxide and methane, which can leach out of peat that is restored to conditions where the

water table depth is higher after restoration than before restoration, and is a further consideration of the carbon calculator. Dissolved Organic Carbon (DOC) is defined as the organic matter that is able to pass through a filter (range in size generally between 0.7 and 0.22 µm). Conversely, Particulate Organic Carbon (POC) is the fraction of soil carbon that is larger in particle size. The assessment tool assumes that 100% of the losses due to leaching DOC and POC from restored drained and improved land are eventually lost as gaseous CO_2.

14.6.39 Only restored drained and improved land has been included in the calculations within the carbon calculator for DOC and POC, because if the land is not restored or improved, then the carbon loss has already been accounted for in the calculations for excavated and drained peat (i.e. the carbon assessment assumes that if land is not restored then 100% of the carbon will be lost from the removed or drained volume of soil).

14.6.40 The carbon calculator calculates that there will be an expected less than 1 tCO_2 equiv. lost due to DOC and POC leaching over the operational life of the Proposed Development.

Total Loss of Carbon Dioxide from Impact on Peat

14.6.41 The following calculations on total loss of CO_2 from impacts on peat have been based on a number of key assumptions (some of which are built into the tool itself), specifically in relation to peat, in order to demonstrate a worst-case (unrealistic) scenario using on-site data with input from ecology and hydrology specialists. In summary, these assumptions are:

- 100% of the area potentially affected by the Proposed Development is covered in peat forming mire habitat;
- The terrain is relatively flat with no existing drainage;
- Infrastructure dimensions for foundations, tracks and hardstands include working/laydown areas;
- 100% of the carbon stored in the excavated peat will be lost as carbon dioxide and not reinstated on site;
- 5 m metre expected average extent of drainage to demonstrate a conservative expected scenario and 10 m worst-case scenario;
- The average extent of drainage assumes that the depth of peat affected by drainage is equal to the depth of peat removed;
- Emissions from drained and undrained land have the same proportion over the emissions period;
- The peat depth data used to inform the volumes of peat removed assume that all recorded depths are in peat; and
- The model assumes no micrositing to further reduce impacts on peat.

14.6.42 The combined expected impact of the Proposed Development on peat and vegetation over the operational lifetime for the proposed layout is calculated as shown in Table 14.5.

Table 14.5: Total CO2 (tCO2 eq.) loss/gains on peat

	CO2 loss from plants +	CO2 loss from removed peat + CO2 loss from drained peat (i.e. soil organic matter loss)	+ CO2 DOC & POC loss
	1,470	24,244	1
Total CO2 loss/gains equiv.	25,714		

Source: Online Tool Reference D35Z-F66Z-WHI2 v6

14.6.43 Based on the calculated emissions savings for fossil fuel-mix generation, the payback time for loss of soil organic carbon is expected to be less than 5 months.

Loss of Carbon Fixing due to Forest Felling

14.6.44 Chapter 11 Forestry proposes that a total of 113.5 ha will be felled for the Proposed Development. However, 56.4 ha of this will be re-planted. Therefore, in accordance with the guidance for the carbon calculator, 57.1 ha has been inserted into the tool for felling, with +/- 10% as maximum and minimum values.

14.6.45 The carbon calculator calculates that there will be an expected 37,686 tCO_2 equiv. lost due to forestry felling over the operational life of the Proposed Development.

14.6.46 Based on the calculated emissions savings for fossil fuel-mix generation, the payback time for loss carbon due to felling of forestry is expected to be less than 7 months.

Carbon Gain Due to Site Improvement and Restoration

14.6.47 Restoration of areas within a proposed site can reverse emissions and act as carbon storage, reducing the total CO_2 emissions as a result of the Proposed Development. The carbon calculator takes into account reductions for emissions resulting from the improvement of degraded bog, felled plantation land as well as the restoration of borrow pits and early removal of drainage from turbine foundations.

14.6.48 The drainage associated with the hardstands and foundations will have an expected draw down on the water table during the construction period until such a time when they are removed/backfilled. This work will where possible, intend to raise the water table depth above that which is already present before construction. All

construction ditches and drainage on site will be blocked to minimise indirect habitat damage and loss through drainage.

14.6.49 To present a worst-case scenario for this assessment, no values for improvement of degraded bog, felled plantation or peat restoration of borrow pits have been entered into the tool. Although the borrow pit will be reinstated, Chapters 7: Ecology and 9: Hydrology, Geology & Hydrogeology within the EIAR clearly indicate that the majority of the infrastructure at the Proposed Development is not located on peat and therefore, no values have been inserted for peat restoration of borrow pits.

14.6.50 The results report -484 tCO_2 equiv. in carbon gains from the removal; of drainage measures in the expected scenario and -1,359 tCO_2 equiv. in carbon gains in the maximum (best-case) scenario. It is important to note that the minimum scenario does not show any carbon gains accrued from improvements of the site as the tool has assumed that no improvement has occurred at all.

14.7 Carbon Balance Summary

14.7.1 Table 14.6 reveals the carbon losses and carbon gains for each of the above parameters for the proposed development and also reveals the net CO_2 emissions.

Table 14.6: Expected CO_2 losses and gains

Carbon Balance Input Parameter	Expected Results
1. Windfarm CO_2 emission saving over other types of energy generation	
Coal fired electricity generation (tCO_2yr^{-1})	135,607
Grid mix of electricity generation (tCO_2yr^{-1})	37,378
Fossil fuel mix of electricity generation (tCO_2yr^{-1})	66,330
Energy output from Proposed Development over lifetime (MWh)	**7,369,963**
Total CO_2 losses due to Proposed Development (tCO2 eq.)	
2 Losses due to turbine life (e.g. manufacture, construction, decommissioning)	47,953
3. Losses due to backup	53,217
4. Losses due to reduced carbon fixing potential	1,470
5. Losses from soil organic matter	24,244
6. Losses due to DOC & POC leaching	1
7. Losses due to felling forestry	37,686
Total losses (tCO_2 eq.)	**164,571**
8. Total CO_2 gains due to improvement of site (tCO_2 eq.)	
8a. Gains due to improvement of degraded bogs	0
8b. Gains due to improvement of felled forestry	0
8c. Gains due to restoration of peat from borrow pits	0
8d. Gains due to removal of drainage from foundations and hardstands	-484
Total gains (tCO_2 eq.)	**-484**
Net CO_2 emissions (tCO_2 eq.)	**164,088**

Source: Online Tool Reference D35Z-F66Z-WHI2 v6: Payback Time and CO_2 emissions page.

14.7.2 The net emissions of CO_2 of the Proposed Development are calculated by deducting the total CO_2 gains produced by improvement and restoration of the site from the total CO_2 emissions from manufacture of, construction of, and impacts on peat from, the individual elements of the Proposed Development (described in the preceding paragraphs).

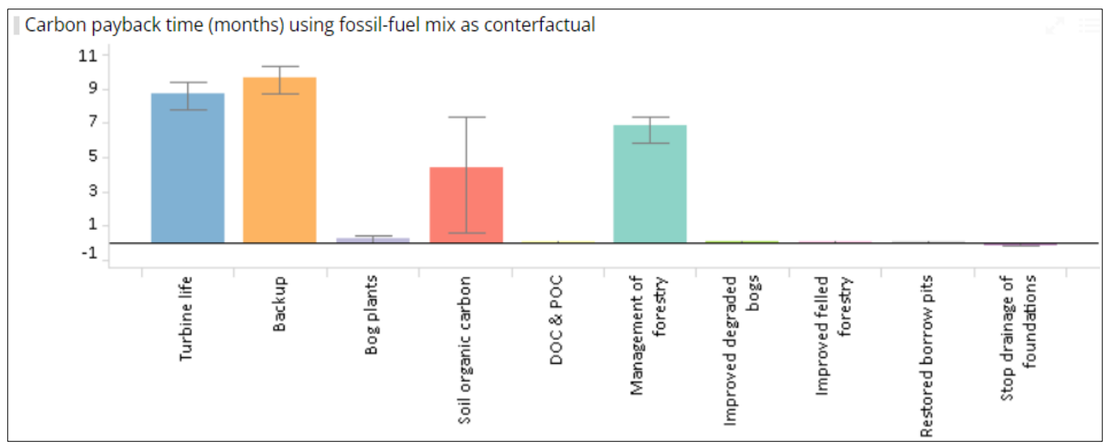
14.7.3 The Proposed Development CO_2 emissions savings of the Proposed Development over other types of generation (i.e. coal-fired, grid-mix, fossil fuel-mix) is calculated by multiplying the energy output of the Proposed Development by the emissions factor of the other type of generation. However, this parameter only takes into consideration the energy output of the Proposed Development and does not take into account any of the carbon losses or gains that are produced from manufacture of, construction of, and impacts on peat from, the individual elements of the Proposed Development. The parameter that takes all parameters into account is the carbon payback time and it is this value that provides an indication of the carbon balance of the Proposed Development.

14.7.4 The carbon payback time for the Proposed Development is calculated by comparing the net loss of CO_2 from the Proposed Development Area due to Proposed Development with the carbon savings achieved by the Proposed Development while displacing electricity generated from coal-fired generation, grid-mix generation or fossil-fuel mix electricity generation. Figures 14.1 and 14.2 below illustrate the payback times for the alternative Proposed Development in years.

RESULTS	Exp.	Min.	Max.
Net emissions of carbon dioxide (t CO2 eq.)	164,088	136,928	203,105
Carbon Payback Time			
...coal-fired electricity generation (years)	1.2	0.7	2.2
...grid-mix of electricity generation (years)	4.4	2.6	7.8
...fossil fuel-mix of electricity generation (years)	2.5	1.5	4.4

Source: Online Tool Reference D35Z-F66Z-WHI2 v6

Figure.14.1: Carbon payback time for the Proposed Development



Source: Online Tool Reference D35Z-F66Z-WHI2 v6

Figure 14.2: Carbon payback time for different elements of the assessment

14.7.5 The results from the carbon calculator reveal that the Proposed Development would have effectively paid back its expected carbon debt from manufacture, construction, impact on habitat and decommissioning within 2.5 years if it replaced the fossil fuel-mix electricity generation method. Based on the minimum and maximum scenarios however, the analysis shows that the payback time for fossil fuel-mix generation ranges between 1.5 to 4.4 years respectively.

14.7.6 The Institute of Environmental Management and Assessment (IEMA) has identified the online carbon calculator tool for wind farm carbon assessments. This tool provides a consistent and the most comprehensive method for carbon assessment for wind farm developments on peat lands to date. However, the online tool does not define what level of impact on peat is considered to be a 'significant effect' as the existing carbon balance literature using this carbon assessment tool does not state this requirement.

14.7.7 In this regard, IEMA concludes that:

"…when evaluating significance, all new Green House Gas (GHG) emissions contribute to a significant negative environmental effect; however; some projects will replace existing development that have higher GHG profiles. The significance of a project's emissions should therefore be based on its net impact, which may be positive or negative. "

14.7.8 In this context, the results of this assessment reveal that the net impact of the Proposed Development will be positive overall, as over its 50-year lifespan, it is expected to generate over 47 years' worth of clean energy if it replaced fossil fuel-mix electricity generation and nearly 46 years' worth of clean energy even if it replaces cleaner grid-mix electricity generation. Therefore, over the expected 47 years that the wind farm is likely to be generating carbon-free electricity, this could result in expected CO_2 emission savings of over 3,117,510 tonnes[15] of CO_2 when replacing fossil fuel-mix electricity generation.

14.7.9 This illustrates a positive net impact on climate change through contributing significantly towards the reduction of GHG from energy production.

[15] Calculation is 47 years x 66,330 tCO_2 (as shown in Table 14.6 and online submission).

15 Safety and Other Issues

15.1 Introduction

15.1.1 This chapter assesses the potential effects of the Proposed Development in relation to:

- Safety (including);
  - Major Accidents and Disasters;
  - Lightning Strike;
  - Public Access;
  - Air Quality;
  - Ice Throw;
- Aviation & Radar;
- Television and Telecommunications; and
- Shadow Flicker.

15.1.2 This assessment has been undertaken by Natural Power (major accidents and disasters, lightning strike, public access and air quality) and the Applicant (aviation and radar, television and telecommunications, shadow flicker and ice throw).

15.1.3 The assessment of potential effects is based on the wind turbine layout as detailed in Chapter 2: Proposed Development.

15.1.4 The assessment of potential effects on aviation and aviation safeguarding considers technical acceptability, based on air navigation safety, rather than following a strict EIA process of assessing the significance of effects. Such effects often require the implementation of technical mitigation solutions to ensure continued safe operation in the presence of a wind farm. The assessment of effects on these receptors is therefore one of technical analysis and consultation and seeks to identify whether the effect is likely to be 'acceptable' or 'not acceptable' to air navigation services provision.

15.2 Safety

Statement of Competence

15.2.1 The section of the chapter has been drafted by Natural Power's Planning & Environment team. It is accredited by the Institute of Environmental Management and Assessment and within it include Chartered Town Planners and Chartered Land Agents. The team has managed EIA and written EIA Report chapters on other infrastructure for onshore wind developments across the UK.

Scope of Assessment

Effects Scoped Out

15.2.2 Effects within this section have been scoped out as follows:

- Major accident and disaster types not considered to be a potential risk for the location of the Proposed Development, i.e. earthquakes, volcanic activity, wildfires, disease epidemics and technological or man-made hazards, such as industrial accidents and displaced populations (note Appendix 9.3 states there is no evidence of commercial mining or quarrying within the Proposed Development Area or immediate surrounds);
- Effects associated with peat slide risk during construction. The results of the peat slide hazard and risk assessment (see Technical Appendix 9.1) indicate that there is a low to very low risk of peat instability across the Proposed Development Area;
- Highly likely but low consequence events as they will not result in a significant environmental effect, such as heavy rainfall as good practice infrastructure design will ensure that on-site flooding will be minimised;
- Low likelihood and low consequence events such as minor spills as these events are not considered to result in significant environmental effects and do not fall into the category of major accidents and disasters; and
- Any hazards for which there is no credible source-pathway-receptor linkage.

Effects Assessed in Full

15.2.3 The following effects have been assessed in full:

Major Accidents and Disasters

15.2.4 A proportionate approach has been adopted for this assessment given that many events which could be classified as 'major accidents and disasters', and which could cause significant effects on the environment, are not relevant to the location of the Proposed Development. As such, any effects identified in the EIA Report which could have secondary effects in relation to major accidents and disasters, but which are not considered to be significant, are not assessed in this chapter.

15.2.5 The effects assessed are therefore limited to the potential for mechanical/structural malfunctions or storms which could result in wind turbine failure and serious injury or loss of life once the Proposed Development is operational.

15.2.6 IEMA has published 'Major Accidents and Disasters in EIA: A Primer'. This chapter therefore reflects the suggested methodology in this document.

Ice Throw

15.2.0 The Scottish Government's web-based renewables advice for onshore wind turbines states that 'the build-up of ice on wind turbine blades is unlikely to present problems on the majority of sites. The Applicant will implement measures to ensure the safety general public in relation to ice throw and ice fall. The Applicant will assess the potential risks of ice throw onto areas of interest to the public and implement mitigation as necessary. This may include but is not limited to shutting down wind turbines under certain conditions and installation of notices in the Proposed Development, alerting members of the public of the possible risk of ice throw and ice fall under certain conditions.

Baseline Characterisation

15.2.1 The assessments presented in this section have been desk based, drawing largely from published guidance and data.

Study Area

Major Accidents and Disasters

15.2.2 The assessment has focussed on the Proposed Development Area itself in relation to the potential for major accidents and disasters.

Desk Study

15.2.3 The following data sources have been used to inform the assessments:

Major Accidents and Disasters

- The International Disaster Database[1];
- Technical Appendix 9.2 Sclenteuch Wind Farm Peat Landslide Hazard and Risk Assessment (2022).

Safety

Guidance

15.2.4 The following guidance documents have been referred to in undertaking the assessments:

- British Standard BS EN 61400-1:2019 'Wind energy generation systems - Design requirements[2];

Assessment Limitations

15.2.5 Wind turbines have a proven track record for good safety. A small number of wind turbines have been known to lose parts of the rotor assembly through accidental damage, due to lightning strike or mechanical failure, however, such incidents occur infrequently.

15.2.6 The safe operation of wind turbines is ensured through a combination of design, quality control and manufacturing to high safety standards.

15.2.7 The Applicant will ensure that the selected wind turbine model will have certification from an internationally recognised authority and have a proven track record of safe operation.

15.2.8 The wind turbines installed in the Proposed Development Area will comply with the BS EN 61400-1:2019 'Wind energy generation systems - Design requirements.'

15.2.9 The primary safety system at the Proposed Development Area will include a computerised central control system housed within the control building within the substation compound. This system will continually monitor the operational status and safe working of key components for the wind turbines and will allow the operator to remotely monitor the wind turbines.

Major Accidents and/or Incidents

Guidance

15.2.10 The following guidance documents have been referred to in undertaking the assessments:

- Major Accidents and Disasters in EIA: A Primer (IEMA, September 2020)[3];
- The Cabinet Office National Risk Register of Civil Emergencies (2017 Edition)[4];
- The International Federation of Red Cross & Red Crescent Societies Early Warning, Early Action[5];
- The British Geological Survey (BGS), various webpages; and
- Delivering Proportionate EIA: A Collaborative Strategy for Enhancing UK Environmental Impact Assessment Practice (applies to climate change also)[6].

Significance Criteria

15.2.11 Although 'accident', 'risk' and 'disaster' are well known terms and are used in everyday language, there is potential for their meaning to be interpreted

[1] Emergency Events Database (2009) The International Disaster Database. Available [online] at: http://www.emdat.be/database
[2] BS EN 61400-1:2019 'Wind energy generation systems - Design requirements'
[3] BS EN 61400-1:2019 'Wind energy generation systems - Design requirements'
sasters-in-eia-primer
[4] Cabinet Office (2017) National Risk Register of Civil Emergencies.
[5] The International Federation of Red Cross & Red Crescent Societies (2008) Early Warning, Early Action.
[6] IEMA (2017) Delivering Proportionate EIA: A Collaborative Strategy for Enhancing UK Environmental Impact Assessment Practice.

differently. IEMA's Major Accidents and Disasters in EIA: A Primer (2020, 'the Primer') provides definitions for these in an EIA context.

15.2.12 The Primer defines ‘major accidents’ as:

‘Events that threaten immediate or delayed serious environmental effects to human health, welfare and/or the environment and require the use of resources beyond those of the client or its appointed representatives to manage. Whilst malicious intent is not accidental, the outcome (e.g. train derailment) may be the same and therefore many mitigation measures will apply to both deliberate and accidental events.’.

15.2.13 The Primer's definition of ‘disaster’ is:

‘May be a natural hazard (e.g. earthquake) or a man-made/external hazard (e.g. act of terrorism) with the potential to cause an event or situation that meets the definition of a major accident’.

15.2.14 Risk is defined in this Primer as:

‘The likelihood of an impact occurring, combined with the effect or consequence(s) of the impact on a receptor if it does occur.’

15.2.15 Two categories of effect are identified for the purposes of this assessment: ‘significant’ or ‘not significant’; there are no degrees of significance identified, as any residual risk of a major accident or disaster is considered to be ‘significant’. In addition, all effects are considered to be adverse.

15.2.16 Significant environmental effect (in relation to a major accidents and/or disasters assessment) is defined in the Primer as:

15.2.17 ‘Could include the loss of life, permanent injury and temporary or permanent destruction of an environmental receptor which cannot be restored through minor clean-up and restoration.’.

15.2.18 The duration of effects is highlighted in the definition and is therefore considered within this assessment.

Assessment Limitations

15.2.19 There is no established guidance for determining the significance of effects in EIA terms for major accidents and disasters, however the IEMA Primer (2020) offers an example approach which has been taken forward in this assessment.

15.2.20 It is assumed that existing legislation and regulatory controls would not permit the Proposed Development to be progressed under circumstances which could result in a highly likely and high consequence event occurring and resulting in a significant effect.

15.2.21 With regards to wind turbine mechanical/structural failure and storms, it is important to note that there are still large uncertainties in the future predictions of storms. Again, whilst there are only small changes in projected wind speed, there is considerable uncertainty with respect to likely changes in wind speed.

15.2.22 Wind turbines are fitted with sensors which detect if wind speeds are too high to operate safely, resulting in their shut down. This prevents excessive wear and damage to the gearbox and reduces the risk of wind turbines catching fire or occurrence of blade failure. The occurrence of wind turbines catching fire from suspected lightning strikes is also very rare, and there is no evidence that human life has been at risk from such events occurring in the past. The closest right of way to the Proposed Development is the Straiton to Patna Hill Track (SKC11) (approximately 520 m at its closest point to the proposed wind turbine locations). It is considered that there is a very low risk of this right of way being at risk from structural failures given the reasons above. As a result, the risk of wind turbine mechanical/structural failure is considered to be not significant.

Lightning Strike

15.2.23 A small number of wind turbines have been known to lose parts of the rotor assembly through damage caused by lightning strikes, however, such incidents occur rarely.

15.2.24 Wind turbines are equipped with lightning conductors as mitigation to lightning strikes which could damage internal components.

Public Access

Guidance

15.2.25 The following guidance documents have been referred to in undertaking the assessments:

- Land Reform (Scotland) Act 2003[7]
- British Standard BS EN 61400-1:2019 ‘Wind energy generation systems - Design requirements’[8];
- Construction (Design and Management) Regulations 2015[9]

[7] Available online: Land Reform (Scotland) Act 2003 (legislation.gov.uk)
[8] British Standard BS EN 61400-1:2019 ‘Wind energy generation systems - Design requirements
[9] Available online: The Construction (Design and Management) Regulations 2015 (legislation.gov.uk)

Public Rights of Way

15.2.26 The Proposed Development has been designed to ensure a safe passage across the Proposed Development Area is maintained.

15.2.27 Straiton to Patna Hill Track (SKC11) right of way passes through the western edge of the Proposed Development Area. The Proposed Development does not intersect the right of way. The nearest section of proposed infrastructure is approximately 370m from the right of way and the nearest proposed wind turbine is approximately 520m from the right of way.

15.2.28 Although members of the public have the right to roam land in Scotland under the Land Reform (Scotland) Act 2003 there will be restricted access during the construction phase for Health & Safety purposes. It is expected that the Proposed Development Area will be managed during the construction phase under the Construction (Design and Management) Regulations 2015. It is proposed that a Path Management Plan is included in the CEMP and is discussed further in Chapter 11 : Transport & Traffic.

Air Quality

15.2.29 The air quality of the Proposed Development Area is expected to be good due to the rural location, with few pollution sources.

15.2.30 During the construction of the Proposed Development, the increased traffic flow on local roads and the construction plant would generate exhaust emissions. However, given the short-term nature of the construction period and the limited area to be developed, effects on air quality are likely to be negligible.

15.2.31 During dry spells, construction activities have the potential to generate dust, which may adversely affect local air quality. Given the scale and nature of construction activities and given the distance between construction areas and the nearest residential properties, it is considered that dust from construction is unlikely to cause a nuisance or cause significant effect upon local air quality.

15.2.32 An operational wind farm produces no notable atmospheric emissions. The operation of the Proposed Development would therefore have no discernible adverse effects on local or national air quality.

15.2.33 The results of the Climate Impact Assessment (Chapter 16) reveal that the net impact of the Proposed Development at Sclenteuch will be positive overall, as over a 50-year lifespan of the Proposed Development, it is expected to generate over 47 years' worth of clean energy if it replaced fossil fuel-mix electricity generation and nearly 46 years' worth of clean energy even if it replaces cleaner grid-mix electricity generation.. Therefore, over the expected 47 years that the wind farm is likely to be generating carbon-free electricity, this could result in expected CO2 emission savings of over 3.1 million tonnes[10] of CO2 when replacing fossil fuel-mix electricity generation. This illustrates a positive net impact through contributing significantly towards the reduction of greenhouse gas emissions from energy production.

15.2.34 Relevant mitigation measures for air quality, dust and pollution control will be captured within the outline CEMP.

Ice Throw

15.2.35 Icing in Scotland is likely to be a rare occurrence, with the Icing Map of Europe (WECO, 2000) showing Scotland to be within a light icing area with an annual average of only 2-7 icing days per year. Especially with the Proposed Development Area in the south of Scotland, icing conditions are expected to be benign.

15.2.36 The design of the Proposed Development has taken into account the possibility of ice throw occurring and wind turbines have been sited in locations to ensure that the rotor blades do not oversail any public roads to minimise the risk from ice fall.

15.2.37 It is noted above that there is a public right of way that traverses the Proposed Development Area however this is further than 500m from the nearest wind turbine locations and therefore the risk associated with ice throw affecting members of the public is considered to be negligible.

15.2.38 To further minimise the risk public notices will be displayed at new and existing access points to the Proposed Development Area, alerting members of the public and staff accessing the Proposed Development Area of the possible risk of ice throw under certain weather conditions.

Summary

15.2.39 The potential risk to members of the public or staff arising from safety matters related to the Proposed Development is low and will be minimised through the construction phase through the CEMP. The ongoing maintenance regime and meteorological monitoring throughout the operational life of the Proposed Development, alongside provision of public notices about potential hazards and risks on-site, will further help to minimise ongoing safety risks through the Proposed Development's operational life.

15.2.40 There are no direct adverse effects upon public rights of way or to the Applicant's proposed additional and improved public access to the Proposed Development Area.

[10] Calculation is 47 years x 66,330 tCO_2 (as shown in Table 16.6 and online submission).

Paths would be appropriately managed during construction for health and safety purposes.

15.2.41 The risk of ice throw posing a threat to members of the public is considered low due to the rare occurrence of significant icing in the south of Scotland. To minimise any residual risk, icing conditions will be monitored by the wind farm operator and public notices will be displayed across the Proposed Development Area.

15.2.42 Given the nature of the Proposed Development, and its remote location, the risk of a major accident or disaster is considered to be extremely low. The Principal Designer will ensure a Design Risk Assessment process is followed during the design phase to ensure designers fully assess risks and mitigate to a level deemed as low as reasonably practicable during the design stage as part of the requirements of the Construction (Design and Management) Regulations (2015).

15.2.43 During the operational phase of the Proposed Development, routine maintenance inspections will be completed in order to ensure the safe and compliant operation of all built infrastructure.

15.3 Aviation & Radar

Introduction

15.3.0 This section of the chapter considers the likely significant effects on aviation and radar associated with the construction, operation and decommissioning of the Proposed Development.

Statement of Competence

15.3.1 The aviation and radar assessment was conducted by Sam Johnson of RES. Sam is the Senior Aviation Manager at RES, with an MMath in Mathematics. Sam has over 20 years' experience in the aviation radar industry with over 15 years specifically in the area of wind farms. Sam is a member of the Renewable UK Aviation Working Group. and is Chair of Aviation Investment Fund Company Limited (AIFCL).

Guidance

15.3.2 This assessment has been prepared with reference to CAA Civil Aviation Publication (CAP) 764, Policy and Guidelines on Wind turbines (CAA, 2016). This is the primary guidance in relation to the assessment of wind turbines on aviation in the UK.

Scope of Assessment

Effects Scoped Out

15.3.3 Interference with surveillance systems and radar can occur when wind turbine blades are moving therefore potential effects during construction are not assessed.

15.3.4 No impacts on military radar were identified.

15.3.5 Upon decommissioning, The Ministry of Defence and the Defence Geographic Centre (AIS Information Centre) will be informed of the removal of wind turbines. Following this, no decommissioning effects are expected and are not considered further.

Effects Assessed in Full

15.3.6 The assessment identifies and considers the potential effects that the Proposed Development may have on civilian and military aviation and air safeguarding and, if required, the mitigation measures proposed to prevent, reduce or offset any potential adverse effects where possible. In relation to civil aviation assets it considers potential impacts on the Primary Surveillance Radar at Prestwick Airport and the NATS En-Route Ltd (NERL) radar at Lowther Hill and the potential mitigation measures identified to address these.

15.3.7 There is also a potential for impact on the Instrument Flight Procedures (IFPs) and VHF Communications equipment at Prestwick Airport.

15.3.8 The assessment is based on an evaluation of existing data sources and desk studies, and consultation with key stakeholders.

15.3.9 The effects of wind turbines on aviation interests are well known but the primary concern is one of safety. The two principal scenarios that can lead to effects on the operations of aviation stakeholders are:

- physical obstruction: wind turbines can present a physical obstruction at or close to an aerodrome or in the military low flying environment, which itself presents a health and safety risk or otherwise requires changes to flight routes in the area which brings about other operational effects; and
- radar/air traffic services (ATS): wind turbine clutter appearing on a radar display can affect the safe provision of ATS as it can mask unidentified aircraft from the air traffic controller and/or prevent them from accurately identifying aircraft under control. In some cases, radar reflections from wind turbines can affect the performance of the radar system itself.

15.3.10 In this context the scope of the assessment is to consider the impact of the Proposed Development on aviation stakeholders, including airports and other airfields, radar systems and air space users. This assessment also considers civil and military stakeholder aviation obstruction lighting requirements.

15.3.11 As standard, the MOD and the Defence Geographic Centre (AIS Information Centre) will be provided with the following information for incorporation on to aeronautical charts and documentation:

- the date of commencement of the Proposed Development.
- the exact position of the wind turbine towers in latitude and longitude;
- a description of all structures over 300 feet high;
- the maximum extension height of all construction equipment;
- the height above ground level of the tallest structure; and
- details of a visible and infrared aviation lighting scheme.

Baseline Characterisation

Study Area

15.3.12 Consideration is given to aviation infrastructure that is within operational range of the Proposed Development. Operational range varies with the type of infrastructure but broadly includes regional and military airports operating radar within 30 km of the Proposed Development, non-radar aerodromes within 17 km, parachute drops zones within 3 km, military Air Defence (AD) Radar and en-route radar systems up to 100 km from the Proposed Development (dependent on operational range).

Desk Study

15.3.13 The Applicant has a dedicated aviation manager who has provided input to the Proposed Development since its inception. This has included:

- civil and military radar line of sight (LoS) analysis;
- review relevant aviation charts;
- review of military low flying charts; and
- general aviation advice based on prevailing civil and aviation issues.

Significance Criteria

15.3.14 Significance criteria for aviation impacts are typically difficult to establish; they are not strictly based on the sensitivity of the receptor or magnitude of change but on whether the industry regulations for safe obstacle avoidance or radar separation (from radar clutter) can be maintained in the presence of the wind turbines.

15.3.15 Any anticipated impact upon aviation stakeholders which results in restricted operations is therefore considered to be of significance.

Assessment Limitations

15.3.16 No limitations have been identified that would affect the findings of the assessment, based on the information available at the time of writing.

Consultation

Table 13.1: Consultation Responses relating to Aviation & Radar

Consultee and Date	Scoping / Other Consultation	Issue Raised	Response / Action
ECU	Scoping	Scottish Ministers request that the Company contacts Defence Infrastructure Organisation and Glasgow Prestwick Airport for further information on Aviation Safety lighting and Low Flying Aircraft.	The Defence Infrastructure Organisation (DIO) were contacted in February 2021 and responded to say they would probably request a visible or infrared lighting scheme. Dialogue with Prestwick Airport has been ongoing since May 2020.
East Ayrshire Council (30.09.21)	Scoping	The Planning Authority will require a detailed assessment of aviation impacts to accompany any application to ensure any potential impacts are fully assessed and any appropriate mitigation detailed. It would be beneficial if the continued requirement for visible aviation lighting is explored with the Civil Aviation Authority to understand if there is any scope or possibility that this requirement might change and the need for visible lighting could be reduced or eliminated entirely. Early engagement with all relevant aviation bodies is encouraged.	An aviation lighting scheme has been agreed with the CAA.
Defence Infrastructure Organisation	Scoping	The airspace over the UK land mass is used to provide the UK Military Low Flying System to deliver essential military low flying training. The proposed development will occupy Low Flying Area 14 within which military fixed wing aircraft are permitted to fly down to 250 feet (76.2 metres) above terrain features. The development proposed will cause a potential obstruction hazard to these military low flying training activities. To address this impact, it would be necessary for the development to be fitted with aviation safety lighting. Therefore, in the	The DIO indicated a potential low flying impact only and indicated they are likely to request a lighting scheme. It is probable that they will accept an infrared only scheme.

Consultee and Date	Scoping / Other Consultation	Issue Raised	Response / Action
		interests of air safety, the MOD would request that the development be fitted with MOD accredited aviation safety lighting in accordance with the requirements of the Air Navigation Order 2016. MOD Safeguarding wishes to be consulted and notified about the progression of this proposal and any subsequent application(s)that may be submitted relating to it to verify that it will not adversely affect defence interests.	
Glasgow Prestwick Airport Ltd (17.09.21)	Scoping	Primary Radar Line of Sight (LOS) analysis at the proposed maximum wind turbine tip heights of 200m for the Sclenteuch Wind Farm - indicates that there is the potential that all wind turbines would be visible to the GPA primary radars. The turbines may impact the Instrument Flight Procedures (IFPs), specifically the Air Traffic Control Surveillance Minimum Altitude Chart (ATCSMAC). A potential impact raised by GPA since scoping is the impact on the VHF Communication masts at the airport.	Dialogue with Prestwick about the potential impact on their primary radar, IFPs and VHF Comms was initiated in 2020 and is ongoing.
NATS response	Scoping	NATS has indicated an impact from the Proposed Development on the Lowther Hill NERL radar.	Dialogue is ongoing with NATS to identify the most appropriate mitigation scheme.

Baseline

Civil Aviation

15.3.17 The Proposed Development is approximately 18 km south east of Glasgow Prestwick Airport (GPA).

15.3.18 GPA has indicated that the Proposed Development will have an unacceptable impact upon the primary radar at the Airport as it has LoS to all wind turbines at the Proposed Development. SPA has also indicated there may be an impact on the IFPs and VHF Communications equipment.

15.3.19 The Civil Aviation Authority requires the Proposed Development to have visible lighting to assist with air safety.

NERL

15.3.20 The Proposed Development is approximately 47 km north west of the NERL Lowther Hill radar.

15.3.21 NERL has indicated that the Proposed Development will have an unacceptable impact upon the Lowther Hill en-route radar as it has LoS to all wind turbines at the Proposed Development.

Military Aviation

15.3.22 The DIO has not indicated that the Proposed Development will have any unacceptable impact on military radar.

15.3.23 The DIO has highlighted a probable requirement for the Proposed Development to agree a suitable scheme of visible or infrared lighting to assist military aircraft in avoiding the Proposed Development.

Mitigation and Residual Effects

Predicted Operational Effects

15.3.24 Wind turbines have the potential to impact the performance of air traffic control radars. These impacts include:

- The creation of "false" targets, whereby the wind turbines present on the radar display. Multiple false targets can lead to the radar initiating false aircraft tracks.
- False returns can also cause track seduction, i.e. real aircraft tracks are ‘seduced’ away from the true position as the radar updates the aircraft track with the false return. This can lead to actual aircraft not being detected.
- Shadowing whereby the aircraft is not detected by the radar as it is flying within the physical ‘shadow’ of the wind turbine.

15.3.25 Due to physical proximity, wind turbines have the potential to breach the airport IFPs and impact VHF Communication mast.

15.3.26 Prior to mitigation, it is considered that the proposed development would affect the operation of the primary radar at Glasgow Prestwick Airport and Lowther Hill and may impact the IFPs and VHF Communications at GPA.

Proposed Mitigation

15.3.27 There are a number of mitigation options available to alleviate problems caused by wind turbines to aviation and aviation radar. Mitigation solutions are highly specific to the effect in questions. Consultation with relevant consultees is key to establishing the appropriate method of mitigation. A Radar Mitigation Scheme (RMS) will be agreed with GPA that will remove or reduce to an acceptable level, the impact of the Proposed Development on the Glasgow Airport primary radar. The RMS will be agreed prior to the Proposed Development becoming fully operational.

15.3.28 An RMS will be agreed with NATS that will remove or reduce to an acceptable level, the impact of the Proposed Development on the NERL Lowther Hill Radar. The RMS will be agreed prior to the Proposed Development becoming fully operational.

A full independent assessment will be commissioned to determine the extent of any impacts of the Proposed Development on the IFPs and the VHF Communications mast at GPA. If impacts are determined to exist, a mitigation scheme will be agreed with GPA.

15.3.29 A visible aviation lighting scheme has been agreed with the CAA and an infrared lighting scheme will be agreed with the DIO prior to the Proposed Development becoming fully operational.

15.3.30 The MOD aviation lighting scheme will consist of infrared obstruction lighting on some of the wind turbines. The CAA Aviation lighting scheme will consist of medium intensity visible 2000 candela lights on the nacelles of wind turbines T1, T2, T4, T5, T6, T7, T8 and T9. The lights on these wind turbines will be capable of being dimmed to 10% of peak intensity when the visibility measured at the Proposed Development by visibility measuring devices exceeds 5 km. No lights are required on the turbine towers.

Summary

15.3.31 The Proposed Development will potentially impact the GPA primary radar, IFPs and VHF Communications and the NERL Lowther Hill radar. In both cases it is expected that the impact can be mitigated with a suitable mitigation scheme. Infrared lighting will be agreed with the DIO for the MOD low flying requirements and a visible lighting will be agreed with the CAA.

15.4 Television and Telecommunications

Introduction

15.4.0 This section of the chapter summarises the potential television and telecommunications effects associated with the Proposed Development.

Guidance

15.4.1 Tall structures such as wind turbines may cause interference of nearby television and telecommunications links. As such, any links in the vicinity of the development must be identified and operators must be consulted.

15.4.2 The Ofcom Spectrum Information Portal[11] was used in the first instance to identify fixed microwave links crossing or adjacent to the Proposed Development Area.

15.4.3 A number of other telecommunications services in addition to fixed microwave links may be present, however most of these services are generally only affected if wind turbines are located in immediate vicinity. Furthermore, where other services are present, there is usually a supporting fixed microwave link to allow onward signal transmission, which would be identified in this assessment. It is therefore considered that the search for fixed microwave links, and discussion with identified operators, also covers all other services.

Scope of Assessment

Effects Scoped Out

15.4.4 Effects on television and telecommunications have been scoped out of detailed assessment for the following reasons:

- Operational effects on television / radio broadcasting: digital television is less likely to be affected by the atmospheric conditions that rendered analogue television unwatchable and does not suffer from reflection effects or ghosted image generation.
- It is not considered likely that radio broadcasting signals will be affected by the Proposed Development once operational. This is because i) the length of radio broadcast signal wavelengths are such that interference from wind turbines is unlikely and ii) any interference to the radio signal is unlikely to noticeably affect the audio signal.

[11] https://www.ofcom.org.uk/spectrum/information/spectrum-information-system-sis/spectrum-information-portal (last accessed 04/06/2021)

Microwave Fixed Links

15.4.5 Fixed microwave links are direct line-of-sight communication links between transmitting and receiving dishes placed on masts generally located on hilltops that vary in length from a few kilometres to over 70 km. They are used for the transmission of information to broadcasting masts for TV and radio and for the mobile telephone networks.

15.4.6 Telecommunications and broadcasting network operators were consulted during the scoping exercise. Openreach responded to confirm that the Proposed Development should not cause interference to BT's current and presently planned radio network. The Joint Radio Company Limited did not respond to scoping, however a search on the Ofcom Spectrum Information Portal has not identified any links that would be affected. The consultation of other operators identified in the search for fixed links is summarised in Table 13.2.

15.4.7 It is acknowledged that the wind turbine layout has changed since scoping however from information gained these particular assets do not feature within the Proposed Development Area and therefore it is expected that these stakeholders will remain unaffected.

Consultation

Table 13.2: Consultation Responses relating to Television & Telecommunications

Consultee and Date	Scoping / Other Consultation	Issue Raised	Response / Action
BT, 21/09/2021	Scoping	No issues raised	None
JRC	Scoping	No response received	Search of the Ofcom Spectrum Information Portal has not identified any affected links, therefore no action is necessary.
Airwave Solutions Limited, 01/10/2021	Other Consultation	No issues raised	None
Vodafone Limited, 07/10/2021	Other Consultation	No issues raised	None

15.4.8 With the information available to the Applicant, the Proposed Development does not directly affect microwave fixed links and the potential effect on microwave fixed links is not significant. Pre-construction checks would be undertaken to ensure this still remains the case nearer the time of construction.

Summary

15.4.9 The Proposed Development does not directly affect microwave fixed links and the potential effect on microwave fixed links is not significant

15.4.10 The potential effect of the Proposed Development is considered to be not significant with respect to other television or radio communication networks.

15.5 Shadow Flicker

Introduction

15.5.0 This section of the chapter summarises the potential effect of shadow flicker associated with the Proposed Development.

15.5.1 Wind turbines are tall structures which can cast long shadows when the sun is low in the sky. Given a conjunction of certain meteorological conditions (clear skies, enough wind for the wind turbines to be rotating and a low angle of the sun in the sky), observers close to a wind farm could experience a phenomenon commonly known as 'shadow flicker', where the rotating wind turbine blades pass between the sun and the observer creating an intermittent shadow. It is, however, part of the nature of long shadows that they pass any particular point relatively quickly and the effect, if present, lasts a short period of time, due to the movement of the sun across the sky. They are generally only observed in the period after dawn and before sunset as the sun is rising and setting.

Guidance

15.5.2 The following guidance documents have been referred to in undertaking the assessments:

- A.D. Clarke 'A Case of Shadow Flicker/Flashing: Assessment and Solution'[12], Technology Policy Unit, Open University, Walton Hall, Milton Keynes, UK
- Onshore wind turbines: planning advice[13]
- Planning practice guidance for renewable and low carbon energy[14]
- South Ayrshire Council in its Supplementary Guidance: Wind Energy[15]

[12] A.D. Clarke 'A Case of Shadow Flicker/Flashing: Assessment and Solution', Technology Policy Unit, Open University, Walton Hall, Milton Keynes, UK.
[13] Available online: https://www.gov.scot/publications/onshore-wind-turbines-planning-advice/ (last accessed 26/11/2020)
[14] "Planning practice guidance for renewable and low carbon energy" available online: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/225689/Planning_Practice_Guidance_for_Renewable_and_Low_Carbon_Energy.pdf (last accessed 26/11/2020)
[15] https://ww20.south-ayrshire.gov.uk/ext/committee/CommitteePapers2015/Leadership%20Panel/3rd%20November%202015%20public/LP-03Nov-Wind%20Energy-Supplementary%20Guidance%20-%20Appendix%201.pdf (last accessed 26/11/2020)

15.5.3 A technical paper by A D Clarke (the Clarke Report) indicates that dwellings situated within ten times the diameter of the wind turbine rotor could potentially experience annoyance from shadow flicker and reflectivity and therefore recommends a separation distance between the nearest wind turbine and properties of at least 10 rotor diameters. Scottish Government guidance[13] advocates that beyond this distance, shadow flicker should not be a problem. UK Government guidance[14] also states that 'only properties within 130 degrees either side of north, relative to the wind turbines can be affected at these latitudes in the UK – wind turbines do not cast long shadows on their southern side'.

Scope of Assessment

15.5.4 South Ayrshire Council's Supplementary Guidance: Wind Energy states that *"Developers will be required to assess the impacts of shadow flicker on adjoining properties. The design of their development should seek to eliminate the effects of shadow flicker or ensure neighbouring property do not experience the effects for more than 10 hours per year."*

15.5.5 East Ayrshire Council's Supplementary Guidance: Planning for Wind Energy (December 2017) similarly mentions that *"careful siting of turbines may be required to reduce or eliminate the potential for shadow flicker. When shadow flicker is likely to occur a shadow flicker assessment should be submitted, including mitigation measures that can be implemented to ensure no shadow flicker impacts occur."*

15.5.6 Wind turbines are to be located a minimum distance of 10 times the rotor diameter of the proposed wind turbines from any regularly occupied buildings not associated with the Proposed Development. Within a distance less than 10 rotor diameters, a shadow flicker assessment will be required.

South Ayrshire Council in its Supplementary Guidance requires properties within 2.5 km of any wind turbine to be assessed for potential impacts of shadow flicker. There are eight properties within 2.5 km but outside 10 rotor diameters in South Ayrshire and none of these eight are located in areas impacted by shadow flicker due to the geometry of the Proposed Development. The assessment was therefore carried out based on the 10 rotor diameter following A.D. Clarke, however in the event of shadow flicker being reported beyond this radius, reports will be investigated and mitigatory measures will be put in place.

Baseline Characterisation

Study Area

15.5.7 Properties have been assessed within a radius of 10 rotor diameters distance as per A.D. Clarke. A total of 83 properties were identified within this radius, 8 of which are currently listed as occupied in the UK address database. One property is unoccupied and another 74 properties are part of the consented the Carskeoch Caravan Park housing development to the south of Patna but not yet built. No exact locations for these consented properties are available but they were taken from the planning documentation as best estimates.

Desk Study

15.5.8 Impacts due to shadow flicker were assessed based on a 150 m rotor diameter, 200 m tip height machine.

15.5.9 The locations of the nearest neighbours to the proposed wind turbines that lie within, or close to, the distance considered appropriate for assessment according to relevant policy are shown in Figure 13.1 in relation to the Proposed Development. H24 is unoccupied and assumed to remain vacant throughout the lifetime of the Proposed Development. The minimum occupied house-to-wind turbine separation is 1194m.

15.5.10 A shadow flicker analysis has been implemented using the Shadow Flicker module of the WindPRO software package. This model accounts for latitude and longitude of the Proposed Development and uses a model of the sun's position in the sky throughout the year to calculate shadow lengths, positions and times. A digital terrain model was used in the assessment to take account of the topography between receptors and wind turbines.

Assessment Limitations

15.5.11 The actual instances of shadow flicker experienced at the distances considered will always be less than those predicted in the model as the following assumptions have been made in those calculations:

- the wind turbines rotors are always turning (in reality this only occurs when there is sufficient wind to turn the rotor blades and the wind turbines are not undergoing maintenance);
- the orientation of the wind turbines is always aligned so as to cast a sufficient shadow towards the house (in reality the wind turbines automatically turn to face the prevailing wind which may, or may not, create this condition)
- the sunshine is always of sufficient intensity to cause flicker (in cloudy skies it is unlikely to do so - [IPCC, 2005] estimates that the Proposed Development experiences cloud cover approximately 75% of the year);
- All receptors have relevantly orientated windows (in reality this may not be true); and

- No trees or walls obscure the view of the wind turbines and hence block any potential shadow flicker (in reality many houses have trees or bushes near to the property that may obscure the view to the Proposed Development).

Assessment results

15.5.12 There are 83 properties within 10 rotor diameters of any wind turbines. Of these, one is unoccupied, eight are occupied and 74 are part of the Carskeoch Caravan Park Housing Development which is currently consented but not built.

15.5.13 Beyond 10 rotor diameters of any wind turbine location, no properties are expected to experience significant shadow flicker.

Mitigation and Residual Effects

15.5.14 All reports of shadow flicker events will be investigated, regardless of the distance of the property to the Proposed Development.

15.5.15 In the event of shadow flicker causing a nuisance, a range of mitigation measures could be incorporated at the operational phase of the Proposed Development to reduce the instance of shadow flicker. Mitigation measures include planting tree belts between the affected residential property and the responsible wind turbine(s), installing blinds at the affected residential property or shutting down individual wind turbines during periods when shadow flicker could occur.

Summary

15.5.16 Eight occupied and 74 consented properties within 10 rotor diameters may potentially experience shadow flicker from the Proposed Development, none of which have financial interest with the Proposed Development. It is therefore concluded that the Proposed Development would not cause a significant effect upon amenity due to shadow flicker.

16 Synergistic Effects, Residual Effects and Schedule of Environmental Mitigation

16.1 Synergistic Effects

16.1.1 An assessment of synergistic effects ensures that the assessments provided in the Environmental Impact Assessment Report (EIAR) for each topic are not considered in isolation. Chapters 7 and 8 of the EIAR assessed the biological environment (Ecology and Ornithology). Chapters 5, 6, 9 and 10) assess the physical environment (LVIA, Cultural Heritage, Hydrology and Forestry) and Chapters 11, 12, 13, 14, 15 and 16 assess population, human health and climate change (Traffic and Transport, Noise, Socioeconomics, Climate Change, Aviation, Safety and Other Issues and Mitigation). It is acknowledged that there are also some potential overlaps between the physical environment and population and human health.

16.1.2 This assessment considers the potential synergistic effect of related residual effects during construction and operation. A synergistic effect during decommissioning is considered to be of similar or less significance than that created during construction and therefore they are discussed together below.

Construction and Decommissioning

16.1.3 During the construction phase and decommissioning phases, potential adverse synergistic effects are limited to the Proposed Development Area where there will be heavy plant operations, earth works, forestry operations and vehicle movements. These could result in potential synergistic effects upon physical and biological receptors including where there are overlaps between ecology, hydrology and hydrogeology. These effects would be temporary in nature and will be managed through a CEMP, CTMP and PMP and in isolation have been assessed in the EIAR as not significant. In addition, these potential effects will also be monitored by an ECoW and if deemed necessary a Planning Monitoring Officer enforced through planning condition(s). Given the limited number and extent of receptors, the limited effects predicted and their temporary nature, the synergistic effects during construction and decommissioning phases are considered not significant.

Operation

16.1.4 Potential synergistic effects during the operational phase relate primarily to overlaps between physical and human receptors and are limited to areas which are within or close to the Proposed Development Area where there may be a combination of potential visual, noise and shadow flicker effects.

16.1.5 The EIAR predicts that there are no significant adverse effects in isolation for noise, visual effects of aviation warning lighting and shadow flicker but there may be potential significant adverse visual effects of turbines upon residential receptors within 2 km of the Proposed Development. However, none of the receptors will be subject to effects which are judged to breach the Residential Visual Amenity Threshold. A combination of all these effects at once is not possible and in sequence would be very limited in occurrence and duration. It is not considered that the synergistic effects would become overbearing such that these places become unpleasant places to stay.

16.1.6 Potential visual effects are predicted on nine of the sixteen representative viewpoints particularly for sensitive receptors located up to 7 km from the Proposed Development. In addition, settlements of Patna and Waterside within the Doon Valley will experience moderate and significant effects on views and significant effects are also predicted to affect sections of local core paths within Doon Valley, Girvan Valley and Patna and Straiton. As these effects on views are only predicted to affect short sections of the core paths, it is not predicted to prevent or reduce the use of the paths. The Applicant is offering to create a walking and nature trail called Keirs Glen Trail which would include the creation of a circular walking trail, with car parking, biodiversity enhancements and information boards which will enhance access around the local area which could potentially increase the local tourist economy. Furthermore, the Applicant has offered to create a local council and communities tailored local benefit package as part of the proposal.

16.2 Schedule of Mitigation

Introduction

16.2.1 Following the implementation of mitigation, potential significant adverse effects are restricted to isolated landscape and visual effects upon limited receptors within close proximity of the Proposed Development, as noted below in Table 16.1: Schedule of Mitigation. These are effects which are commonly associated with wind farms and should be duly considered by the Energy Consents Unit (ECU) in a decision that is balanced with the increase in renewable sourced electricity as well as the

other environmental and socio-economic benefits which the Proposed Development provides.

16.2.2 The Schedule of Mitigation presents a summary of the mitigation and enhancement measures identified through the Environmental Impact Assessment (EIA) process to which the Applicant has committed to implementing. It indicates how these mitigation measures will be implemented. In addition to summarising mitigation, enhancement measures identified in the topic specific chapters of this EIAR are also highlighted.

16.2.3 The mitigation and enhancement measures included in this EIAR fall into five broad categories:

i) Measures incorporated during the design process for the Proposed Development;
ii) Measures required following receipt of planning permission, prior to construction;
iii) Measures to be implemented during construction;
iv) Measures required through operational management; and
v) Measures likely to be required during decommissioning.

16.2.4 Table 16.1 below summarises the mitigation and enhancement measures proposed for each issue identified by the EIA process. The measures are divided into the five categories outlined above, with the numbers in brackets within the table corresponding to those in the list above. It should be noted that the table presents a summary only; further details on the mitigation and enhancement measures are included within each chapter and associated reports.

16.2.5 A full description of the Proposed Development, together with information on the embedded mitigation measures and activities that will take place within the development, construction and operational phases are provided within Chapter 2: The Proposed Development/Project Description. Details of construction and operation are also provided within this chapter.

Table 16.1 – Summary of effects, schedule of mitigation and residual effects

Topic	Assessment in EIA Terms				
	Potential Significant Effects	Proposed Mitigation/Enhancement	Timing	Residual Additional Effects	Proposed Condition(s)
Chapter 2 Proposed Development					
Borrow Pits	N/A	Final borrow pit locations within borrow pit search area would be subject to detailed ground investigations to confirm suitability of material. A Borrow Pit Management Plan will be agreed with SEPA and the planning authorities prior to the commencement of construction. The Borrow Pit Management Plan will be included in the Construction Environmental Management Plan (CEMP).	ii)Following receipt of planning permission; prior to construction	N/A	An Outline Borrow Pit Management Plan is detailed in Technical Appendix 2.2.
Landscape and Visual Impact	Landscape effects during construction will be largely limited to the host Landscape Character Types (LCT)(s), as effects beyond the extents of the site will be indirect and largely related to the construction of the partially erected turbines. As such, effects on the wider LCTs are not considered to be any greater than operational effects. Potential visual effects during the construction phase, beyond those experienced at the site level where low level construction activity, will be apparent in certain views, these will largely relate to views of tall cranes and turbine construction experienced from the wider study area. These effects will be transient and change throughout the construction phase as wind turbines are gradually constructed in sections. As such, visual effects during the construction phase are unlikely to exceed the level of effect associated with operational visual effects. During operation, the presence of the Proposed Development will physically affect the landscape of the Proposed Development Area, potentially altering its character. Beyond the immediate surrounding of the Proposed Development Area, the Proposed Development may influence the character of adjacent landscapes. For the most part, the presence of the Proposed Development in views from a particular LCT is unlikely to lead to a significant effect on the character of that LCT. The main potential effects of the Proposed Development on visual amenity arise from the presence of the wind turbines in views. The other elements of where the Proposed Development Area may give rise to significant effects on views is where the Proposed Development itself is a key feature in the outlook. Views of the wind turbines may affect the outlook from residential properties to the extent that the residential visual amenity of the occupants may be affects however, it is not considered that such	Embedded mitigation (outlined in Chapter 3: Design Evolution and Alternatives) has been considered as part of the iterative design process. The appearance of the Proposed Development from key locations played an important role in the progression of the layout design of the Proposed Development. Construction of the turbines and associated infrastructure will be undertaken in line with the Construction Environmental Management Plan (CEMP). This includes vegetation and soil remove, storage and replacement, vegetation restoration and stream crossings. Re-vegetation strategies – disturbed areas will be restored, and new planting established as appropriate	i) Incorporated into design; pre-construction iii)During construction iii)During construction	Landscape Character: Significant effects are predicted to extend across the Proposed Development Area and the immediately surrounding landscape during construction and operation During operation, there will be significant effects to LCTs 17b, 10 and 12. Visual Receptors: Significant visual effects are predicted for sensitive receptors including viewpoints 1, 2, 3, 4, 5, 6, 7, 9 and 11). Significant effects are predicted on sections of a number of routes within approximately 5 km of the Proposed Development Area (Minor roads, B741, B7045, Patna to Straiton Core Path, Core paths within the	The preparation and adherence to a CEMP will be required through a planning condition. A draft CEMP has been provided in Technical Appendix 2.1.

	effects would occur beyond 2 km from the turbines. The potential effects during operation may be significant where the Proposed Development affects views that are critical to the experience of another landscape. For the most part, the presence of the Proposed Development in views from a particular LCT is unlikely to lead to a significant effect on the character of that LCT. The Proposed Development may affect local landscape designations by altering the qualities for which they have been designated. It is considered that these qualities are only likely to be significantly affected, where significant effects are identified on the LCTs within the designation. The main potential effects of the Proposed Development on visual amenity arise from presence of the wind turbines in views. The theoretical visibility of the turbines is indicated in the ZTV (Figure 5.2.1), and effects could potentially occur across this area. Effects are only likely to be significant where the wind turbines are closer to the viewer or form a prominent feature in a valued view. The other elements of the Proposed Development may give rise to significant effects on views where the site itself is a key feature in the outlook. This is likely to be limited to local views, and other project elements (e.g. tracks, substation, borrow pits) are unlikely to affect wider views. Views of the wind turbines may affect the outlook from residential properties to the extent that the residential visual amenity of the occupants may be affected. Based on established approaches, it is not considered likely that such effects would occur beyond 2 km from the turbines, and so a focused assessment of effects on properties within this distance is carried out.			Doon Valley and around Straiton) Residential Visual Amenity: Receptors within approximately 2 km of the Proposed Development are assessed in the Residential Visual Amenity Assessment (RVAA) to have the potential to experience a significant visual effect, however none of the effects are assessed as breaching the Residential Visual Amenity Threshold.	
Aviation Lighting	Aviation lighting is predicted to have no significant effect on landscape character as the Proposed Development will introduce lights in views where other light sources are often visible.	Use of variable lighting intensities to reflect meteorological conditions. The use of cardinal or peripheral lighting. Directional lighting, whereby the maximum intensity of the light is only seen by viewers at the same elevation as the light.	i)Incorporated into design iv)Operation	No significant effect.	Condition to allow new technologies to be considered should they become available prior to construction of the Proposed Development (if consented).

Chapter 6 Cultural Heritage					
Asset 14	Potential construction impact on Asset 14 as it is located close to the proposed crane hardstanding at Turbine 9.	Fencing off of Asset 14 prior to construction activity to avoid accidental damage during construction ensuring no effects.	ii) Following receipt of planning permission; prior to construction	No significant effect.	Condition requiring a programme of investigation and Mitigation agreed with WoSAS and recorded in a Written Scheme of Investigation.
Asset 1	A single recorded heritage asset, Asset 1, has the potential to be impacted by the Proposed Development as the asset intersects with the area of a borrow pit search area. The asset itself has been assessed to be of negligible value. Should the entire asset be removed by quarrying during construction, the magnitude of impact would be high resulting in a very slight adverse significant effect.	Initial investigations to establish the extent of the asset and fencing off to avoid impacts during construction. In addition, a programme of investigation and mitigation through a watching brief or strip map and sample programme as deemed appropriate. Programme of mitigation agreed with West of Scotland Archaeological Service (WoSAS) and recorded in a Written Scheme of Investigation which would detail the methods and standards of investigation and reporting to be adhered to.	ii)Following receipt of planning permission; prior to construction		
Chapter 7 Ecology Assessment					
Bats	The impact of the Proposed Development on common and soprano pipistrellas, Nathusius's pipistrelle and *Nyctalus sp.* during operation is predicted to be medium negative resulting in an effect which is not significant at the local level. The impact of the Proposed Development on Myotis bat species is considered to be low negative resulting in an effect which is not significant at the local level.	Felling will be undertaken within 96 m of wind turbines with a hub height of 105 m and within 75 m of wind turbines with a hub height of 125 m. This is to ensure a 50 m buffer between wind turbine blade tip and nearest woodland edge.	i) Incorporated during design process. Preconstruction	Moderate adverse effect for common, soprano and Nathusius's pipistrelle and *Nyctalus sp*. Bats. Minor adverse effect for Myotis bats.	
Design	No significant effect due to embedded mitigation.	Embedded mitigation has been considered as part of the iterative design process and measures have been proposed at the outset of the Proposed Development. A CEMP will be produced prior to construction works commencing. This will be updated throughout the pre-construction, construction and post construction phases. Technical Appendix 2.1 contains the draft CEMP. An Environmental Clerk of Works (ECoW) will be present during the enabling works and throughout the construction phase of the Proposed Development. The ECoW will provide advice so works can be carried out in accordance with environmental measures detailed in the CEMP and to monitor compliance with relevant legislation and good practice.	i)Incorporated during design process. Preconstruction ii)Following receipt of planning permission; prior to construction iii) During construction ii)Following receipt of planning permission; prior to construction iii)During construction iv)Operation iii)During construction	No significant effect	The preparation and adherence to a CEMP will be required through a planning condition. A draft CEMP has been provided in Technical Appendix 2.1. An ECoW will be required through a planning condition and present during the enabling works and throughout the construction phase of the Proposed Development. A Habitat Management Plan will be required through planning condition to capture habitat enhancement measures.

Badgers	No significant effect due to embedded mitigation.	A buffer of at least 100 m has been left between the Proposed Development and confirmed badger setts to minimise disturbance to badgers with the Proposed Development Area.	i) Incorporated during design process; prior to construction		
Otters	No significant effect due to embedded mitigation.	A buffer of at least 30 m has been left between Proposed Development and areas that held potential to be used by otters as a couch (over-grown resting place).	i) Incorporated during design process; prior to construction		
Habitats	No significant effects predicted on all of the Important Ecological Features (IEF)s and no cumulative effects on IEFs.	Detailed mitigation measures will be provided in the CEMP for protection of habitats. Habitat enhancement measures targeted at blanket bog are proposed in the form of a Habitat Management Plan. Where possible, micrositing of infrastructure will be undertaken to ensure construction does not impact on the most sensitive habitats and any other identified ecological constraints and will be completed in consultation with the ECoW. Any land degraded by construction and not required for the operation of the Proposed Development, will be restored as soon as possible after construction is completed.	i) Incorporated during design process. Preconstruction ii)Following receipt of planning permission; prior to construction (i)Incorporated into design; prior to construction iii) Construction & iv) Operation iv)Operation		
Fish and freshwater pearl mussel	No significant effects predicted.	A comprehensive Water Quality and Fish Monitoring Plan (WQFMP) will be produced in consultation with NatureScot and local fishery boards to monitor the watercourses and the species that depend on them. Operational monitoring is proposed following completion of the pre-construction and construction monitoring.	ii)Following receipt of planning permission; prior to construction iii)During construction iv) Operation		
Watercourses	No significant effects predicted.	Watercourse protection measures will be adopted within the CEMP and include protection against siltation, sedimentation, and pollution incidents. Robust mitigation measures will be installed prior to works commencing to ensure the impacts on watercourses are minimised. Mitigation throughout the Proposed Development will be regularly monitored and	i) Prior to receipt of planning permission; prior to construction iii)Construction		

		maintained/replaced as required. Refuelling of vehicles and machinery will be carried out at a central designated area, on an impermeable surface, located at least 60 m away from any watercourse.			
Protected Species	No significant effects predicted.	A Species Protection Plan (SPP) is proposed as part of the CEMP and will be agreed by NatureScot prior to the commencement of construction, detailing measures to be implemented before and during construction to protect species present in the Proposed Development Area. The Operation Environmental Management Plan (OEMP) will detail mitigation measures required during the operational phase relating to protected species to ensure ongoing compliance with relevant environmental legislation.	iI)Following receipt of planning permission; prior to construction iii)Construction ii)Following receipt of planning permission; prior to construction iv)Operation		
Chapter 8 Ornithology Assessment					
Design	No significant effects predicted.	Embedded mitigation is built into the Proposed Development to minimise the potential for any negative effects associated with the Proposed Development, and to ensure compliance with the Wildlife and Countryside Act (WCA) (1981). This includes the appointment of an ECoW which will be implemented through a CEMP, agreed with the local planning authorities in consultation with NatureScot and SEPA. The ECoW will be present on-site during enabling works and throughout the construction period.	i)Incorporated into design; prior to construction ii)Following receipt of planning permission; prior to construction iii)Construction	No significant effect	
Goshawks	No significant effects predicted.	Should breeding goshawk be found within disturbance distances of 500 m during the construction phase, embedded mitigation measures will be implemented to prevent or minimise disturbance to breeding goshawks including pre-construction nest monitoring for breeding activity, implementing and maintaining an appropriate exclusion zone around any active nests, as well as monitoring for disturbance and controlling construction traffic.	i)Incorporated into design; prior to construction iii)Construction		

Chapter 9 Geology, Hydrology and Hydrogeology Assessment					
Geology and the water environment	No significant effects predicted.	Any likely effects of the Proposed Development on geology or the water environment identified by the assessment have been addressed and mitigated by the design. The application of good practice guidance (including The Water Environment (Controlled Activities) (Scotland) Amendment Regulations, 2013 (CAR)) to be implemented as standard.	i)Incorporated into design; prior to construction iii)Construction iv)Operation v)Decommissioning	No significant effects.	
Peat and peat management	No significant effects predicted.	Areas of deep peat have been avoided by the Proposed Development design and a site-specific peat landslide and hazard risk assessment has been prepared to inform the Proposed Development design. In addition, a site-specific peat management plan has been prepared (shown in Technical Appendix 9.2). 674 m of floating tracks are to be considered in areas where peat is in excess of 1 m for 100m at least. In addition, it is proposed a geotechnical risk register is maintained during the construction and post construction phases of the Proposed Development (as seen in Technical Appendix 9.1 Peat Landslide Hazard and Risk Assessment (PLHRA)). Good construction practice and methodologies prevent peat instability within areas that contain peat deposits.	i)Incorporated into design; prior to construction iii)Construction		PHLRA would be maintained by the Applicant and secured by a planning condition.
Watercourses	No significant effects predicted.	A 50 m buffer has been applied to watercourses and, with the exception of four watercourse crossings, where practical any proposed construction activities or infrastructure has been located outside of this buffer. The layout of the access track was design to minimise the requirement for watercourse crossings. Watercourse crossings would be subject to maintenance requirements under CAR.	i)Incorporated into design; prior to construction		
Groundwater Dependent Habitats	No significant effects predicted.	Measures, such as permeable access tracks and regular cross track drains, have been proposed to safeguard existing water flow paths and maintain existing water quality. In addition, the ECoW would ensure existing surface water flow paths, and water flushes are maintained.	i)Incorporated into design; prior to construction iii)Construction		
Water quality	No significant effects predicted.	Water quality monitoring prior to any construction activity and during the construction phase would be undertaken for the surface water catchments that serve the Proposed Development to ensure that none	ii)Following receipt of planning permission; prior to construction iii)Construction		

		of the tributaries of the main channels are carrying pollutants or suspended soils.			
Fluvial Flood Risk	No significant effects predicted.	Sustainable Drainage Systems (SuDS) would be incorporated in the aim to mimic pre-development run-off conditions and balance or throttle flows to the rate of run-off that might have been experienced at the Proposed Development Area prior to development.	ii) Following receipt of planning; prior to construction		
Water Abstraction	No significant effects predicted.	Any water abstractions would only be made with authorisations from SEPA and in accordance with CAR. Along with good practice measures	iii)Construction		
Good practise measures/CEMP	No significant effects predicted.	Good practice measures would be applied in relation to pollution risk and management of surface run-off rates and volumes. This would form part of the CEMP to be implemented for the Proposed Development. In addition, a Pollution Prevention Plan would be agreed with SEPA and adhered to on site.	ii)Prior to construction iii)Construction ii)Following receipt of planning; prior to construction iii)Construction		
Chapter 10 Forestry					
Forest Plan	The Forestry Study Area extends to approximately 650.1 ha and comprises of privately owned and managed woodlands within the Proposed Development Area. Felling would occur on 113.5 ha for construction of the Proposed Development and the species composition of the forest would change as a result. In particular, the area of conifer woodland would decrease by 52 ha. Overall, the area of unplanted ground would increase with a net loss of woodland area of 57.1 ha.	A Wind Farm Forest Plan detailing existing crop and forestry information will be provided. Field surveys and a desk based assessment will also be carried out as necessary which will include details on species, planting year and felling and restocking plans where available.	i)Incorporated into design; prior to construction	No significant effect	
Keyholing	No significant effects predicted.	A 2.9 ha (97 m) keyhole was adopted around wind turbines 1 – 4 and wind turbine 8 and a 1.76 ha (75 m radius) keyhole was adopted around all other wind turbine locations. These keyholes are for construction, operation and environmental mitigation. There would be an additional area for disturbance at each wind turbine location with a 75 m keyhole, which would accommodate the infrastructure required for the erection of the proposed wind turbine. A 10 m buffer will be applied around each other item of temporary and permanent infrastructure, in addition to area required	i)Incorporated into design; prior to construction iii)Construction iv)Operation ii)Following receipt of planning permission; prior to construction		

		for the infrastructure. An indicative 30 m corridor has been applied to all new access tracks and upgraded existing tracks to be used for wind turbine delivery and construction purposes.	iii)Construction		
Compensatory Planting	No significant effects predicted.	The Applicant is committed to providing appropriate compensatory planting to mitigate the loss of woodland area. The extent, location and composition of such planting will be agreed with Scottish Forestry prior to commencement of construction of the wind farm.	i)Incorporated into design; prior to construction		
Chapter 11 Traffic and Transport					
General Construction Traffic	During construction, the Proposed Development would lead to a temporary increase in traffic volumes on the study road network however would fall considerably outside the peak period of construction. The maximum traffic impact associated with construction is predicted to occur in Month 3 of the construction programme with the greatest impact occurring along the A713, to the north of the main site entrance. At peak construction, the Proposed Development will result in 88 Heavy Goods Vehicles (HGV) movements per day and 35 cars and lights.	A website will be updated regularly to provide latest information on traffic movements associated with vehicles accessing the Proposed Development Area. A Construction Traffic Management Plan (CTMP) will be implemented during the construction phase.	iii)Construction	No significant effect	
Severance	No significant effects predicted.	CTMP proposals	ii)Prior to construction; via a condition of consent iii)Construction		
Driver Delay	No significant capacity issues are expected on any of the roads within the study area due to additional construction traffic movements associated with the Proposed Development as background traffic movements are low, the links are reasonable standard and appropriate mitigation is proposed.	CTMP Proposals and improved signage	ii)Prior to construction; via a condition of consent iii)Construction		
Pedestrian delay and amenity, fear and intimidation	No significant effects predicted.	CTMP and Path Management Plan proposals	ii)Prior to construction; via a condition of consent iii)Construction		
Accidents and Safety	No significant effects predicted.	CTMP proposals and improved site entrance design to East Ayrshire Council (EAC) standards	i)Incorporated into design ii)Prior to construction; via a condition of consent iii)Construction		

Abnormal Invisible Loads	No significant effects predicted.	An Abnormal Invisible Loads (AIL) Route Survey Report will be produced to identify constraint points. An AIL Management Plan will be developed which includes the Abnormal Load Transport Management Plan.	i)Prior to construction		
Footpaths and trails	During construction, the assessment of significance suggests that core path users would experience significant effects, prior to the application of mitigation measures.	A Path Management Plan is proposed.	ii)Following receipt of planning permission; prior to construction		
Chapter 12 Noise					
Operational Noise	Predicted operational 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.	Due to consideration of noise impacts throughout the design of the Proposed Development (embedded mitigation measures in the turbine layout) no further mitigation measures are required due to the noise levels being below noise limits derived in accordance with ETSU-R-97.	i)Incorporated into design; prior to construction ii)Following receipt of planning permission; prior to construction iv)Operation	No significant effect	Technical Appendix 12.8 details the proposed noise levels to be enforced through a planning condition proposed to provide a degree of protection to nearby residents in the form of limits relating to noise level and tonality.
Construction Noise	A construction noise assessment found that construction noise levels are predicted to temporarily exceed construction noise criteria at nearby properties although appropriate mitigation measures have been identified.	All activities will be undertaken with measures to reduce noise levels with regard to practicality and cost. 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 situated as far away as reasonably possible from residential properties and where necessary and appropriate, acoustic barriers could be used to screen them. The movement of vehicles to and from the site would be controlled and employees instructed to ensure compliance with the noise control measures adopted. Site operations will be limited to 0700 – 1900 Monday to Saturday except during turbine erection and commissioning or during periods of emergency work. Mitigation measures will be considered should it be necessary to reduce noise levels from the conservative predicted levels to adhere to the 55 dB(A) target level for Saturdays 1300 – 1900. These are of the following: - Reduce the number of construction activities occurring simultaneously;	ii)Following receipt of planning permission; prior to construction iii)Construction		Construction noise mitigation measures would be implemented as part of the CEMP – would be required to be agreed as a condition of consent

		- Restrict the distance of construction activity from nearby properties during these times; & - Reduce construction traffic as appropriate.			
Vibration and air overpressure	No significant impact on nearby residents should the mitigation measures be adopted.	In regard to blasting, the following mitigation measures will be implemented: - Good practice on blasting, as recommended by Planning Advice Note (PAN) 50 'Controlling the environmental effects of surface mineral workings' shall be followed; - The vibration and air overpressure reduction methods outlined in Section 8.6.9.2 of BS 5228-2:2009 shall be adhered to where appropriate; - Advance warning shall be given to nearby residents; - Blasting should only occur between the hours of 0800-1800 on Mondays-Fridays or between the hours of 0800-1300 on Saturdays; and No more than three blasts per day should occur.	iii)Construction		
Chapter 13 Socioeconomics					
Community benefit	No significant effects predicted.	The Applicant is offering to create a walking and nature trail called Keirs Glen Trail. This would include the creation of a circular walking trail, with car parking, biodiversity enhancements and information boards. This will help to create new routes for visitors, tourists and the local community to use for outdoor pursuits, exercise and wildlife interests. This has the potential to increase footfall within the local area and have a positive effect on the tourism economy. Furthermore, the Applicant is engaging with local councils and communities for information on priority aims and projects in their area to provide a tailored local benefit package as part of the proposal. The Applicant is also offering to provide a community benefit fund which is expected to be in line with the Scottish Government Good Practice Principles on Community Benefit.	ii) Following receipt of planning permission; prior to construction	No significant effect	

Paths and Trails	Core path 7 identified as having moderate significant effect from the Proposed Development during construction as the path passes through the Proposed Development Area. Several of the core paths (including Core Path 7 Patna to Straiton) around Straiton, Doon Valley and the A713 have been assessed as having a moderate significant effect during operation however this will only be experienced in short sections along the route where turbines are visible.	The disruption to the access for paths within the Proposed Development Area will be minimised through the Path Management Plan included in the CEMP.	i)Incorporated into design; prior to construction ii)Following receipt of planning permission; prior to construction		
Chapter 14 Climate Impact Assessment					
Climate Change	The Proposed Development will have expected net emissions of 164,088 t CO_2 eq. The results from the carbon calculator determined that the Proposed Development would have effectively paid back its expected debt from manufacture, construction, impact on habitat and decommissioning within 2.5 years if it replaced the fossil fuel-mix electricity generation method. Based on the minimum and maximum net emission scenarios, the analysis shows that the payback time for fossil fuel-mix generation ranges between 1.5 to 4.4 years respectively. The overall net impact of the Proposed Development is positive as over its 50 year lifespan it is expected to generate over 47 years' worth of clean energy if it replaced fossil fuel -mix electricity generation. This could result in expected CO_2 emission savings of over 3,117, 510 tonnes of CO_2 when replacing fossil fuel-mix electricity generation.	No significant effects to mitigate	N/A	No significant effect.	
Chapter 15 Aviation, Safety and Other Issues					
Lightning strikes	No significant effects are predicted.	Wind turbines are equipped with lighting conductors as mitigation to lightning strikes which could damage internal components	i)Incorporated into design; prior to construction	No significant effect	
Air quality	No significant effects are predicted.	Relevant mitigation measures for air quality, dust and pollution control will be captured within the CEMP.	i)Incorporated into design; prior to construction ii)Following receipt of planning permission; prior to construction		
Aviation - Radar	The Proposed Development has the potential to impact the performance of air traffic control radars from the creation of 'false' targets, shadowing and false returns. In addition, wind turbines have the potential to breach the airport Instrument Flight Procedures (IFPs) and impact Very High Frequency (VHF) Communication mast. The Proposed Development has the potential to affect the operation of the primary radar at Glasgow Prestwick Airport (GPA) and Lowther Hill and may impact the IFPS and VHF Communications at GPA.	A Radar Mitigation Scheme (RMS) will be agreed with GPA that will remove or reduce to an acceptable level, the impact of the Proposed Development on the Glasgow Airport primary radar. An RMS will also be agreed with National Air Traffic Services (NATS) that will remove or reduce to an acceptable level, the impact of the Proposed Development on the NATS En-Route Ltd (NERL) Lowther Hill Radar. A full independent assessment will be commissioned to determine the extent of any impacts of the Proposed Development on IFPs	i)Incorporated into design; prior to construction ii)Following receipt of planning permission; prior to construction.		

		and VHF Communications mast at GPA. A mitigation scheme will be agreed with GPA if impacts are determined to exist on the IFPs and VHF Communications mast at GPA.			
Aviation – lighting	Significant landscape and visual effects associated with aviation lighting are judged to be limited. During night-time conditions, for most of the proposed lit turbine hours, will be darker with the proposed lighting and other light sources (if visible). As such, the window for landscape effects, and effects on many of the associated key characteristics and special qualities (most of which can only be appreciated during daytime), is limited. Given that the Proposed Development will introduce lights in views where other light sources are often visible, no significant effects are predicted on landscape character, or are judged to compromise the special qualities of designated or protected landscapes. Therefore, that the matter of visible aviation lighting assessment is wholly a visual concern as without being able to see and fully appreciate the features of the landscape and the composition of views it is not possible to carry out a meaningful landscape character assessment In terms of visual effects, no significant visual effects are predicted for Viewpoints 2 (Waterside, Doon Valley Railway), 4 (Patna) and 11 (Dalmellington) as these locations have already been influenced by close proximity artificial lighting within these settled low lying areas. Significant effects have been identified for Viewpoint 15 (Cornish Hill) as the Proposed Development will introduce artificial lighting into a wide expanse of relatively dark view, resulting in the red lights on the Proposed Development creating a notable change in these dark views. This significant effect will only occur in the 2000 cd maximum brightness scenario. This is a less realistic worst case, since lights will only be at full brightness during conditions of limited visibility (which will limit actual visibility of the lights). When atmospheric visibility is greater than 5 km, the intensity of the lights will be reduced to 200 cd. At 12.5 km distance, only the latter scenario is likely to be seen from Viewpoint 15. This means that significant effects on views from Cornish Hill and other locations within the Galloway Dark Sky Park and Merrick WLA are unlikely in practice, and would only be experienced by a small number of visual receptors visiting this location at dusk and by night. Significant cumulative visual effects at night have been identified for Viewpoint 15, where the potential spread of artificial lighting from proposed wind farms will give rise to significant total effects, though additional effects are not predicted to be significant. Again, these effects would only occur in the less likely 2000 cd scenario. No	A visible lighting scheme has been agreed with the Civil Aviation Authority (CAA) and an infrared lighting scheme will be agreed with the DIO prior to the Proposed Development becoming fully operational. The MOD aviation lighting scheme will consist of infrared obstruction lighting on some of the wind turbines. The CAA Aviation lighting scheme will consist of medium intensity visible 2000 candela lights on the nacelles of wind turbines T1, T2, T4, T5, T6, T7, T8 and T9. The lights on these wind turbines will be capable of being dimmed to 10% of peak intensity when the visibility measured at the Proposed Development by visibility measuring devices exceeds 5 km.	ii)Following receipt of planning permission; prior to construction		

	significant cumulative effects are predicted for the more likely 200 cd scenario. Technical Appendix 5.5 details the Aviation Lighting Night-Time Assessment. The Defence Infrastructure Organisation (DIO) has highlighted probable requirement for the Proposed Development to agree a suitable scheme of visible or infrared lighting to assist military aircraft in avoiding the Proposed Development.				
Shadow Flicker	There are 83 properties within 10 rotor diameters of any wind turbines. Of these, one is unoccupied, eight are occupied and 74 are part of the Carskeoch Caravan Park Housing Development which is currently consented but not built. Beyond 10 rotor diameters of any wind turbine location, no properties are expected to experience significant shadow flicker.	A range of mitigation measures will be incorporated at the operational phase, in the event of shadow flicker causing a nuisance. These could include planting tree belts between the affected residential property and the responsible wind turbine, installing blinds at the affected property or shutting down individual wind turbines during periods when shadow flicker could occur.	iv)Operation		
Telecommunications	No significant effects predicted.	Pre-construction checks would be undertaken to ensure no significant effects still remains to be the case nearer the time of construction.	iii)Construction		
Public Water Supply	The Proposed Development is not located in a Drinking Water Protected Area. In addition, no private water supplies are located within the Proposed Development. Six potential registered private water supplies were located within the Study Area. The risk assessment determined that all private water supply sources are located more than 250 m from the Proposed Development and all are located in different water catchments therefore the private water supply sources are not at risk from the Proposed Development.	No mitigation proposed	N/A		

16.3 Conclusions

16.3.1 The Proposed Development has been subject to an extensive site identification and design process involving consultation with statutory consultees, local interest groups and the local community. The predicted environmental effects as a result of the construction, operation and decommissioning of nine wind turbines and associated infrastructure have been carefully considered throughout the design of the Proposed Development. The final design, where possible, has taken into account the view of statutory consultees, the local community and their representatives, as well as views of other interested parties and has sought to minimise adverse impacts.

16.3.2 The layout of the Proposed Development has been prepared through a detailed EIA and design iteration process which has sought, as far as possible, to avoid or reduce any significant environmental effects identified through embedded mitigation in the projects design. Where appropriate, additional mitigation measures have been proposed and summarised in the Schedule of Mitigation found in this chapter. The opportunities for enhancement measures within the Proposed Development Area also been carefully considered throughout the design iteration process.

16.3.3 Following a detailed assessment, with embedded design through the creation of 50 m buffer between wind turbine blade tip and nearest woodland, moderate/minor residual effects are predicted for common, soprano and Nathusius's pipistrelle and *Nyctalus sp*. Bats.

16.3.4 Due to its nature, the development of a wind farm will inevitably result in effects on landscape character and visual resource and the EIA has identified that the Proposed Development would have some localised long term, but reversible, significant effects on landscape character and visual amenity. However, the landscape and visual impact assessment presented in Chapter 5 of this EIAR has concluded that overall, the Proposed Development would bring about some inevitable significant visual effects as would be expected with any commercial scale wind energy development, all of which would be experienced within a relatively small part of the landscape that surrounds the Proposed Development Area.

16.3.5 The EIA has also identified that noise levels during construction will result in no significant effect at receptors.

16.3.6 The significant effects above also need to be considered alongside the numerous benefits the Proposed Development will bring, including:

- The potential to generate £30.4 million to benefit the Scottish economy per annum during the development and construction phase;
- The potential to generate £9.6 million to benefit the local economy per annum during the development and construction phase;
- The potential to generate 232 jobs at the Scottish level and 72 jobs at the local level during the development and construction phases;
- Provide communities with a minimum contribution of £5,000 per installed MW which could equate to £270,000 per year (£13.5 million over the lifetime of the wind farm) and will assist in the regeneration of the local communities;
- Furthermore, the Applicant is engaging with local communities and councils to provide a tailored local benefit package;
- Based on 6 MW wind turbines, the Proposed Development would produce sufficient electrical energy to satisfy the average annual requirements of approximately 6, 796 homes and the carbon payback period is expected to be 2.5 years if it replaced the fossil fuel-mix electricity generation method;
- Make a positive contribution to the Scottish Government's target of net zero emissions by 2045;
- Support energy sovereignty by reducing reliance on imported fossil fuels; and
- Support the renewables industry, which currently employs around 22,660 people[1] across Scotland in 2019, and onshore wind in particular is the biggest renewables employer with 8,780 people in full time employment.

16.3.7 Overall, the EIA concludes that the Proposed Development will have limited significant long – term adverse effects on either the physical environment or on human health and population. The EIA also identifies a number of short – and long – term benefits for both the local human population as well as benefits to the local and wider environment. The balance of these issues is considered further in policy terms in a separate Planning Statement.

[1] New figures reveal renewable energy jobs and investment (scottishrenewables.com)